



# ENERGY NORTHWEST

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August 31, 2010  
GO2-10-127

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 7, 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 101730271)

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. 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.

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
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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

Enclosure: License Renewal Application Amendment 5

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

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

“Request for Additional Information for the Review of the Columbia Generating Station,  
License Renewal Application,”  
(ADAMS Accession No. ML 101730271)

**RAI B.2.19-1**

**Background:**

The Generic Aging Lessons Learned (GALL) Report XI.E1 program, under the scope of program element, states that this inspection program applies to accessible electrical cables and connections within the scope of license renewal that are installed in an adverse localized environment.

**Issue:**

The applicant has not described the methodology to be used to identify an adverse localized environment.

**Request:**

Describe how an adverse localized environment will be identified including EQ records, environment surveys, plant walkdowns, and operating experiences.

**Energy Northwest Response:**

The inspection program will define adverse localized environments through a review of plant engineering data (environmental qualification [EQ] records, environmental surveys, cable and connection material specifications, etc.), plant operating experience, and plant walkdowns. The cable and connection insulation materials' 60-year design limits, as taken from industry guidance documents, will also be used in identifying plant adverse localized environments.

Revision to the License Renewal Application (LRA) Scope of Program discussion in section B.2.19 is shown in Amendment 5, provided in the Enclosure to this letter.

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### **RAI B.2.19-2**

#### **Background:**

The GALL Report XI.E1 program, under the parameters monitored or inspected element, states that a representative sample of accessible electrical cables and connections installed in adverse localized environment are to be visually inspected for cable and connection jacket surface anomalies. In addition, the technical basis for the sample selected is to be provided. In the basis document LRPD-05, under the same element, the applicant states that the program will provide for the visual inspection of accessible cables and connections located in adverse localized environments. LRPD-05 also states that the implementing document for the program will provide the technical basis for the sample selection with respect to both sample size and inspection locations.

#### **Issue:**

The applicant has not developed the technical basis for sample selection for accessible cables and connections installed in adverse localized environments.

#### **Request:**

Provide the technical basis for selecting samples of accessible cables and connections installed in adverse localized environments.

#### **Energy Northwest Response:**

The Parameters Monitored or Inspected discussion in LRA B.2.19, states:

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program will provide for the visual inspection of accessible cables and connections located in adverse localized environments.

As there is no selection criteria stated other than the cable be accessible, Energy Northwest will inspect all accessible cables located in localized adverse environments. Therefore, no sampling program will be used.

Amendment 5 for LRA B.2.19 Parameters Monitored or Inspected and Detection of Aging Effects was revised to specify that all accessible cables and connections located in adverse localized environments will be inspected. The statement that “the implementing document for the program will provide the technical basis for the sample selection with respect to both sample size and inspection locations” has been deleted as the Columbia program does not use sampling.

The Detection of Aging Effects discussion in LRA B.2.19 is not consistent with A.1.2.19 regarding the inspection frequency. Amendment 5 corrects that inconsistency by revising B.2.19. Amendment 5 is provided in the Enclosure to this letter.

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**RAI B.2.21-1**

**Background:**

The GALL Report XI.E6, under Element 3 (parameters monitored or inspected), states that the applicant is to document the technical basis for the samples selected. In the basis document LRPD-05, under the same program attribute, the applicant states that it will document the technical basis for the sample selected.

**Issue:**

The applicant has not developed the technical basis for selecting samples of bolted connections for one-time testing.

**Request:**

Provide the technical basis for selecting samples of bolted connections for one-time inspection.

**Energy Northwest Response:**

The Parameters Monitored or Inspected discussion in LRA B.2.21 states (in part):

A representative sample of electrical cable connections will be inspected. The following factors will be considered for sampling: application (high, medium, and low voltage), circuit loading, and physical location (high temperature, high humidity, vibration, etc.) with respect to connection stressors.

In the absence of other technical basis, Energy Northwest has elected to use the sampling from the April 2010 draft for Revision 2 of NUREG-1801 under element 4, Detection of Aging Effects:

Twenty percent of the population with a maximum sample of 25 constitutes a representative sample size.

