



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

January 21, 2011

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

SUBJECT: AUDIT REPORT REGARDING THE COLUMBIA GENERATING STATION,  
LICENSE RENEWAL APPLICATION

Dear Mr. Gambhir:

By letter dated January 19, 2010, Energy Northwest submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54), to renew operating license NPF-21 for Columbia Generating Station, for review by the U.S. Nuclear Regulatory Commission (NRC or the staff). On May 28, 2010, the staff completed the onsite audit of aging management programs. The audit report is enclosed.

If you have any questions, please contact me at 301-415-4029 or by e-mail at [evelyn.gettys@nrc.gov](mailto:evelyn.gettys@nrc.gov).

Sincerely,

A handwritten signature in cursive script that reads "Evelyn H. Gettys".

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

Docket No. 50-397

Enclosure:  
As stated

cc w/enci: Distribution via Listserv

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION, DIVISION OF LICENSE RENEWAL

Docket No: 50-397

License No: NPF- 21

Licensee: Energy Northwest

Facility: Columbia Generating Station

Location: 76 North Power Plant Loop  
Richland, WA 99354

Dates: May 24-28, 2010

Reviewers: E Gettys, Project Manager, Division of License Renewal (DLR)  
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## Introduction

An audit was conducted by the Nuclear Regulatory Commission (NRC) at the Columbia Generating Station (CGS) northwest of Richland, WA on May 24-28, 2010. The purpose of this audit was to examine Energy Northwest's, (the applicant's) aging management programs (AMPs) and related documentation for CGS and to verify the applicant's claim of consistency with the corresponding Generic Aging Lessons Learned (GALL) Report (NUREG-1801, Rev. 1) AMPs. Exceptions to the GALL Report AMP elements are evaluated separately as part of the NRC staff's (or the staff) review of the CGS license renewal application (LRA) and documented in the staff's Safety Evaluation Report (SER).

The Standard Review Plan (SRP) for Review of License Renewal Applications for Nuclear Power Plants (NUREG-1800, Rev. 1) provides the staff guidance for reviewing an LRA. The SRP allows an applicant to reference in its LRA, the AMPs described in the GALL Report. By referencing the GALL Report AMPs, the applicant concludes that its AMPs correspond to those AMPs which are reviewed and approved in the GALL Report. If an applicant credits an AMP for being consistent with a GALL Report program, it is incumbent on the applicant to ensure that the plant program contains all of the elements of the referenced GALL Report program. The applicant's determination should be documented in an auditable form and maintained onsite.

During this audit, the staff audited AMP elements 1-6, which includes: 1) scope of program; 2) preventative actions; 3) parameters monitored or inspected; 4) detection of aging effects; 5) monitoring and trending; and 6) acceptance criteria. Also included in the audit was AMP element 10, operating experience. These elements of the applicant's AMPs were claimed to be consistent with the GALL Report and were audited against the related elements of the associated AMP described in the GALL Report, unless otherwise indicated in this Audit Report. Elements 7-9 address corrective actions, confirmation process, and administrative controls, respectively, and were audited during the Scoping and Screening Methodology audit (ML102160357) conducted on May 10-13, 2010 and are evaluated separately. The staff audited all AMPs that the applicant stated were consistent with the GALL Report AMPs.

During this audit, if an applicant took credit for a program in the GALL Report, the staff verified that the plant program contains all the elements of the referenced GALL Report program. In addition, the staff verified the conditions at the plant were bounded by the conditions for which the GALL Report program was evaluated.

In performing this audit, the staff examined the applicant's LRA, program bases documents and related references, interviewed various applicant representatives, and conducted walkdowns of several plant areas. This report documents the staff's activities during this audit.

### **LRA AMP B.2.1, Aboveground Steel Tanks Inspection**

In the CGS LRA, the applicant states that AMP B.2.1, "Aboveground Steel Tanks Inspection" is a new program with exception that is consistent with the program elements in GALL Report AMP XI.M29, "Aboveground Steel Tanks." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the Final Safety Analysis Report (FSAR) Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The first exception affects LRA program element 2 (preventive actions). In the GALL Report AMP, this program element recommends that sealant or chalking at the interface edge between the tank and concrete foundation mitigates corrosion of the bottom surface of the tank by preventing water and moisture from penetrating the interface, which would lead to corrosion of the bottom surface. Alternatively, this program element in the LRA states, there is no sealant or chalking at the interface edge between the tank and concrete foundation.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "storage tank," "tank coating," and "tank corrosion."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05 Attachment 2.9	License Renewal Evaluation of Aboveground Steel Tanks Inspection Program	Revision 2 4/8/2010
2. AR 00218647	Corrosion and Coating Degradation Identified on CST Tank	No Revision 5/26/2010
3. AR 00218619	PM 23371 Needs Revised to Include UT Exams	No Revision 5/26/2010
4. AR 00211176	PM 23371 Needs Updated to Incorporate Periodic External Inspection of CST Tanks	No Revision 1/17/2010
5. CR 2-07-08674	Paint Chips and Debris in Condensate Storage Tanks	No Revision 9/25/2007

The staff conducted its audit of LRA program elements 1 – 6 based without considering aspects of program element 2 (preventive actions) of the LRA AMP which are associated with the exception. Aspects of these elements not associated with the exception were evaluated and are described below.

During the audit, the staff found that:

elements 1, 3, 4, 5, and 6 (scope of program, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff) and

the operating experience provided by the applicant and identified by the staff's independent data base search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the following subjects:

Surface corrosion and peeling paint was identified at the base of the condensate storage tanks based on the photographs provided by the applicant during a plant walkdown of the audit. It is unclear to the staff how the observed corrosion and paint degradation was evaluated and how this aging effect is managed by the Aboveground Steel Tanks Inspection Program.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 – 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 – 6 for which additional information or additional evaluation is required before consistency can be determined;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.3, Appendix J Program**

In the CGS LRA, the applicant states that AMP XI.S4, "Appendix J Program" is an existing program that is consistent with the program elements in GALL Report AMP XI.S4,

"10 CFR Part 50, Appendix J." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent data base search of the applicant's operating experience database using the keywords: "bolt," "closure stud," "corrosion," "connection," "degrad," "inspect," "loss of material," "piping," "preload," "rust," "SCC," and "weld."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05, Attachment 3.5	Aging Management Program Evaluation Results, Appendix J Program	Revision 3 4/7/2010
2.	Columbia Primary Containment Leakage Testing Program Plan	Revision 5
3.TSP-CONT-B801	Drywell/Wetwell Bypass Leak Rate Test (BLRT)	Revision 2 9/19/2007
4. GI2-05-055	Letter from B. Benney, NRC to J. V. Parrish, Energy Northwest, Subject: Columbia Generating Station – Issuance of Amendment RE: One-time Extension of Appendix J Type A Integrated Leakage Rate Test Interval (TAC No. MC3942)	5/12/2005
5.	Email from J. Twomey to C. Chu dated September 10, 2009, OIN-435 Closure Information: R19 ILRT Test Results	8/18/2009

During the audit of program elements 1 - 6, the staff found that:

elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and the operating experience provided by the applicant and identified by the staff's independent data base search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

To support verification of consistency with GALL Report AMP XI.S4, "10 CFR Part 50, Appendix J, the staff confirmed that the applicant's Appendix J Program is a monitoring program that detects degradation of the Primary Containment and systems penetrating the Primary Containment. The objective of this program is to provide assurance that leakage from the Primary Containment will not exceed maximum values for containment leakage. The regulatory basis for their Appendix J Program includes 10 CFR 50 Appendix J Option B, Regulatory Guide 1.163 (Performance-Based Containment Leak-Test Program), and NEI 94-10 (Industry Guideline for Implementing Performance Based Option of 10 CFR Part 50, Appendix J). During the audit, the applicant provided the staff with the most recent integrated leak rate test (ILRT) result that was obtained on June 14, 2009. The total leakage for this ILRT was 0.341785% which is less than the acceptance limit of 0.50%.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report AMP;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B2.4, Bolting Integrity Program**

In the CGS LRA, the applicant states that AMP B2.4, "Bolting Integrity Program" is an existing program with exceptions, that is consistent with the program elements in GALL Report AMP XI.M18, "Bolting Integrity." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation

process, and administrative controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The first exception affects LRA program elements 1 (scope of program), 2 (preventive actions), and 4 (detection of aging effects). In the GALL Report AMP, these program elements recommend the use of guidelines in NUREG-1339, EPRI NP-5769, and EPRI TR-104213 as the industry's technical basis for this program. Alternatively, the program elements 1 and 2 in the LRA state that the applicant's AMP does not explicitly address the guidelines outlined in EPRI NP-5769, or as delineated in NUREG-1339, but instead relies on recommendations of EPRI document NP-5067. Other elements affected by this exception are: 7 (corrective actions) and 10 (operating experience).

The second exception affects LRA program element 5 (monitoring and trending). Under this element the GALL Report AMP states that if a bolting connection for pressure retaining components (not covered by ASME Section XI ISI) is reported to be leaking, then it may be inspected daily. Further, if the leak rate does not increase, the inspection frequency may be decreased to biweekly or weekly. Alternatively, the program element 5 in the LRA states that the frequency of follow-up inspections is established by engineering evaluation of the identified problem.