Amendment 5, LRA B.2.21 specifies that twenty percent of the population with a maximum sample of 25 constitutes a representative sample size. Amendment 5 is provided in the Enclosure to this letter.

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### **RAI B.2.22-1**

#### **Background:**

In Standard Review Plan (SRP) Table 4.4-2, "Examples of FSAR Supplement for EQ of Electrical Equipment TLAA Evaluation," it states that reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. In license renewal application (LRA) Appendix A, Final Safety Analysis Report (FSAR) Supplement A.1.2.22, the applicant did not address the reanalysis attributes.

#### **Issue:**

The LRA Appendix A, FSAR Supplement A.1.2.22 description is not consistent with SRP Table 4.4-2. The reanalysis attributes are important attributes to extend the qualified life of EQ electrical components and must be included in the summary description in LRA Appendix A.

#### **Request:**

Explain why reanalysis attributes are not included in the FSAR Supplement to be consistent with SRP Table 4.4-2.

#### **Energy Northwest Response:**

The revision to include the EQ component reanalysis attributes in the program description in LRA Section A.1.2.22 is shown in Amendment 5, provided in the Enclosure to this letter.

### **RAI B.2.32-1**

#### **Background:**

The GALL Report aging management program (AMP) XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" provides definitions for significant moisture and significant voltage. In addition, the GALL Report AMP XI.E3 states that the specific type of test performed will be a proven test for detecting deterioration of the insulation system due to wetting. The GALL Report AMP XI.E3 also states that inspection for water collection is performed based on actual plant experience with a minimum inspection frequency at least once every two years. SRP-LR Table 3.6-2, FSAR Supplement for Aging Management of Electrical and Instrumentation and Control System also includes definitions for significant moisture and significant voltage, and discussions on the specific type of test, and inspection for water collection based on plant-specific experience.

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### **Issue:**

LRA FSAR Supplement Section A.1.2.32 does not include definitions of significant moisture or significant voltage consistent with SRP-LR Table 3.6-2 or GALL Report AMP XI.E3. LRA FSAR Supplement Section A.1.2.32 does not include a discussion of the specific type of test to be performed or specify that inspection of water collection will be based on plant-specific experience. The missing LRA FSAR Supplement definitions and testing and inspection discussions results in inconsistency with the GALL Report AMP XI.E3 and SRP-LR Table 3.6-2.

### **Request:**

Explain why LRA FSAR supplement A.1.2.32 for LRA AMP B.2.32 does not include the definitions of significant voltage, significant moisture, or discussions on specific testing and inspection for water collection based on operating experience consistent with the GALL Report AMP XI.E3 and SRP LR Table 3.6-2.

### **Energy Northwest Response:**

In LRA Section B.2.32, the Scope of Program discussion defines significant voltage and significant moisture. The Parameters Monitored or Inspected discussion addresses specific testing. The Detection of Aging Effects discussion addresses the inspections for water collection. These discussions are consistent with GALL Report AMP XI.E3 and SRP LR Table 3.6-2.

The LRA FSAR supplement A.1.2.32 revision to include the definitions of significant voltage, significant moisture, or discussions on specific testing and inspection for water collection based on operating experience consistent with the GALL Report AMP XI.E3 and SRP LR Table 3.6-2 is contained in Amendment 5, provided in the Enclosure to this letter.

### **RAI B.2.32-2**

### **Background:**

The GALL Report AMP XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" states that the specific type of test performed will be a proven test for detecting deterioration of the insulation system due to wetting and tested at least once every ten years. The GALL Report AMP XI.E3 also states that inspection for water collection is performed based on actual plant experience with a minimum inspection frequency at least once every two years. The GALL Report AMP XI.E3 states that the first test and inspections are to be completed before the period of extended operation.

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### **Issue:**

In element 4, "detection of aging effects," of the LRA AMP, it states that cable testing and inspection for water collection will be performed, with the first test and inspection to occur during the 10-year period prior to the end of the current operating license. However, LRA Appendix A, Section A.1.2.32 states that the first test and inspection are to be implemented prior to the period of extended operation. The GALL Report AMP also states that the first tests and inspections for license renewal are to be completed before the period of extended operation.