The third exception affects LRA program element 6 (acceptance criteria). The element 6 of GALL AMP XI.M18 recommends that indications of aging effects in ASME pressure retaining bolting be evaluated in accordance with Section XI of the ASME Code, and for other pressure retaining bolting, NSSS component support bolting and structural bolting, indications of aging be dispositioned in accordance with the corrective action process. Alternatively, the program element 6 of LRA does not specify acceptance criteria for bolting, and instead indicates that the other related inspection/monitoring programs do, or will prior to the period of extended operation, include acceptance criteria for evidence of degradation in the bolting.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "bolting," "fastener," "stress corrosion," "crack," "preload," "torque," "gasket," "leak," "lubricant or sealant," "tightening," "hot bolting," and "assembly."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. PPM 10.2.10	Fastener Torque and Tensioning	Revision 022 10/16/2008
2. PPM 10.2.13	Approved Lubricants	Revision 053 12/31/2009

Document	Title	Revision / Date
3. TM-1302	Bolts/Fasteners and Torquing Guidelines	08/05/1983
4. TM-2081	Fastener Torque Control Tolerances	Revision 0 2/24/1995
5. EPRI NP-5067, Volume 1	Good Bolting Practices, a Reference Manual for Nuclear Power Plant Maintenance Personnel, "Large Bolt Manual"	1987
6. EPRI NP-5067, Volume 2	Good Bolting Practices, a Reference Manual for Nuclear Power Plant Maintenance Personnel, "Small Bolts and Threaded Fasteners"	12/1990
7. AR 1314-28	Comparison of Columbia's Bolting Integrity Program to Industry Recommendations, pages 1-4	1/7/2010
8. AR 7766	Use of Hardened Washers in Bolted Connections	2/23/2005
9. CR 2-04-05860	EPRI Recommends the Use of Hardened Washers in Bolted Connections	10/21/2004
10. CR 2-06-08057	HPCS-P-2 Pressure Boundary Bolting Was Found Significantly Degraded	11/03/2006
11. PER 203-1265	Deficiencies Noted/Discovered on 18" Sw(22)-2 Sw B Return Line Pipe Supports Downstream of Sw-V-12b Between Swph B and the Sw A Spray Pond	04/17/2003
12. PER 203-3624	Mounting Bolts Have Corrosion Buildup and Are Susceptible to Failure	10/01/2003
13. PER 204-0169	Corrosion of Underwater Service Water Pump Bolts	01/14/2004
14. LRPD-04	Operating Experience Review Results and Summary	Revision 3 04/12/2010

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed exceptions.

During the audit, the staff found that:

element 3 (parameters monitored/inspected) of the LRA AMP was consistent with the corresponding element of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1, 2, 4, 5, and 6 (scope of program, preventive actions, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 2, 4, 5, and 6 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAls for the following subjects:

In element 1 (scope of program) and element 2 (preventive actions) of the LRA AMP the applicant states that it does not explicitly address the guidelines outlined in EPRI NP-5769, or as delineated in NUREG-1339, and instead relies on the recommendations contained in related EPRI document NP-5067. The GALL Report AMP states that staff's recommendations and guidelines are delineated in NUREG-1339, and incorporate EPRI NP-5769 (with the exceptions noted in NUREG-1339) and EPRI TR-104213 as the industry's technical basis. It is not clear to the staff if these two positions are fully consistent or the two technical bases are equivalent, because the single document used by the applicant is an earlier report and forms a subset of the GALL referenced three newer documents.

Other elements affected by the above NP-5067 exception also include: 4 (detection of aging effects) and 10 (operating experience). These impacts are not noted in the LRA exception. The GALL Report consistency of LRA AMP for these elements under this exception is not clear to the staff, because NP-5067 is primarily "good practices" (maintenance) manual for solving maintenance problems as they occur and not necessarily focused on long-term management of aging issues—as the manual itself well predates the license renewal effort—which also address evaluation procedures for assuring integrity, appropriate acceptance criteria, and management of stress corrosion cracking (SCC) in non-ASME bolting.

The Element 4 (detection of aging effects) of GALL AMP XI.M18 notes that the potential for SCC of structural bolts/fasteners of nuclear steam supply system (NSSS) component supports should be assessed based on the actual yield strength, and for the identified high strength bolting (greater than 1-inch nominal diameter) volumetric examination comparable to that of Examination Category B-G-1 is required in addition to visual examination. From the review of on-site documentation the staff could not confirm if the potential for SCC in the applicable bolting was evaluated and whether the actual yield strength values were factored in the evaluation. Based on the staff's discussion with the applicant's technical staff it appears that only visual examination of these bolts/fasteners is covered under the applicant's bolting program. For these reasons the consistency of this element of LRA AMP with the GALL Report is not clear to the staff without further clarifications.

In Element 5 (monitoring and trending) of the LRA AMP the applicant states that, for bolting not covered by the ASME ISI programs (IWB, IWC, IWD, and IWF), if leakage or degradation is detected through other periodic inspection programs then the frequency of follow-up inspections is established by an engineering evaluation of the identified problem. In the GALL Report AMP it states that if bolting connections for pressure retaining components (not covered by ASME Section XI) is reported to be leaking, then it may be inspected daily, and if the leak rate does not increase, the inspection frequency may be decreased to biweekly or weekly. These two statements do not seem consistent or equivalent to the staff since the GALL Report is prescriptive while the LRA AMP uses engineering judgment and report evaluation on a case-by-case basis.

In Element 6 (acceptance criteria) the applicant does not specify acceptance criteria for bolting, and instead indicates that other related inspection/monitoring programs do, or will prior to the period of extended operation, include acceptance criteria for evidence of degradation in the bolting. The GALL AMP XI.M18 recommends that indications of aging effects in ASME pressure retaining bolting be evaluated in accordance with Section XI of the ASME Code, and for other pressure retaining bolting, NSSS component support bolting and structural bolting, indications of aging be dispositioned in accordance with the corrective action process. It is not clear to the staff that these statements are consistent because the acceptance criteria in the LRA AMP are either not specified or do not indicate the incorporation of corrective action process in dispositioning of indications under this LRA AMP.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify whether the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the following subjects:

The operating experience described in LRA AMP notes that loss of preload, leaking joints and closures, corroded bolting connections have been identified and corrective actions taken, and that the experience was reviewed and found to be effective. The staff could not judge the program effectiveness since there was no consolidated list of these occurrences and (reduction in) their frequency over time. The staff also noted a recent instance of bolting degradation related to aging (LER-2009-005-00) not discussed in the applicant's experience review.

Since the applicant's review shows that only leaks have been found, and no cracking in any bolting application under the license renewal scope, these must come from improper assembly and/or loss of preload. The operating experience also shows continued occurrence of loss of preload instances. These observations reflect on the training and implementation under applicant's reliance on EPRI NP-5067 guidance. Therefore, it is not clear to the staff if the effectiveness and any self-assessment of the training and procedural management of the bolting integrity program, especially for the loss of preload, are adequate for the extended period of operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable, with the exception dealing with the applicant's use of EPRI NP-5067 instead of the GALL Report AMP basis documents NUREG-1339, EPRI NP-5769, and EPRI

TR-104213 — none of which are noted in the FSAR Supplement description. This exception is discussed above for which it is already noted that the staff will consider issuing an RAI.

Based on this audit the staff:

verified that most aspects of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B.2.5, Buried Piping and Tanks Inspection**

In the Columbia Generation Station LRA, the applicant states that AMP B.2.5, "Buried Piping and Tank Inspection" is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M34, "Buried Piping and Tanks Inspection." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects LRA program element 1 (scope of program). This enhancement expands on the existing program element by adding the buried portions of the radwaste building outside air piping.

The second enhancement affects LRA program element 4 (detection of aging effects). This enhancement expands on the existing program element by adding additional inspections of a representative sample of buried piping to be performed within the 10-year period prior to and after entering the period of extended operation.

During its audit, the staff conducted a walkdown, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "buried piping," "steel piping," and "piping corrosion."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05 Attachment 2.3	License Renewal Evaluation of Buried Piping and Tanks Inspection Program	Revision 2 4/15/2010
2. AR 213308	Piping Exposed for SW-V-816 Work Has Coating Failures	No Revision 2/24/2010
3. SWP-ENG-04	Buried Piping Integrity Program	Revision 0 4/3/2008
4. PER 202-2754	OER PER INPO Network Item OE 14585 – Leakage of Buried Air Piping Discovered When Bubble Were Observed in a Puddle Near Cooling Tower	No Revision 11/26/2002

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff found that:

elements 1, 2, 3, 4, 5, and 6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify whether the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the following subjects:

Recent events at nuclear power plants have given rise to new insight for management of aging issues for buried piping. It is not clear to the staff whether lessons learned from these recent industry operating experience are incorporated this experience into the applicant's buried piping AMP.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

verified that the description provided in the FSAR Supplement is an adequate description of the program

**LRA AMP B.2.6, BWR Feedwater Nozzle Program**

In the CGS LRA, Section B.2.6, the applicant stated that the boiling-water reactor (BWR) Feedwater (FW) Nozzle Program at CGS is an existing program that will assure that aging degradation due to intergranular stress corrosion cracking (IGSCC) is adequately managed for CGS' FW nozzle components, so that their intended function is maintained. This AMP entails inspection and evaluation of the aging effects due to cracking and provides guidelines for mitigating cracking. The applicant further stated that this AMP is consistent with the program elements in GALL AMP XI.M5, "BWR Feedwater Nozzle."