The staff is concerned that the inaccessible medium-voltage cable inspection and test may exceed the interval specified by the GALL Report AMP XI.E3. In addition, the staff is concerned that if cable inspection or tests are performed up to 10 years prior to the period of extended operation and credited as the initial test, the test or inspection results may not be representative of inaccessible medium-voltage cable data taken prior to the period of extended operation.

### **Request:**

Explain how LRA AMP B.2.32, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program," is consistent with the GALL Report AMP XI.E3 and SRP LR Table 3.6-2 with respect to performing the inspection and test prior to the period of extended operation such that the inspection and test frequency won't exceed the intervals specified by the GALL Report AMP XI.E3.

### **Energy Northwest Response:**

LRA AMP B.2.32 Detection of Aging Effects states:

The cable testing will be performed at least once every 10 years, with the first test to occur during the 10-year period prior to the end of the current operating license. The inspections for water collection will be performed based on actual plant operating experience with water accumulation in the manholes. However, the inspection frequency will be at least once every two years. The first inspections will occur during the 10-year period prior to the end of the current operating license.

This was to specify that the first test/inspection would not be conducted more than 10 years prior to the period of extended operation and that there would never be a period greater than 10 years between tests or two years between inspections.

As stated by the NRC in the Background statement above, GALL Report AMP XI.E3 states that the first test and inspections are to be completed before the period of extended operation. This would allow the first test/inspection to be completed any number of years before the period of extended operation, as long as the subsequent tests are performed at least once every 10 years and subsequent inspections are performed at least every two years.

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Columbia agrees that the NRC position allows for more flexibility. Also, Columbia recognizes that in LRA B.2.32 Program Description, LRA A.1.2.32 and LRA Table A-1 Item Number: 32 we did not use the statement that the first test/inspection would be conducted "during the 10-year period prior to the end of the current operating license."

Therefore, LRA AMP B.2.32 Detection of Aging Effects is revised to state that the first test and inspection will occur prior to the end of the current operating license. Amendment 5, with the applicable change, is provided in the Enclosure to this letter.

**RAI B.2.32-3**

**Background:**

The GALL Report AMP XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" provides definitions for significant moisture and significant voltage. In addition, the GALL Report AMP XI.E3 states that the specific type of test performed will be a proven test for detecting deterioration of the insulation system due to wetting. The GALL Report AMP XI.E3 also states that inspection for water collection is performed based on actual plant experience with a minimum inspection frequency of at least once every two years.

**Issue:**

LRA AMP B.2.32 and associated basis document specify that inspections for water collection will be based on actual plant operating experience with a minimum frequency of at least once every two years. However, event driven water collection is not discussed. Periodic inspection may not mitigate event driven water collection and may allow inaccessible medium-voltage cables to be exposed to significant moisture.

**Request:**

Explain why event based inspection is not included in LRA AMP B.2.32 to prevent inaccessible medium voltage cable exposure to significant moisture.

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**Energy Northwest Response:**

As stated Section B.2.32 under Detection of Aging Effects:

The inspections for water collection will be performed based on actual plant operating experience with water accumulation in the manholes.

This is consistent with the wording in NUREG-1800 Table 3.6-2 which states:

In addition, inspection for water collection is performed based on actual plant experience with water accumulation in the manholes.

NUREG-1801 XI.E3 Element 4 states:

The inspection for water collection should be performed based on actual plant experience with water accumulation in the manhole.

NUREG-1800 Table 3.6-2 and NUREG-1801 XI.E3 Element 4 define significant moisture as periodic exposures to moisture that last more than a few days. Event driven water collection is not discussed specifically in the LRA, because any event driven water collection is plant experience that would be evaluated as operating experience (OE). An event driven water accumulation would be plant operating experience, and is therefore covered implicitly under the term "actual plant operating experience."

**RAI B.2.40-1**

**Background:**

In element 10 of the LRA AMP, the applicant states that the Metal-Enclosed Bus (MEB) Program is a new program for which there is no direct site-specific operating experience. In the GALL Report AMP XI.E4, it states that operating experience has shown that bus connections in MEBs exposed to appreciable ohmic heating during operation may experience loosening due to repeated cycling of the connected load.