During the audit, the staff reviewed the applicant's on-site basis documentation for the CGS BWR FW Nozzle Program in order to determine whether CGS' BWR FW Nozzle Program elements are consistent with the 10 elements in GALL AMP XI.M5. The staff also interviewed the applicant's technical staff and reviewed other on-site documentation for determining whether the CGS BWR FW Nozzle Program, as described in LRA Section B.2.6, is consistent with GALL AMP XI.M5 and in compliance with regulatory requirements. The staff reviewed the following onsite documents:

**Relevant Documents Reviewed**

Document	Title	Revision / Date
LRPD-05, Attachment 1.1	Columbia License Renewal Project, XI.M5, BWR Feedwater Nozzle Program [On-Site Basis Document]	Rev 3 / 4-6-10
AR Number 00097169	OE9966 [Pertains to Industry Operating Experience (OE) Regarding FW Nozzle Weld Flaws at Perry]	6/1/1999
AR Number 00031665	Additional thermal cracks have been recorded in the RPV RFW [Cracks Verified to be in the Non-Code FW Sparger Components; Applicant's Inspections Follow General Electric (GE) Report NE-523-A71-0594-A]	5/30/2005
ISI-3	Columbia Third 10-Year Interval Inservice Inspection Program Plan, "INTERVAL 3"	Rev. 3

The staff reviewed the applicant's on-site basis documentation for the CGS BWR FW Nozzle Program in order to verify that the elements of this program are consistent with GALL AMP XI.M5 program elements 1 through 10. The staff found that these program elements, as discussed in LRA Section B.2.6 and the supporting basis documentation, are consistent with the GALL AMP XI.M5 program elements with the exception of an issue concerning the qualification of ultrasonic non-destructive examination (NDE) systems. The applicant stated that inspection and flaw evaluation for CGS' FW nozzle components is implemented in accordance with ASME Code, Section XI requirements and the recommendations of General Electric (GE) Report NE-523-A71-0594-A. The applicant stated that the control of reactor coolant system (RCS) water chemistry at Columbia is implemented in accordance with the guidelines of applicable Boiling-Water Reactor Vessel and Internals Project (BWRVIP) documents. The staff verified that the applicant provided an adequate summary description of this program in LRA Section B.2.6.

During the audit, staff also reviewed the CGS Inservice Inspection (ISI) Program Plan for the current (third) 10-year interval ISI program. The staff also reviewed operating experience reports, including a sample of condition reports prepared by the applicant, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff verified that the operating experience described in the applicant's basis documents adequately addresses the plant-specific operating experience for this AMP.

During the AMP audit, the staff found that several issues related to the applicant's implementation of ISI requirements for the FW nozzle components required further clarification. These issues are: (1) ASME Code, Section XI compliance related to the implementation of GE Report NE-523-A71-0594-A and (2) the qualification of ultrasonic non-destructive examination (NDE) systems. The staff issued a RAI to address these issues, and the resolution of the RAIs will be discussed in the staff's safety evaluation for LRA Section B.2.6. With the exception of the above issues, the staff confirmed that the elements of the Columbia BWR FW Nozzle Program are consistent with and bounded by the program elements described in GALL AMP XI.M5.

#### **LRA AMP B.2.7, BWR Penetrations Program**

In the CGS LRA, Section B.2.7, the applicant stated that the BWR Penetrations Program at Columbia is an existing program that will assure that aging degradation due to IGSCC is adequately managed for CGS reactor vessel (RV) penetrations, so that the intended function of these components is maintained. This AMP entails inspection and evaluation of the aging effects due to cracking and provides guidelines for mitigating cracking. The applicant further stated that this AMP is consistent with the program elements in GALL AMP XI.M8, "BWR Penetrations."

During the audit, the staff reviewed the applicant's on-site basis documentation for the CGS BWR Penetrations Program in order to determine whether CGS' BWR Penetrations Program elements are consistent with the 10 elements in GALL AMP XI.M8. The staff also interviewed the applicant's technical staff and reviewed other on-site documentation for determining whether

the Columbia BWR Penetrations Program, as described in LRA Section B.2.7, is consistent with GALL AMP XI.M8. The staff reviewed the following onsite documents:

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRPD-05, Attachment 1.2	Columbia License Renewal Project, XI.M8, BWR Penetrations Program (On-Site Basis Document)	Rev 3 / 4-6-10
ISI-3	Columbia Third 10-Year Interval Inservice Inspection Program Plan, "INTERVAL 3"	Rev. 3

The staff reviewed the applicant's on-site basis documentation for the CGS BWR Penetrations Program in order to verify that the elements of this program are consistent with the GALL AMP XI.M8 program elements 1 through 10. The staff found that the on-site basis documentation adequately discussed these program elements. The staff found that these program elements, as discussed in LRA Section B.2.7 and the supporting basis documentation, are consistent with the GALL AMP XI.M8 program elements. The applicant stated that inspection and flaw evaluation for these components is carried out in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements and the guidelines of applicable BWRVIP documents. The applicant stated that the control of reactor coolant system (RCS) water chemistry is implemented in accordance with the guidelines of applicable BWRVIP documents. The staff verified that the applicant provided an adequate summary description of this AMP in LRA Section B.2.7.

During the audit, staff also reviewed the CGS ISI Program Plan for the current (third) 10-year interval ISI program and applicable BWRVIP documents. The staff also reviewed operating experience reports, including a sample of condition reports prepared by the applicant, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff verified that the operating experience described in the applicant's basis document adequately addresses the plant-specific operating experience for this AMP.

During the AMP audit, the staff found no issues of concern related to the applicant's implementation of BWRVIP documents and management of aging degradation for the CGS RV penetrations components. The staff confirmed that the elements of the CGS BWR Penetrations Program are consistent with and bounded by the program elements described in GALL AMP XI.M8.

**LRA AMP B.2.8, BWR Stress Corrosion Cracking Program**

In the CGS LRA, Section B.2.8, the applicant stated that the BWR SCC Program at Columbia is an existing program that will assure that aging degradation due to IGSCC is adequately managed for CGS' reactor coolant pressure boundary (RCPB) components, so that their intended function is maintained. This AMP entails inspection and evaluation of the aging effects

due to cracking and provides guidelines for mitigating cracking. The applicant further stated that this AMP is consistent with the program elements in GALL AMP XI.M7, "BWR Stress Corrosion Cracking."

During the audit, the staff reviewed the applicant's on-site basis documentation for the CGS BWR SCC Program in order to determine whether CGS' BWR SCC Program elements are consistent with the 10 elements in GALL AMP XI.M7. The staff also interviewed the applicant's technical staff and reviewed other on-site documentation for determining whether the CGS BWR SCC Program, as described in LRA Section B.2.8, is consistent with GALL AMP XI.M7 and in compliance with regulatory requirements. The staff reviewed the following onsite documents:

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRPD-05, Attachment 1.3	Columbia License Renewal Project, XI.M7, BWR Stress Corrosion Cracking Program (On-Site Basis Document)	Rev 3 4/6/2010
AR Number 00049737	OER CR INPO OE24381 Ultrasonic inspection of the recirculation system [Pertains to Industry OE, Regarding Recirc Nozzle-to-Safe End Weld Flaws at Duane Arnold]	12/13/2007
AR Number 00053866	The initial HPCS-P-1 16" inlet piping ASME weld during R-18 [this is a Code-compliant weld repair to a Class 2 ECCS system component]	7/12/2007
AR Number 00042348	OER CR INPO OE22809 – GL 88-01 Exams Not Performed Within Required Frequency [Industry OE for GL 88-01 Category E Welds at Perry Erroneously Put on a 10-Year Examination Schedule]	12/13/2007
AR Number 00042348	OE 22809 - GL 88-01 Exams Not Performed Within Required Frequency [Pertains to Industry OE Addressed By the Columbia ISI Program]	11/14/2006
ISI-3	Columbia Third 10-Year Interval Inservice Inspection Program Plan, "INTERVAL 3"	Rev. 3

The staff reviewed the applicant's on-site basis documentation for the CGS BWR SCC Program in order to verify that the elements of this program are consistent with GALL AMP XI.M7 program elements 1 through 10. The staff found that these program elements, as discussed in LRA Section B.2.8 and the supporting basis documentation, are consistent with the GALL AMP XI.M7 program elements with the exception of issues concerning 10 CFR 50.55a compliance related to implementation of BWRVIP documents, the disposition of flaws in RCPB piping, and the qualification of ultrasonic NDE systems. The applicant stated that inspection and flaw evaluation for Columbia's RCPB components is implemented in accordance with the ASME Code, Section XI requirements, Generic Letter (GL) 88-01 criteria, and applicable BWRVIP documents. The applicant stated that the control of reactor coolant system (RCS) water chemistry at Columbia is implemented in accordance with the guidelines of applicable BWRVIP

documents. The staff verified that the applicant provided an adequate summary description of this program in LRA Section B.2.8.

During the audit, staff also reviewed the CGS ISI Program Plan for the current (third) 10-year interval ISI program and BWRVIP documents. The staff also reviewed operating experience reports, including a sample of condition reports prepared by the applicant, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff verified that the operating experience described in the applicant's basis documents adequately addresses the plant-specific operating experience for this AMP.

During the AMP audit, the staff found that several issues related to the applicant's implementation of BWRVIP documents and management of aging degradation for the RCPB components required further clarification. These issues are: (1) 10 CFR 50.55a and ASME Code, Section XI compliance related to the implementation of BWRVIP-75, (2) the disposition of flaws in RCPB piping components previously categorized under GL 88-01 criteria, and (3) the qualification of ultrasonic NDE systems in accordance with ASME Code, Section XI requirements. The staff issued an RAI to address these issues, and the resolution of the RAIs will be discussed in the staff's safety evaluation for LRA Section B.2.8. With the exception of the above issues, the staff confirmed that the elements of the CGS BWR SCC Program are consistent with and bounded by the program elements described in GALL AMP XI.M7.

#### **LRA AMP B.2.9, BWR Vessel ID Attachment Welds Program**

In the CGS LRA, Section B.2.9, the applicant stated that the BWR Vessel ID Attachment Welds Program at Columbia is an existing program that will assure that aging degradation due to IGSCC is adequately managed for CGS RV ID attachment welds, so that the intended function of these components is maintained. This AMP entails inspection and evaluation of the aging effects due to cracking and provides guidelines for mitigating cracking. The applicant further stated that this AMP is consistent with the program elements in GALL AMP XI.M4, "BWR Vessel ID Attachment Welds."

During the audit, the staff reviewed the applicant's on-site basis documentation for the Columbia BWR Vessel ID Attachment Welds Program in order to determine whether CGS' BWR Vessel ID Attachment Welds Program elements are consistent with the 10 elements in GALL AMP XI.M4. The staff also interviewed the applicant's technical staff and reviewed other on-site documentation for determining whether the CGS BWR Vessel ID Attachment Welds Program, as described in LRA Section B.2.9, is consistent with GALL AMP XI.M4. The staff reviewed the following onsite documents:

#### **Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRPD-05, Attachment 1.4	Columbia License Renewal Project, XI.M4, BWR Vessel ID Attachment Welds Program [On-Site Basis Document]	Rev 3 4/6/10

Document	Title	Revision / Date
ISI-3	Columbia Third 10-Year Interval Inservice Inspection Program Plan, "INTERVAL 3"	Rev. 3

The staff reviewed the applicant's on-site basis documentation for the CGS BWR Vessel ID Attachment Welds Program in order to verify that the elements of this program are consistent with the GALL AMP XI.M4 program elements 1 through 10. The staff found that the on-site basis documentation adequately discussed these program elements. The staff found that these program elements, as discussed in LRA Section B.2.9 and the supporting basis documentation, are consistent with the GALL AMP XI.M4 program elements. The applicant stated that inspection and flaw evaluation for these components is carried out in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements and the guidelines of applicable BWRVIP documents. The applicant stated that the control of RCS water chemistry is implemented in accordance with the guidelines of applicable BWRVIP documents. The staff verified that the applicant provided an adequate summary description of this AMP in LRA Section B.2.9.

During the audit, staff also reviewed the CGS ISI Program Plan for the current (third) 10-year interval ISI program and applicable BWRVIP documents. The staff also reviewed operating experience reports, including a sample of condition reports prepared by the applicant, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff verified that the operating experience described in the applicant's basis document adequately addresses the plant-specific operating experience for this AMP.

During the AMP audit, the staff found no issues of concern related to the applicant's implementation of BWRVIP documents and management of aging degradation for the CGS RV ID attachment welds components. The staff confirmed that the elements of the Columbia BWR Vessel ID Attachment Welds Program are consistent with and bounded by the program elements described in GALL AMP XI.M4.

#### **LRA AMP B.2.10, BWR Vessel Internals Program**

In the CGS LRA, Section B.2.10, the applicant stated that the BWRVIP at Columbia is an existing program that will assure that aging degradation due to IGSCC, irradiation-assisted stress corrosion cracking (IASCC), and fatigue is adequately managed for CGS reactor's vessel internal (RVI) components, so that their intended function is maintained. This AMP entails inspection and evaluation of the aging effects due to cracking and provides guidelines for mitigating cracking. The applicant further stated that this AMP is consistent with the program elements in GALL AMP XI.M9, "BWR Vessel Internals."

During the audit, the staff reviewed the applicant's on-site basis documentation for the CGS BWRVIP in order to determine whether CGS' BWRVIP elements are consistent with the 10 elements in GALL AMP XI.M9. The staff also interviewed the applicant's technical staff and reviewed other on-site documentation for determining whether the CGS BWRVIP, as described

in LRA Section B.2.10, is consistent with GALL AMP XI.M9. The staff reviewed the following onsite documents:

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRPD-05, Attachment 1.5	Columbia License Renewal Project, XI.M9, BWR Vessel Internals Program (On-Site Basis Document)	Rev 3 4/14/2010
AR Number 00037431	INPO's October 2005 BWRVIP Review Visit Report Recommendations	5/31/2006
ISI-3	Columbia Third 10-Year Interval Inservice Inspection Program Plan, "INTERVAL 3"	Rev. 3

The staff reviewed the applicant's on-site basis documentation for the CGS BWRVIP in order to verify that the elements of this program are consistent with the GALL AMP XI.M9 program elements 1 through 10. The staff found that the on-site basis documentation adequately discussed these program elements. The staff found that these program elements, as discussed in LRA Section B.2.10 and the supporting basis documentation, are consistent with GALL AMP XI.M9 program elements, with the exception of aging management issues related to the implementation of BWRVIP documents for the core shroud, steam dryer, and access hole covers; and the management of aging effects and neutron embrittlement analyses for the core shroud. The applicant stated that inspection and flaw evaluation for the RVI components and the control of RCS water chemistry are implemented in accordance with the guidelines of applicable BWRVIP documents. The staff verified that the applicant provided an adequate summary description of this program in LRA Section B.2.10.

During the audit, staff also reviewed the CGS ISI Program Plan for the current (third) 10-year interval ISI program, CGS site ISI procedures for RVI components, and BWRVIP documents. The staff also reviewed operating experience reports, including a sample of condition reports prepared by the applicant, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff verified that the operating experience described in the applicant's basis document adequately addresses the plant-specific operating experience for this AMP.

During the AMP audit, the staff found that several issues related to the applicant's implementation of BWRVIP documents and management of aging degradation for the RVI components required further clarification. These issues are: (1) the applicant's implementation of specific BWRVIP documents for the core shroud, steam dryer, and RV access hole covers, (2) specific actions related to the management of aging effects for the core shroud, (3) reduced fracture toughness for core shroud materials exposed to a higher neutron fluence levels, (4) the methodology for calculating core shroud fluence exposure, and (5) the NDE coverage for the jet pump holddown beams. The staff issued a request for additional information (RAI) to address these issues, and the resolution of the RAIs will be discussed in the staff's safety evaluation for LRA Section B.2.10. With the exception of the above issues, the staff confirmed that the elements of the Columbia BWRVIP are consistent with and bounded by the program elements described in GALL AMP XI.M9.

### LRA AMP B.2.11, BWR Water Chemistry

In the CGS LRA, the applicant states that AMP B.2.11, "BWR Water Chemistry Program" is an existing program that is consistent with the program elements in GALL Report AMP XI.M2, "Water Chemistry." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent data base search of the applicant's operating experience database using the keywords: "oxygen," "chemistry," "hydrogen," "sulfate" and "SCC."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1.	Columbia Generating Station LRA, B.2.11, BWR Water Chemistry Program	No Revision 01/2010
2. Chem.6	Chemistry Strategic Plan	Revision 2 5/21/2006
3. SWP-CHE-02	Chemical Process Management and Control	Revision 16 04/07/2009
4. BWRVIP-130	BWR Vessel and Internals Project BWR Water Chemistry Guidelines	No Revision 10/2004
5. LRPD-05 Att 2.4	BWR Water Chemistry Program	Revision 2 1/15/2000
6. AR 00025640	Hydrogen injection rate of 5 SCFM into the condensate/ feedwater system has resulted in a feedwater dissolved oxygen level less 30 ppb.	No Revision 09/15/2004
7. AR 00020856	Reactor water sulfate and chloride concentrations exceeded the normal plant Mode 1 ranges of <2ppb and <1 ppb, respectively	No Revision 05/24/2010
8. AR 00020700	Reactor water sulfate and chloride concentrations exceeded the normal plant Mode 1 ranges of <2ppb and <1 ppb, respectively	No Revision 02/23/2004

During the audit of program elements 1 - 6, the staff found that:

elements 1, 2, 3, 4, 5, and 6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff).

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report AMP;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **LRA AMP B.2.12, Chemistry Program Effectiveness Inspection**

In the CGS LRA, the applicant states that AMP B.2.12, "Chemistry Program Effectiveness Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 12. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "chemistry," "cracking," "piping," "corrosion," "fuel oil," and "weld."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Chemistry Program Effectiveness Inspection	(no rev. no.) (no date)
2. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009
3. LRPD-05, Attachment 2.4d	Aging Management Program Evaluation Results, Chemistry Program Effectiveness Inspection	Revision 1 10/12/2009
4. LRPD-05	Aging Management Program Evaluation Results	Revision 3 5/03/2010
5. CR 2-05-06248	Fuel Oil Tank Found to have Excessive Amount of Water, Sludge, and Bio-Fouling during Cleaning per 01098416-01	(no rev. no.) 8/03/2005

During the audit of program elements 1 - 6, the staff found that:

elements 2 (Preventive Actions), 5 (Monitoring and Trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

element 1 (scope of program) of the LRA AMP was not strictly consistent with the corresponding elements of the GALL Report AMP but that sufficient information was available to allow the staff to determine that this element of the LRA AMP is equivalent to the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 3 (parameters monitored/inspected) and 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

The basis for the staff's determination that element 1 (scope of program) of the LRA AMP is equivalent to the corresponding GALL Report AMP is as follows:

Element 1 of the applicant's AMP fails to state that the program verifies that unacceptable degradation is not occurring, thereby validating the effectiveness of existing AMPs in accordance with GALL XI.M35. However, this statement is made in the opening paragraph of the applicant's AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 3 (parameters monitored/inspected) and 4 (detection of aging effects) are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques...." The GALL Report AMP XI.M32 states under this program element that inspections are to be

performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant AMP states that “a sample population will be determined by engineering evaluation based on sound statistical sampling methodology...” The GALL Report AMP XI.M32 states under this program element that “the inspection includes a representative sample of the system population, and, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin.” It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff’s independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff’s independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and verified that the description provided in the FSAR Supplement is an adequate description of the program.