During the staff walkdown on May 25, 2010, the staff noticed possible smoke residue on the 6.9kV E-BUS -NONSEG/N2/X MEB and the surrounding conduits and cable trays. In Action Request (AR) 202384, the applicant states that the bus failed catastrophically on August 5, 2009. The applicant determined that the failure of the bus was caused by loosening of the bolted connections on the central phase flexible link due to repeated thermal cycles over time.

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### **Issue:**

Even though these MEBs are not in-scope of license renewal, the staff is concerned that a similar failure mode may occur in the in-scope MEBs during the extended period of operation. Columbia Generating Station operating experience may not support the applicant's conclusion that LRA AMPB.2.40 will provide reasonable assurance that the aging effects will be managed such that the in-scope MEBs will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

### **Request:**

Describe the corrective actions taken or planned to prevent recurrence of similar failures of MEBs in the scope of license renewal.

### **Energy Northwest Response:**

The failure of the MEB discussed above was added to the LRA in Amendment 1, transmitted to the NRC in a letter dated July 16, 2010, SK Gambhir to NRC, "License Renewal Application First Annual Update."

As discussed in Licensee Event Report (LER) Number 2009-004-00, contained in letter SK Gambhir to NRC, dated October 5, 2009, the following corrective actions were taken or planned to prevent recurrence of similar failures of MEBs in the scope of license renewal:

1. The damage to the 6.9 kV bus was repaired, and windows installed in the bus duct covers to allow for more direct thermography monitoring of the links.
2. An appropriate frequency for thermography checks will be established in conjunction with performing torque checks on the other non-segregated buses during the next refueling outage to prevent recurrence of this type of event. The content and controls for preventative maintenance (PM) activities will be strengthened to ensure proper completion of critical steps, that there are appropriate levels of review, and approval is applied to changes.
3. The other non-segregated buses were visually inspected and had insulators torque checked. Additional infrared thermography windows were installed in the bus housing covers at all flexible and rigid link locations with the exception of the some locations in two startup buses that are only normally energized during startup up to 23% power. The remaining window installations, for the two startup buses, are scheduled to be installed during the next refueling outage in 2011.

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An additional action includes the performance of preventive maintenance on the remaining non-segregated buses in accordance with preventive maintenance standards, requirements and expectations (i.e., complete the link torque checks or link replacement and perform the Hi-pot testing during the next refueling outage in 2011).

The intent of these corrective actions is to establish the condition of the MEB's bolted connections at Columbia, bring any degraded bolted connections back to an acceptable condition, and to monitor the bolted connections for any indication of future degradation. The torque checks identified in item 2 above are not part of the B.2.40 program. Thermography is the B.2.40 credited inspection.

As stated in LRA Appendix B.2.40 Operating Experience:

The Metal-Enclosed Bus Program is a new program for which there is no direct site specific operating experience. Based on review of plant-specific and industry operating experience, the identified aging effects require management for the period of extended operation.

It also states:

Plant operating experience has shown that the corrective action program has addressed issues related to bus and bus enclosure degradation in recent years. For example, corrosion was identified on insulators used to support bus associated with the one of the unit normal auxiliary transformers (which is not in scope for license renewal). In addition, the corrective action program noted that the use of thermography would provide an improvement to the bus preventive maintenance program.

Under Parameters Monitored or Inspected, Appendix B.2.40 states:

The Metal-Enclosed Bus Program will inspect a sample of bus bolted connections via thermography for signs of loose connections. The in-scope bus will be checked from the exterior with the bus energized to provide gross detection of circuit hot spots.

Under Detection of Aging Effects, Appendix B.2.40 states:

The Metal-Enclosed Bus Program will utilize thermography to check the bolted connections in the non-segregated metal-enclosed bus that is within the license renewal scope. The thermography inspection will be performed for representative portions of the in-scope non-segregated metal-enclosed bus.

This section also states that thermography inspections will be performed at least once every 10 years, with the first inspections to be completed within the 10-year period prior to the end of the current operating license.

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Energy Northwest believes that the listed corrective actions and the implementation of the Metal-Enclosed Bus Program will provide reasonable assurance that the aging effects will be managed such that the in-scope MEBs will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

The Detection of Aging Effects discussion in LRA B.2.40 states:

Both the thermography inspection and the visual inspections will be performed at least once every 10 years, with the first inspections to be completed within the 10 year period prior to the end of the current operating license.