**LRA AMP B.2.13, Closed Cooling Water Chemistry Program**

In the Columbia Generating Station LRA, the applicant states that AMP B.2.13, "Closed Cooling Water Chemistry Program" is an existing program with an enhancement and an exception that is consistent with the program elements in GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects LRA program element 4 (detection of aging). This enhancement expands on the existing program element by adding at least one additional RCC corrosion rate measurement prior to entering the period of extended operation in order to ensure the effectiveness of the chemical treatments. The LRA further states that additional measurements and their frequency may be considered depending upon the corrosion rate results.

In Section A.1.5 of the LRA, the applicant committed to implement this enhancement prior to the period of extended operation.

The first exception affects LRA program element 3 through 6 (parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria). In the GALL Report AMP, this program element recommends that performance or functional testing is conducted for heat exchangers and pumps. Alternatively, this program element in the LRA states, that performance or functional testing for managing loss of material or cracking does not provide information about the degradation of passive components. The program elements further state that instead of performance or functional testing, one time inspection testing will be conducted to ensure the adequacy for mitigating the loss of material and cracking in low flow and stagnant areas.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "chemistry," "crack," and "pitting."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05 Attachment 2.4b	Closed Cooling Water Chemistry Program	Revision 1 10/9/2009

Document	Title	Revision / Date
2. SWP-CHE-02	Chemical Process Management and Control	Revision 15 4/22/2008
3. PPM 12.14.9	Sampling of Chilled, Heated and Cooling Jacket Water Systems	Revision 10 4/25/2007
4. PPM 12.14.10	Chemical Addition to the Chilled and Heated Water Systems	Revision
5. PPM 12.14.11	Chemical Addition to the Cooling Jacket Water Systems	Revision 6 7/15/2008
6. PPM 12.14.12	Reactor Closed Cooling Water	Revision 7 2/1/2007
7. PowerPlant Chemistry Article	Flow Restrictions in Water-Cooled Generator Stator Coils: Prevention, Diagnosis and Removal	No Revision 2004
8. CL-9.4	Trending - Energy Northwest Chemistry Instructions	Revision 7 1/7/2009
9. EPRI 1007820	Closed Cooling Water Chemistry Guideline	Revision 1 4/2004

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements. Aspects of program elements 3 through 6 (parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP associated with the exception were not evaluated during this audit. Aspects of these program elements that are not associated with the exception were evaluated and are described below

During the audit, the staff found that:

elements 1, 3, 4, 5, 6 (scope of program, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

elements 2 (preventive actions) of the LRA AMP were not strictly consistent with the corresponding elements of the GALL Report AMP but that sufficient information was available to allow the staff to determine that this element of the LRA AMP are equivalent to the corresponding elements of the GALL Report AMP; and

The basis for the staff's determination that element 2 (preventive actions) of the LRA AMP is equivalent to the corresponding GALL Report AMP is:

In the applicant's closed cooling water chemistry program, the applicant indicated that it was using the EPRI 1007820, Closed-Cycle Water Chemistry Guideline, Revision 1. The GALL Report indicates that the EPRI Closed-Cycle Water Chemistry Guideline, Revision 0 should be used. The staff considered the use of the updated EPRI guidelines acceptable because they incorporate newer operating experiences in closed cycle cooling water systems.

Secondly, the applicant indicated that the HVAC chiller is a nitrate system, but does not use azoles as suggested by the EPRI Guideline Report. The applicant provided documentation that shows the copper corrosion levels to be low under the operating conditions found in the HVAC chiller system. The staff find that it is acceptable to not use azoles in this system because the environment is not conducive to corrosion of copper and copper concentration in the system is being monitored for indications of corrosion.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff);

the operating experience provided by the applicant and identified by the staff's independent data base search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report AMP

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.14, Cooling Units Inspection**

In the Columbia LRA, the applicant states that AMP B.2.14, "Cooling Units Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 14. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "condensation," "corrosion," "fouling," "MIC," "coils," and "cooling unit."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Cooling Units Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9b	Aging Management Program Evaluation Results, Cooling Units Inspection	Revision 2 (no date)
4. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
3. AR 00182962	DSA-TK-1B UT Head Thickness Step Change	(no rev. no.) 06/24/2008
4. WO 01045966, Task 01	DSA-TK1B—Internal Inspection of	(no rev. no.) 08/06/2002
5. WO 01101172, Task 01	WMAAH52AINSP—Inspect Coils	(no rev. no.) 12/06/2005
6. WO 01101173, Task 01	WMAAH51AINSP—Inspect Cooling Coils	(no rev. no.) 10/11/2005
7. WO 01131937, Task 01	WMAA-AH-52B—Inspect Unit/Clean Coils	(no rev. no.) 06/19/2007
8. WO 01131938, Task 01	WMAA-AH-51B—Inspect Unit/Clean Coils	(no rev. no.) 06/25/2007
9. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 2 (Preventive Actions), 5 (Monitoring and Trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and sufficient information was not available to determine whether elements 1 (scope of program), 3 (parameters monitored/inspected), 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 2 (preventive actions), 5 (monitoring and trending), and 6 (acceptance criteria) are

consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 1, the applicant's AMP is presented as a stand-alone program designed to verify lack of degradation in the applicable components. In the GALL Report AMP it states that the program "includes measures to verify that unacceptable degradation is not occurring, thereby verifying the effectiveness of existing AMPs..." The SRP-LR (Table 3.1-2) further states in the FSAR Supplement guidelines that the One-Time Inspection Program "verifies the effectiveness of other aging management programs..." It is not clear to the staff that these statements are consistent because the applicant's AMP does not identify an underlying aging prevention or mitigation program for which it provides verification.

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "a sample population will be determined by engineering evaluation based on sound statistical sampling methodology." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population, and, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing an RAI as described above for program element 1 ("Scope of Program").

Based on this audit the staff:

verified that half of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B.2.15, Control Rod Drive Return Line Nozzle Program**

In the CGS LRA, Section B.2.15, the applicant stated that the Control Rod Drive Return Line (CRDRL) Nozzle Program at CGS is an existing program that will assure that aging degradation due to IGSCC and fatigue is adequately managed for CGS' CRDRL nozzle components, so that their intended function is maintained. This AMP entails inspection and evaluation of the aging effects due to cracking and provides guidelines for mitigating cracking. The applicant further stated that this AMP is consistent with the program elements in GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle."

During the audit, the staff reviewed the applicant's on-site basis documentation for the CGS CRDRL Nozzle Program in order to determine whether CGS' CRDRL Nozzle Program elements are consistent with the 10 elements in GALL AMP XI.M6. The staff also interviewed the applicant's technical staff and reviewed other on-site documentation for determining whether the CGS CRDRL Nozzle Program, as described in LRA Section B.2.15, is consistent with GALL AMP XI.M6 and in compliance with regulatory requirements. The staff reviewed the following onsite documents:

#### **Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRPD-05, Attachment 1.6	Columbia License Renewal Project, XI.M6, Control Rod Drive Return Line Nozzle Program (On-Site Basis Document)	Rev 3 / 4-14-10
AR Number 00022251	CR00204196 OE CR NRC IN 2004-08: Reactor Coolant Pressure Boundary Leakage Attributable to Propagation of Cracking in RV Nozzle Welds [Pertains to Industry OE and NRC Information Notice, Regarding CRDRL Nozzle-to-Cap Weld Cracking at Pilgrim]	8/5/2006
ISI-3	Columbia Third 10-Year Interval Inservice Inspection Program Plan, "INTERVAL 3"	Rev. 3

The staff reviewed the applicant's on-site basis documentation for the CGS CRDRL Nozzle Program in order to verify that the elements of this program are consistent with GALL AMP XI.M6 program elements 1 through 10. The staff found that these program elements, as discussed in LRA Section B.2.15 and the supporting basis documentation, are consistent with

the GALL AMP XI.M6 program elements with the exception of an issue concerning the qualification of ultrasonic NDE systems. The applicant stated that inspection and flaw evaluation for Columbia's CRDRL nozzle components is implemented in accordance with ASME Code, Section XI requirements. The applicant stated that the control of RCS water chemistry at CGS is implemented in accordance with the guidelines of applicable BWRVIP documents. The staff verified that the applicant provided an adequate summary description of this program in LRA Section B.2.15.

During the audit, staff also reviewed the CGS ISI Program Plan for the current (third) 10-year interval ISI program and documentation concerning modifications to the CRDRL. The staff also reviewed operating experience reports, including a sample of condition reports prepared by the applicant, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff verified that the operating experience described in the applicant's basis documents adequately addresses the plant-specific operating experience for this AMP.

During the AMP audit, the staff found that one issue related to the applicant's implementation of ISI requirements for the CRDRL nozzle components required further clarification. This issue concerns ASME Code, Section XI compliance related to the qualification of ultrasonic NDE systems. The staff issued a request for additional information (RAI) to address this issue, and the resolution of the RAI will be discussed in the staff's safety evaluation for LRA Section B.2.15. With the exception of the above issue, the staff confirmed that the elements of the CGS BWR FW Nozzle Program are consistent with and bounded by the program elements described in GALL AMP XI.M6.

#### **LRA AMP B.2.16, Diesel Starting Air Inspection**

In the CGS LRA, the applicant states that AMP B.2.16, "Diesel Starting Air Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 16. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "diesel," "corrosion," "condensation," "dryer," and "piping."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Diesel Starting Air (DSA) Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9d	Aging Management Program Evaluation Results, Diesel Starting Air Inspection	Revision 1 (no date)
4. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
3. AR 00182962	DSA-TK-1B UT Head Thickness Step Change	(no rev. no.) 06/24/2008
4. WOT Package 01045966 01	DSA-TK-1B—Internal Inspection of	(no rev. no.) 08/06/2002
5. CR 2-07-07671	DG DSA Air Sampling Requires Several Different Tests to Pass Dew Point Inspection	(no rev. no.) 08/09/2002
6. LER 90-023-1	Engineered Safety Feature Actuation of Containment Instrument Air (CIA) Caused by System Overpressure During Surveillance Testing	Revision 1 11/05/1990
7. PER 202-1537	Current Thickness of DSA-TK-1B, DSA-TK-3B & DSA-TK7B Bottom Heads has Dropped Below the Code Data Report Thickness Value	(no rev. no.) 05/21/2002
8. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 1 (scope of program), 2 (preventive actions) and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 3 (parameters monitored or inspected), 4 (detection of aging effects), and 5 (monitoring and trending) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 3, 4, and 5 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are

consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "a sample population will be determined by engineering evaluation based on sound statistical sampling methodology." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population, and, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

Under program element 5, the applicant's AMP begins by stating that "No actions are taken as part of the Diesel Starting Air Inspection to monitor or trend inspection results." However, the GALL Report AMP XI.M32 includes guidelines for monitoring and trending inspection results under this program element. In addition, the applicant's statement appears to be inconsistent with its closing statement under this program element, which states that results of the inspection activities may result in "expansion of the sample size and inspection locations to determine the extent of the degradation."

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that three of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

**LRA AMP B.2.17, Diesel Systems Inspection**

In the Columbia LRA, the applicant states that AMP B.2.17, “Diesel Systems Inspection” is a new program that is consistent with the program elements in GALL Report AMP XI.M32, “One-Time Inspection.” The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 17. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “diesel,” “corrosion,” “exhaust,” and “piping.”

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff’s search of the applicant’s operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Diesel Systems Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9e	Aging Management Program Evaluation Results, Diesel Systems Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
4. AR 00182962	DSA-TK-1B UT Head Thickness Step Change	(no rev. no.) 06/24/2008
5. WOT Package 01045966 01	DSA-TK1B—Internal Inspection of	(no rev. no.) 08/06/2002
6. CR 2-07-07671	DG DSA Air Sampling Requires Several Different Tests to Pass Dew Point Inspection	(no rev. no.) 08/09/2002
7. LER 90-023-1	Engineered Safety Feature Actuation of Containment Instrument Air (CIA) Caused by System Overpressure During Surveillance Testing	Revision 1 11/05/1990
8. PER 202-1537	Current Thickness of DSA-TK-1B, DSA-TK-3B & DSA-TK7B Bottom Heads has Dropped Below the Code Data Report Thickness Value	(no rev. no.) 05/21/2002

Document	Title	Revision / Date
9. Design Specification 15B.1	Non-ASME Piping Systems	Revision 27 03/28/2006
10. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 2 (preventive actions), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and sufficient information was not available to determine whether elements 1 (scope of program), 3 (parameters monitored/inspected), and 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3, and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 1, the applicant's AMP is presented as a stand-alone program designed to verify lack of degradation in the applicable components. In the GALL Report AMP it states that the program "includes measures to verify that unacceptable degradation is not occurring, thereby verifying the effectiveness of existing AMPs...." The SRP-LR (Table 3.1-2) further states in the FSAR Supplement guidelines that the One-Time Inspection Program "verifies the effectiveness of other aging management programs ...." It is not clear to the staff that these statements are consistent because the applicant's AMP does not identify an underlying aging prevention or mitigation program for which it provides verification.

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques...." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "a sample population will be determined by engineering evaluation based on sound statistical sampling methodology...." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population, and, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing an RAI as described above for program element 1 (scope of program).

Based on this audit the staff:

verified that half of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B.2.18, Diesel-Driven Fire Pumps Inspection**

In the CGS LRA, the applicant states that AMP B.2.18, "Diesel-Driven Fire Pumps Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 18. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's

operating experience database using keywords: "diesel," "fire pump," "corrosion," "exhaust," "heat exchanger," and "piping."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

<b>Relevant Documents Reviewed</b>		
<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Diesel-Driven Fire Pumps Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9c	Aging Management Program Evaluation Results, Diesel-Driven Fire Pumps Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
3. CR 2-07-02170	FP-P-1 had Diesel Exhaust Header Leak; Leak was Promptly Tightened	(no rev. no.) 03/09/2007
4. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 2 (preventive actions), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (scope of program), 3 (parameters monitored/inspected), and 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3, and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 1, the applicant's AMP is presented as a stand-alone program designed to verify lack of degradation in the applicable components. In the GALL Report AMP it states that the program "includes measures to verify that unacceptable degradation is not occurring, thereby verifying the effectiveness of existing AMPs...." The SRP-LR (Table 3.1-2) further states in the FSAR Supplement guidelines that the One-Time Inspection Program "verifies the effectiveness of other aging management programs...." It is not clear to the staff that these statements are consistent because the applicant's AMP does not identify an underlying aging prevention or mitigation program for which it provides verification.

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "the inspection locations will be determined by engineering evaluation...." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population...." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e. no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing an RAI as described above for program element 1 (Scope of Program).

Based on this audit the staff:

verified that half of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B2.19, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program**

In the CGS LRA, the applicant states that AMP B.2.19, "Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program", is a new program that is consistent with the program elements in GALL Report AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant committed to implementing this program prior to the period of extended operation in reference to LRA Section A, Table A4-1, License Renewal Commitments. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "cables," "connections," "cracking," "melting," "discoloration," and "embrittlement."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05	Columbia Management Program Evaluation Results Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Program	Rev. 2
2.	Operating Experiences for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program	

During the audit of program elements 1-6, the staff found that elements 2, 4, 5 and 6 (preventive actions, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

Sufficient information was not available to determine whether elements 1 and 3 (scope of program and parameter monitored or inspected) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP. In order to obtain the information necessary to verify whether the LRA program staff will consider issuing a RAI for the following subjects:

GALL XI.E1 program under 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 adverse localized environment. In the basis document LRPD-05, under the same element, the applicant states that the program includes all cables and connections that are not subject to the environmental qualification (EQ) requirements of 10 CFR 50.49 and that are within the scope of license renewal. The basis document also states that the program is credit with detecting aging effects from adverse localized environments in non-EQ cables and connection. The applicant has not described in detail how adverse localized environment will be identified.

GALL XI.E1 program under Parameters Monitored or Inspected, it states that a representative sample of accessible electrical cables and connections installed in adverse localized environment are visually inspected for cable and connection jacket surface anomalies. 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. The implementing document for the program will provide the technical basis for the sample selection, with respect to both sample size and inspection locations. The applicant has not developed the technical basis for selecting sample of cables and connections installed in adverse localized environment as well as sample locations.

During the audit of program element 10 (operating experience), the staff found that the operating experience identified by the staff's independent data base search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff). The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable

Based on this audit the staff:

verified that most of the LRA program elements (2, 4, 5, and 6) are consistent with corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 and 3 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.20, Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits**

In the CGS LRA, the applicant states that AMP B2. 20, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation

Circuits” is a new program that is consistent with the program elements in GALL Report AMP XI.E2, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.” The applicant committed to implement this program prior to the period of extended operation in LRA Appendix A Section A.5, License Renewal Commitments. To verify this claim of consistency, the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant’s staff, and reviewed onsite documentation provided by the applicant. The staff also conducted independent searches of the applicant’s operating experience database using keywords: “cable,” “degradation,” “oxidation,” “cracking,” and “thermal.”

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff’s search of the applicant’s operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRPD-05	Columbia License Renewal Project Aging Management Program Evaluation Results Electrical Cable and Connections Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuit Program	Rev. 2
LRPI-04	Columbia License Renewal Project Electrical Screening and Aging Management Review	Rev. 2
LRAMR-E01	Columbia License Renewal Project Aging Management Review of Electrical Component Commodity Groups	Rev. 0

During the audit of program element 10 (operating experience), the staff found that the operating experience identified by the staff’s independent data base search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff). The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report AMP;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

**LRA AMP B.2.21, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements**

In the Columbia LRA, the applicant states that AMP B.2.21, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" is a new program with exception(s) that is consistent with the program elements in GALL Report AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance Criteria) and 10 (Operating Experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (Corrective actions, confirmation process, and Administrative Controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The exception affects LRA program element 4 (detection of aging effects). In the GALL Report AMP, this program element recommends electrical connections within the scope of license renewal will be tested at least once every ten years. Alternatively, this program element in the LRA states that because electrical cable connections for many end devices (such as motors, bus connections, and transformers) are inspected (and repaired 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.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "cable connections," "loosening," and "corrosions."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05	Columbia Management Renewal Project - Aging Management Program Evaluation Results,	Rev. 2

	Electrical Cable Connections Not Subject to EQ Requirements Inspection	
2. LRAMR-E01	Aging Management Review of Electrical Component Commodity Group	Rev. 0
3. LRPI-04	Electrical Screening and Aging Management Review	Rev. 2

The staff conducted its audit of LRA program elements 1, 2, 3, 5, and 6 without considering aspects of program element 4 (detection of aging effects) of the LRA AMP which are associated with the exception(s). Aspects of these elements not associated with the exception(s) were evaluated and are described below.

During the audit, the staff found that:

elements 1, 2, 5, and 6 (scope, preventive actions, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 3 (parameter monitored/inspected) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element number 3 (Parameter Monitored/Inspected) is consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 3 of the LRA AMP it states the technical basis for the sample selection will be documented. In the GALL Report AMP it states that the applicant will document the technical basis for the sample selected. It is not clear to the staff that these statements are consistent because the applicant has not developed the criteria for sample selection technique.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent data base search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff).