This wording "within the 10 year period" is the same that the NRC questioned in RAI B.2.32-2. Therefore, in Amendment 5, LRA AMP B.2.40 the Detection of Aging Effects discussion is revised to state: "Both the thermography inspection and the visual inspections will be performed at least once every 10 years, with the first inspections to be completed prior to the end of the current operating license." Amendment 5 is provided in the Enclosure to this letter.

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**AMENDMENT 5**

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B.2.40	B-156	B.2.40-1

#### **A.1.2.21 Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements Inspection**

The Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements Inspection detects and characterizes the material condition of metallic electrical connections within the scope of license renewal. The inspection uses thermography (augmented by contact resistance testing) to detect loose or degraded connections that lead to increased resistance for a representative sample of metallic electrical connections in various plant locations.

The Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements Inspection is a new one-time inspection that will be implemented prior to the period of extended operation. The inspection activities will be conducted within the 10-year period prior to the period of extended operation.

#### **A.1.2.22 EQ Program**

Environmental qualification (EQ) analyses for electrical components with a qualified life of 40 years or greater are identified as TLAAs; therefore, the effects of aging must be addressed for license renewal.

NRC regulation 10 CFR 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants," requires licensees to identify electrical equipment covered under this regulation and to maintain a qualification file demonstrating that the equipment is qualified for its application and will perform its safety function up to the end of its qualified life. The EQ Program is an existing program that implements the requirements of 10 CFR 50.49 (as further defined by the Division of Operating Reactor Guidelines, NUREG-0588, and Regulatory Guide 1.89 Revision 1).

~~In accordance with 10 CFR 54.21(c)(1)(iii), the EQ Program will be used to manage the effects of aging on the intended functions of the components associated with EQ TLAAs for the period of extended operation.~~

Insert A page A-15a

#### **A.1.2.23 External Surfaces Monitoring Program**

The External Surfaces Monitoring Program consists of observation and surveillance activities intended to detect degradation resulting from loss of material due to corrosion and cracking due to SCC for mechanical components, as well as hardening and loss of strength for elastomers. The External Surfaces Monitoring Program is a condition-monitoring program.

The External Surfaces Monitoring Program is an existing program that requires enhancement prior to the period of extended operation.

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In accordance with 10 CFR 54.21(c)(1)(iii), the EQ Program will be used to manage the effects of aging on the intended functions of the components associated with EQ TLAAAs for the period of extended operation because equipment will be replaced prior to reaching the end of its qualified life. Reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions if acceptance criteria are not met. Reanalysis of aging evaluations to extend the qualification of components is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of the Columbia EQ Program.

minimized by verifying the quality of new fuel oil before it enters the emergency diesel generator storage tanks and by periodic sampling to ensure that both the emergency diesel generator tanks and fire protection tanks are free of water and particulates. The Fuel Oil Chemistry Program is a mitigation program.

The Fuel Oil Chemistry Program is supplemented by the Chemistry Program Effectiveness Inspection, which provides verification of the effectiveness of the program in mitigating the effects of aging.

#### **A.1.2.30 Heat Exchangers Inspection**

The Heat Exchangers Inspection detects and characterizes the surface conditions with respect to fouling of heat exchangers and coolers that are in the scope of the inspection and exposed to indoor air or to water with the chemistry controlled by the BWR Water Chemistry Program or the Closed Cooling Water Chemistry Program. The inspection provides direct evidence as to whether, and to what extent, a reduction of heat transfer due to fouling has occurred on the heat transfer surfaces of heat exchangers and coolers.

The Heat Exchangers Inspection is a new one-time inspection that will be implemented prior to the period of extended operation. The inspection activities will be conducted within the 10-year period prior to the period of extended operation.

#### **A.1.2.31 High-Voltage Porcelain Insulators Aging Management Program**

The High-Voltage Porcelain Insulators Aging Management Program is an existing program that manages the build-up of contamination (hard water residue) on the surfaces of the 115-kV high-voltage insulators. The program provides for periodic cleaning or recoating of insulators and visual inspection of the coating (if present) on the high-voltage porcelain insulators between the 115-kV backup transformer and circuit breaker E-CB-TRB located in the station transformer yard.