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1, 2, 5, and 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of

LRA program element 3 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **LRA AMP B.2.22, Environmental Qualification (EQ) of Electrical Components**

In the CGS LRA, the applicant states that AMP B.2.22, "Environmental Qualification (EQ) of Electrical Components" manages component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. The applicant also stated that as required by 10 CFR 50.49, EQ components not qualified to the current license term are to be refurbished or replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. The applicant further stated that the EQ program is an existing program that is consistent with the program elements in GALL Report AMP X.E1, "Environmental Qualification of Electrical Components." To verify this claim of consistency, the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted independent searches of the applicant's operating experience database using key words: "cable," "corrosion," "cracking," "environment qualification."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

#### **Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-02	Columbia License Renewal Project TLAA and Exemption Evaluation Results EQ Program Evaluation	Revision 3
2.	Operating Experience for EQ Program	
3. SA-2006-0089	Operating Experience Historical Self	

Document	Title	Revision / Date
	Assessment	
EQES-2	Technical Requirements for Electrical Equipment Environmental Qualification	Rev. 12
QID #036001EL-01A	Environmental Qualification 5 kV Power Cable (Okoguard/Okolon)	Rev. 1
QID 195013EL-02	Environmental Qualification FCI Level Monitoring System	Rev. 2
QID 382003EL-05	Environmental Qualification Westinghouse Electrical Penetration (Low Voltage) with "Q-1/Q-2"	Rev.0
SA-2006-0152	Self Assessment/Benchmark Planning Report	12/22/06

The staff conducted its audit of LRA program elements 1-6 based on the contents of the program. The staff also reviewed a sample of EQ calculation for 5kV power cable (Okoguard/Okolon). The staff reviewed a sample of these calculations to ensure that the original environmental qualification of Okonite insulation was substantiated and extended qualified life of these electrical components to 60 year life is documented and well justified.

During the audit, the staff found those elements 1, 2, 3, 4, 5, and 6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP was consistent with the corresponding elements of the GALL Report AMP

During the audit of program element 10 (operating experience), the staff found that the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff). The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing RAIs for the following subjects:

In 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 are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. In LRA Appendix A, FSAR Supplement A.1.2.22, the applicant did not address the reanalysis attributes which are important attributes to extend the qualified life of EQ for electrical components and must be included in summary description in LRA Appendix A.

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report AMP;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B2.23, External Surfaces Monitoring Program**

In the Columbia Generating Station LRA, the applicant states that AMP B.2.23, "External Surfaces Monitoring Program" is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M36, "External Surfaces Monitoring." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects LRA program element 1 (scope of program). This enhancement expands the existing program element by adding aluminum, copper alloy, copper alloy >15% Zn, gray cast iron, stainless steel (including CASS), and elastomers to the scope of the program.

The second enhancement affects LRA program element 1 (scope of program). This enhancement expands on the existing program element by adding cracking as an aging effect for aluminum and stainless steel components.

The third enhancement affects LRA program element 5 (monitoring and trending). This enhancement expands the existing program element by adding visual (VT-1 or equivalent) or volumetric techniques to detect cracking.

The fourth enhancement affects LRA program element 1 (scope of program). This enhancement expands on the existing program element by adding hardening and loss of strength as an aging effect for elastomer-based mechanical sealants and flexible connections in HVAC systems.

The fifth enhancement affects LRA program element 5 (monitoring and trending). This enhancement expands on the existing program element by adding physical examination techniques in addition to visual inspections to detect hardening and loss of strength for elastomer-based mechanical sealants and flexible connections in HVAC systems.

In Section A.1.5 of the LRA, the applicant committed to implement these enhancements prior to the period of extended operation and then ongoing.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "rust," "corrosion," "cracking," "elastomer" and "pitting."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. B.2.23	Columbia Generating Station LRA, External Surfaces Monitoring Program – B2.23	No Revision 01/2010
2. ESMP.2 LRPD-05 Attachment 2.5	Aging Management Program Evaluation Results – External Surfaces Monitoring Program	Revision 2 No date
3. ESMP.2, SYS-2-1	Conduct of System Engineering Manual (COSEM)	Revision 1 8/31/2009
4. ESMP.7, MOT-DAMP-1-1	Maintainance Optimization Template Dampers	Revision 2 No date
5. TI-2.2	System Walkdown	Revision 12 No date
6. TI-4.31	Equipment Performance Monitoring and Trending Program	Revision 2 No date
7. EPRI Report 1010639	Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools	Revision 4 01/2006
8. EPRI Report 1007933	Aging Assessment Field Guide	No Revision 12/2003
9. AR 00039543	The boot on the outlet duct of DMA-AH-21 has a tear.	No Revision 03/14/2006
10. AR 00051267	WEA-FN-2A discharge air boot has a hole	No Revision 05/09/2007
11. AR 00217300	Small holes in flexible boot connecting air handlers to ductwork	No Revision 05/04/2010
12. AR 00181144	CAS piping needs cleaned and repainted	No Revision 05/24/2008
13. AR 00185964	SW discharge piping is rusted after repairs left it uncoated	No Revision 09/08/2008
14. AR 00207066	RCC-V-8 Piping has degraded coating	No Revision 11/04/2009
15. AR 00020168	DG-1, DG-2 & DG-3 room walkdown items that required work requests or further evaluations	No Revision 12/13/2007

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff found that:

elements 2, 3, 4, and 6 (Preventive Actions, Parameters Monitored or Inspected, Detection of Aging Effects, and Acceptance Criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

sufficient information was not available to determine whether elements 1 and 5 (Scope, Monitoring and Trending) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1 and 5 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 1 of the LRA AMP it states that the scope of the program includes steel, aluminum, copper, copper alloy, stainless steel and elastomer seals in HVAC systems. In the GALL Report AMP it states that the scope of the program include steel. It is not clear to the staff that these statements are consistent because the applicant's program scope includes materials not addressed in the GALL program scope, and the applicant has taken no exception.

In element 5 of the LRA AMP it states that the scope of the program includes management of loss of material, and cracking. In the GALL Report AMP it states that the scope of the program includes the management of loss of material. It is not clear to the staff that these statements are consistent because the applicant's program scope includes aging effects not addressed in the GALL program scope, and the applicant has taken no exception.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff's independent data base search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **Existing Program consistent with GALL with Enhancements LRA AMP B2.24, Fatigue Monitoring Program**

In the CGS LRA, the applicant states that AMP B.2.24, "Fatigue Monitoring Program" is an existing program that is consistent with the program elements in GALL Report AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects LRA program element 2 (preventive actions), 5 (monitoring and trending), and 6 (acceptance criteria). This enhancement expands on the existing program element by adding an action that will be taken when the lowest number of analyzed cycles, are approached for the six recommended locations for which environmental effects are being monitored.

The second enhancement affects LRA program element 6 (acceptance criteria). This enhancement expands on the existing program element by adding a commitment to manage the aging effect of fatigue for the period of extended operation, with consideration of environmental effects, by implementing of one or more of three proposed action items.

The third enhancement affects LRA program element 1 (scope of program). This enhancement expands on the existing program element by adding an additional commitment to correlate information relative to fatigue monitoring and provide more definitive verification that the transients monitored and their limits are consistent with or bound the FSAR and the supporting fatigue analyses, including environmentally-assisted fatigue analyses.

In LRA Table A-1, item 24, the applicant committed to implement these enhancements prior to the period of extended operation, and then ongoing.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "fatigue" "crack," and "environment."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems that Credit Fatigue Monitoring Program	(no rev. number) (no date)
2. LRPD-03	Columbia License Renewal Project Document TLAA – Metal Fatigue	Revision 3 04/09/2010
3. TPS-RPV-A101	Tracking Fatigue Cycles	Revision 1 04/15/2008
4. EN2-PE-07-010	Interoffice Memorandum, Tracking Columbia Fatigue Cycles	(no rev. number) 08/22/2007

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements. Aspects of these program elements were evaluated and are described below.

During the audit, the staff found that:

elements 1 (scope of program), 2 (preventive actions), 3 (parameters monitored/inspected), 4 (detection of aging effects), and 5 (monitoring and trending), of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 6 (acceptance criteria) and follow-up corrective action (element 7) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element number 6 is consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAI for the following subject:

Element 6 of the LRA AMP states that when the accumulated cycles approach the number of analyzed cycles, corrective action is required to ensure that the analyzed number of cycles is not exceeded. The LRA further states that for each location that may exceed a cumulative usage of 1.0, the Fatigue Monitoring program will implement corrective action consistent with the GALL Report. The GALL Report AMP states that maintaining the fatigue usage factor below the design code limit and considering the effect of the environment will provide adequate margin against fatigue cracking of reactor coolant system components due to anticipated cyclic strains. In program element 3, the GALL report states that as an alternative to monitoring the number of transients, more detailed local monitoring of the plant transient may be used to compute the actual usage for each transient. Also, in program element 7 "corrective action," the

GALL report recommends to include a review of additional affected reactor coolant pressure boundary. It is not clear to the staff that the acceptance criteria and the follow-up corrective actions are consistent with the GALL Report.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff's independent data base search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **Existing Program consistent with GALL with Exceptions LRA AMP B.2.25, Fire Protection Program**

In the Columbia Generation Station LRA, the applicant states that AMP B.2.25, "Fire Protection Program" is an existing program with exceptions that is consistent with the program elements in GALL Report AMP XI.M26, "Fire Protection." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The first exception affects LRA program element 1 (scope of program). In the GALL Report AMP, this program element recommends management of aging effects on the intended function of the halon fire suppression system and the carbon dioxide suppression system. The applicant took an exception that neither the halon fire suppression system nor the carbon dioxide suppression system is in the scope of license renewal.