The High-Voltage Porcelain Insulators Aging Management Program is a preventive maintenance program consisting of activities to mitigate potential degradation of the insulation function due to hard water deposits. Uncoated insulators are inspected and cleaned every two years. Coated insulators are visually inspected for damage every two years and are re-coated every 10 years.

#### **A.1.2.32 Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program**

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~~The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program manages the aging of inaccessible medium-voltage cables that are not environmentally qualified and are within the scope of license renewal. The~~

~~program provides for testing to identify the conditions of the conductor insulation, and also provides for periodic inspection and drainage (if necessary) of electrical manholes.~~

~~The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program is a new aging management program that will be implemented prior to the period of extended operation. The frequency of the cable testing portion of the program will be once every 10 years, with the first test to be performed prior to the period of extended operation. The frequency of the manhole inspections will be at least once every two years, with the first inspections to be performed prior to the period of extended operation.~~

Insert A page A-18a

#### **A.1.2.33 Inservice Inspection (ISI) Program**

The Inservice Inspection (ISI) Program is an existing condition monitoring program that manages cracking due to SCC/IGA and flaw growth of multiple reactor coolant system pressure boundary components, including the reactor vessel, a limited number of internals components, and the reactor coolant system pressure boundary. The Inservice Inspection (ISI) Program also manages loss of material due to corrosion for reactor vessel internals components and reduction of fracture toughness due to thermal embrittlement of cast austenitic stainless steel pump casings and valve bodies.

The Inservice Inspection (ISI) Program details the requirements for the examination, testing, repair, and replacement of components specified in ASME Section XI for Class 1, 2, or 3 components. The Inservice Inspection (ISI) Program complies with the ASME Code requirements.

The program scope has been augmented to include additional requirements, and components, beyond the ASME requirements. Examples include the augmentation of ISI to expanded reactor vessel feedwater nozzle examinations, examinations of high energy line piping systems that penetrate containment, and examinations per Generic Letter 88-01. Such augmentation is consistent with the ISI program description in NUREG-1801, Section XI.M1.

#### **A.1.2.34 Inservice Inspection (ISI) Program – IWE**

The Inservice Inspection (ISI) Program – IWE is an existing program that establishes responsibilities and requirements for conducting IWE inspections as required by 10 CFR 50.55a. The Inservice Inspection (ISI) Program – IWE includes visual examination of all accessible surface areas of the steel containment and its integral attachments, and containment pressure-retaining bolting in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWE.

The inservice examinations conducted throughout the service life of Columbia will comply with the requirements of the ASME Section XI Edition and Addenda

Insert A

The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will manage the aging of in-scope, medium-voltage cables exposed to significant moisture and significant voltage. First tests or first inspections for license renewal will be completed before the period of extended operation. These cables will be tested at least once every 10 years to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR -103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. Significant moisture is defined as periodic exposures that last more than a few days (e.g., cable in standing water). Periodic exposures that last less than a few days (e.g., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than 25% of the time. The moisture and voltage exposures described as significant in these definitions are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization are not significant for submarine cables). In addition, inspection for water collection will be performed based on actual plant experience with water accumulation in the manholes. However, the inspection frequency will be at least once every two years.

renewal and which are not, the program inspections will be prioritized based on location rather than component identification or function.

~~Particular attention will be given to the identification of adverse localized environments. The inspection program will define these areas through a review of plant engineering data (EQ records, environmental surveys, etc.) and plant walkdowns.~~

← Insert A page B-86a

- Preventive Actions

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program is an inspection program; no actions are taken to prevent or mitigate aging degradation. The program is based on visual observation (and detection) only.

← Insert B page B-86a

- Parameters Monitored or Inspected

~~The Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program will provide for the visual inspection of accessible cables and connections located in adverse localized environments. The implementing documents for the program will provide the technical basis for the sample selection, with respect to both sample size and inspection locations. Temperature, radiation, and moisture levels will be considered, along with cable insulation material.~~

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program focuses on a visual inspection of accessible cables and connections. The cables and connections will not be touched during the inspection (either lifted, separated, felt, or handled in any way). The inspection will record the visible condition of the cable jacket or the visible condition of the connection (splice, terminal block, fuse block, etc.).

← Insert C page B-86a

- Detection of Aging Effects

~~As described above in *Parameters Monitored or Inspected*, the Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program provides for a visual inspection of a representative sample of accessible electrical cables and connections located in adverse localized environments. The visual inspections will be performed on a 10-year interval, with the first inspection taking place within the 10-year period prior to the end of the current operating license. The program will inspect the accessible cables and connections for aging effects due to heat, radiation, and moisture, in the presence of oxygen. The visible effects are embrittlement, discoloration, cracking, and surface contamination.~~

- Monitoring and Trending

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program will not include trending actions. If anomalies are found

Insert A

Particular attention will be given to the identification of adverse localized environments. The inspection program will define these areas through a review of plant engineering data (EQ records, environmental surveys, cable and connection material specifications, etc.), plant operating experience, and plant walkdowns. The cable and connection insulation materials' 60-year design limits, as taken from industry guidance documents, will also be used in identifying plant adverse localized environments.

Insert B

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program will provide for the visual inspection of all accessible cables and connections located in adverse localized environments.

Insert C

As described above in *Parameters Monitored or Inspected*, the Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program provides for a visual inspection of all accessible electrical cables and connections located in adverse localized environments. The inspection frequency of the program will be once every 10 years, with the initial inspection to be performed prior to the period of extended operation. The program will inspect the accessible cables and connections for aging effects due to heat, radiation, and moisture, in the presence of oxygen. The visible effects are embrittlement, discoloration, cracking, and surface contamination

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or remade as necessary) whenever the end device is tested or worked on, and because Columbia has a thermography program that routinely inspects electrical connections throughout the plant (based on current industry practices), a one-time inspection in response to the guidance of NUREG-1801 XI.E6 is adequate. Performance of the inspection will confirm the absence of aging degradation on electrical cable connections.

The technical methodology utilized by the program (thermography augmented by contact resistance tests) is identical to that of NUREG-1801, XI.E6.

### Aging Management Program Elements

The results of an evaluation of each program element are provided below.

- Scope of Program

The metallic parts of electrical cable connections, not subject to 10 CFR 50.49, and associated with cables that are within the scope of license renewal, are part of this program, regardless of their association with active or passive components.

The Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements Inspection is applicable to non-environmentally qualified electrical cable connections for the site buildings that are within the scope of license renewal.

- Preventive Actions

No actions are taken as part of this activity to prevent or mitigate aging degradation.

(Twenty percent of the population with a maximum sample of 25)

- Parameters Monitored or Inspected

This inspection will focus on the metallic parts of electrical cable connections. The inspection will include detection of loosened bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. A representative sample of electrical cable connections will be inspected. The following factors will be considered for sampling: application (high, medium, and low voltage), circuit loading, and physical location (high temperature, high humidity, vibration, etc.) with respect to connection stressors. ~~The technical basis for the sample selected will be documented.~~ If an unacceptable condition or situation is identified in the sample, a determination will be made as to whether the same condition or situation is applicable to other connections.

- Detection of Aging Effects

A representative sample of the metallic electrical cable connections not subject to 10 CFR 50.49 EQ requirements and within the scope of license renewal will receive a one-time inspection via thermography (augmented with contact resistance testing) prior to the period of extended operation. Thermography is a proven test method for detecting loose connections and degraded connections (i.e., chemical contamination, corrosion, oxidation) leading to increased resistance, and will be

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- **Scope of Program**

The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program involves two parts: first, the actions to inspect the plant manholes (and to drain them, if necessary) on a periodic basis; and second, the development of a testing program to confirm that the conductor insulation on the cables is not degrading.

This program applies to medium-voltage cables within the scope of license renewal that meet the criteria of an inaccessible location, exposure to wetting, and exposure to significant voltage. Significant moisture is defined as periodic exposure to moisture that lasts more than a few days (e.g., cables in standing water). Periodic exposure to moisture that lasts less than a few days (i.e., normal rain and drain) is not significant. Significant voltage exposure is defined as being subject to system voltage for more than twenty-five percent of the time.

- **Preventive Actions**

The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will include periodic preventive actions to inspect for water collection in electrical manholes, and to remove water (as necessary).

- **Parameters Monitored or Inspected**

The specific type of test to be utilized in the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will be determined prior to the initial test. The implementing documents will specify a proven test (such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2) for detecting the deterioration of the insulation system due to wetting (and energization), and will reflect the actual test methodology prior to the initial performance of the cable testing. In addition, the provisions for inspecting and draining (if necessary) the electrical manholes will be described in the implementing documents.

- **Detection of Aging Effects**

The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will provide for the testing of in-scope medium-voltage cables to detect degradation of the conductor insulation. The program will utilize a proven test for detecting deterioration of the cable insulation due to wetting (and energization). The program will also conduct inspections of the electrical manholes to detect water collection and to drain the manholes (if necessary).

The cable testing will be performed at least once every 10 years, with the first test to occur ~~during the 10-year period~~ prior to the end of the current operating license. The inspections for water collection will be performed based on actual plant operating experience with water accumulation in the manholes. However, the inspection

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frequency will be at least once every two years. The first inspections will occur ~~during the 10-year period~~ prior to the end of the current operating license.

- **Monitoring and Trending**  
The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will not include trending actions. If anomalies are found during the testing, they will be addressed at that time under the corrective action program. The results of the manhole inspections will be recorded such that increasing water levels, or the need for more frequent performance of draining, can be identified.
- **Acceptance Criteria**  
The acceptance criteria for each test in the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will be defined by the specific type of test to be performed. The type of test will be determined prior to the initial utilization of the program. The implementing documents will contain specific information on the acceptance criteria for each test.
- **Corrective Actions**  
This element is common to Columbia programs and activities that are credited with aging management during the period of extended operation and is discussed in Section B.1.3.

In addition, for the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program, an engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cables can be maintained consistent with the current licensing basis. Such an evaluation will consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective actions required, and the likelihood of recurrence. When an unacceptable condition or situation is identified, a determination will be made as to whether the same condition or situation is applicable to other inaccessible, in-scope medium-voltage cables.

- **Confirmation Process**  
This element is common to Columbia programs and activities that are credited with aging management during the period of extended operation and is discussed in Section B.1.3.
- **Administrative Controls**  
This element is common to Columbia programs and activities that are credited with aging management during the period of extended operation and is discussed in Section B.1.3.

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The Metal-Enclosed Bus Program is credited with detecting aging effects for in-scope metal-enclosed bus. The in-scope bus is limited to non-segregated metal-enclosed bus in the 6.9-kV and 4.16-kV electrical systems associated with the off-site power supply (via transformer E-TR-S).

- Preventive Actions

The Metal-Enclosed Bus Program is an inspection program; no actions are taken to prevent or mitigate aging degradation.

- Parameters Monitored or Inspected

The Metal-Enclosed Bus Program will inspect bus insulation for anomalies, such as embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The internal bus enclosure will be inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The internal bus supports (i.e., internal to the enclosure) will be inspected for structural integrity and any sign of cracks.

The Metal-Enclosed Bus Program will inspect a sample of bus bolted connections via thermography for signs of loose connections. The in-scope bus will be checked from the exterior with the bus energized to provide gross detection of circuit hot spots.

The Metal-Enclosed Bus Program will inspect the bus joints, seals, and gaskets when the assembly covers are removed for inspection of the internal components.

- Detection of Aging Effects

The Metal-Enclosed Bus Program will utilize thermography to check the bolted connections in the non-segregated metal-enclosed bus that is within the license renewal scope. The thermography inspection will be performed for representative portions of the in-scope non-segregated metal-enclosed bus.

The Metal-Enclosed Bus Program also includes visual inspection of the internal bus enclosure, bus insulation, and internal bus supports. The bus enclosure will be inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulation will be inspected for anomalies, such as signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The internal bus supports (internal to the enclosure) will be inspected for structural integrity and signs of cracking. The elastomers used to seal the bus enclosure assembly will be inspected for embrittlement, cracking, loosening, flaking, peeling, and other indications of aging degradation.

Both the thermography inspection and the visual inspections will be performed at least once every 10 years, with the first inspections to be completed ~~within the 10-~~year period prior to the end of the current operating license.