The second exception affects LRA program element 1 (scope of program) and 6 (acceptance criteria). The program element in the LRA states that the Fire Protection Program does not include specific confirmation that there is “no degradation in the fuel oil supply line for the diesel-driven fire pump.” Rather, degradation noted for fuel oil supply components during periodic performance testing of the diesel-driven fire pumps through the Fire Protection Program, if any, is evaluated prior to loss of intended function. In addition, the Chemistry Program Effectiveness Inspection characterizes the internal surface condition of the fuel oil supply line (tubing) for confirmation of the effectiveness of the Fuel Oil Chemistry Program.

During its audit, the staff conducted walkdowns, interviewed the applicant’s staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “fire door,” fire wrap,” “fire barrier.”

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff’s search of the applicant’s operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. CR-2-04-02579	QC failed to notify Fire Protection Engineering of Discrepancies noted during the 18 month inspection of Darmatt in a timely manner, dated May 27 2004	11/03/05
2. CR 2-05-09057	Degraded Darmatt Raceway Fire barriers found during PPM 15.4.10 periodic surveillance, dated November 21, 2005	11/21/2005
3. CR-2-06-00197 H-237815	Thermo-Lag R510-051 found degraded from water intrusion	01/09/2006
4. CR 2-07-02318	The corrosion rates measured in the hot leg of the TSW system on the corrosion coupons exposed for periods of 91 days (short term) were above the CGS criteria of 2.0 mpy for mild steel and below the CGS criteria of 0.2 mpy for yellow metals	03/13/2007
5. CR 2-07-03040	During investigation of RW 467 vital island floor coating, identified cracks in coating that are credited flood barrier in RW vital island. Cause: shrinkage of construction joint	04/04/2007
6. WO 01078651 01	Repair essential fire barrier - Darmatt community C121-H1-004, dated November 4, 2004	06/01/04
7. WO 01099451	Repair Gaps in flame safe barriers on EI 487 PPM 10.25.57, dated January, 11, 2007	05/15/08
8. WO 01109862	(XP) Rework degraded Darmatt fire barrier	02/07/06

01	communities, dated September 23, 2006	
9. WO 01132828	Degraded Darmatt Fire Barriers RW 467, dated May 07, 2008	01/09/08
10. WR 29050972	Rework degraded Darmatt fire barrier commodities, dated November 21, 2005	04/23/10
11. FPP-1.1	FPP-1.1, "Administration Controls"	07/23/03
12. FPP-1.2	FPP-1.2, "Fire Protection Review"	05/26/06
13. FPP-1.8	FPP-1.8, "Fire Protection System Compensatory Measures"	10/12/04
14. PPM 1.3.10	Administration Procedure PPM 1.3.10, "Plant Fire Protection Program Implementation"	11/17/05
15. PPM 15.1.2	PPM 15.1.2, "Fire Door Operability Weekly, Bi-weekly"	04/10/07
16. PPM 15.1.3	PPM 15.1.3, "FP-P-1 Operability Test"	01/04/08
17. PPM 15.1.4	PPM 15.1.4, "FP-P-110 Operability Test"	03/28/08
18. PPM 15.1.25	PPM 15.1.25, "FP-P-1 Loss of Power Test"	01/04/08
19. PPM 15.1.26	PPM 15.1.26, "FP-P-110 Loss of Power Test"	09/14/05
20. PPM 15.3.6	PPM 15.3.6, "Control Room Halon Pressure X Check, Weight Check, Flow Test, and PGCC Barrier Inspection"	05/24/05
21. PPM 15.3.17	"Fire Door Operability – Semiannual, Annual, Biennial"	07/26/06
22. PPM 15.4.6	"Fire Rated Penetration Seal and Structural Integrity and Essential Fire Barrier Operability Inspection"	04/01/08
23. PPM 15.4.9	"Fire Rated Thermo-lag Structural Steel Fireproofing Operability Inspection"	11/01/99
24. PPM 15.4.10	"Raceway Fire Barriers Protective Fire Wrap system Operability"	03/02/00
25. PPM 15.4.11	"Non-essential Fire Barrier Functionality Inspection"	04/29/08
26. PSM 5.10	"Policy Statement Manual 5.10 "Fire Protection"	01/03/07
27. LRPD-05, Attachment 2.6b	Fire Protection Program	Revision 2.6b

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program. Aspects of program elements 1 (scope of program) and 6 (acceptance criteria) of the LRA AMP associated with the exceptions were not evaluated during this audit. Aspects of these program elements that are not associated with the exceptions were evaluated and are described below.

During the audit, the staff found that:

elements 2 (preventive actions), 3 (parameters monitored or inspected), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (scope of program), 4 (detection of aging effects), and 5 (monitoring and trending) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program elements 1, 4 and 5 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Element 1 of the LRA AMP and the basis document states neither the carbon dioxide suppression system nor the halon 1301 fire suppression systems is within the scope of license renewal because they are not required in the post-fire safe shutdown. The GALL Report states that management of the aging effects of the carbon dioxide suppression system and the halon 1301 fire suppression is included in the scope of XI. M26 Fire Protection program. However, it is not clear to the staff whether there were any systems or components added in the LRA when the halon 1301 fire suppression systems were removed from the scope of license renewal. If no added systems and components were added, clarify which fire suppression system is being used for the control room.

Element 4 of the LRA AMP and the basis document states the sequential starting/controller function tests for the diesel-driven fire pump are conducted every 5 years. In the GALL Report, it states periodic tests are performed at least once every refueling outage, such as flow and discharge tests, sequential starting capability tests, and controller functions tests. It is not clear to the staff that these statements are consistent with the GALL Report because the applicant uses a much longer test interval than the test interval recommended in the GALL Report for the sequential starting/controller function tests of the diesel-driven fire pump.

Element 5 of the LRA AMP and the basis document states there are no aging effects that require management for fire barrier walls/floors/ceiling, fire wraps, and fire proofing. It further states that the LRA Fire Protection Program will be used to confirm the absence of significant aging effects for the period of extended operation. The GALL Report states loss of material caused by chemical attack, reaction with aggregates, cracking, and spalling are aging effects for management of fire barriers (walls/floors/ceilings). The applicant's procedure for inspection of fire wraps states that the inspection is to ensure no obvious degradations such as splits, tears, holes, gaps, or missing pieces. The applicant procedure for inspection of Thermo-lag states that the inspection is to verify Thermo-lag free of obvious holes, cracks, splits, voids, gouges, or broken pieces. It is not clear to the staff that these statements are consistent with the GALL Report because the applicant does not consider aging effects of chemical attack, reaction with aggregates, cracking, and spalling for fire barrier walls/floors/ceilings and aging effects of splits, tears, cracks, holes, gaps or missing pieces for wire wraps and fire proofing.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e. no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify whether the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing an RAI for the following subject:

An independent search by the staff identified an event in which 15 to 20 gallons of water spilled onto the floor of the Radwaste Building Cable Spreading Room (CSR) and leaked down into the Remote Shutdown Room and the Division II switchgear room below the CSR floor (LER 2002-003-00). The pathway for leakage through the floor of the CSR was through cracks in the concrete that allowed a penetration flood seal to be bypassed, and through shrinkage and flexural cracks in the concrete floor slab. The root cause of the event was unsealed cracks in the concrete floor slab. The "operating experience" program element of the LRA AMP does not include a description of this LER or discuss any follow-up corrective action as a result of this event. The concrete floor fire barriers in the CSR appeared to have lost their intended function during this event.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;  
identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

Based on this audit the staff verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **LRA AMP B2.26, Fire Water System**

In the CGS LRA, the applicant states that AMP B.2.26, "Fire Water System" is an existing program with enhancement(s), that is consistent with the program elements in GALL Report AMP XI.M27, "Fire Water System." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects LRA program element 3 (parameters monitored/inspected) and 4 (detection of aging effects). This enhancement expands on the existing program element by adding ultrasonic testing or internal visual inspection of representative portions of above ground fire protection piping that are exposed to water, but do not normally experience flow, after the issuance of the renewal license but prior to the end of the current operating term, and at reasonable intervals thereafter, based on engineering review of the results.

The second enhancement affects LRA program element 4 (detection of aging effects). This enhancement expands on the existing program element by adding a commitment to either replace sprinkler heads that have been in place for 50 years or submit representative samples for field service testing in accordance with National Fire Protection Association (NFPA) 25 recommendations. In addition, perform subsequent replacement or field service testing of representative samples at 10-year intervals thereafter or until there are no sprinkler heads installed that will reach 50 years of service life during the period of extended operation.

The third enhancement affects LRA program element 6 (acceptance criteria). This enhancement expands on the existing program element by adding hardness testing (or equivalent) of the sprinkler heads as part of their NFPA sampling, to determine whether loss of material due to selective leaching is occurring.

In LRA Table A-1, item 26, the applicant committed to implement these enhancements prior to the period of extended operation.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "corrosion," "MIC, and "loss of material."

The table below lists the documents, which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems that Credit Fire Water Program	(no rev. number) (no date)
2. LRPD-05 Attachment 2.6a	Aging management Program Evaluation Results Fire Water Program	Revision 2
3. PPM 15.1.1	Fire Suppression Systems Inspection	Revision 16 04/08/2008
4. PPM 15.1.12	Fire Main Header Flush and Hydrant Inspection	Revision 11 07/23/2009
5. PPM 15.1.17	Ventilation Deluge Systems Air Flow Test	Revision 13 10/24/2006
6. PPM 15.1.21	Hose Station Flow Test	Revision 8

		02/17/2004
7. PPM 15.3.7	Fire Systems Inspection	Revision 7 12/27/2001
8. PPM 15.3.12	Interior Deluge Systems Header/Strainer Flush & Inspection	Revision 11 09/24/2003
9. PPM 15.3.14	Exterior Deluge Systems Trip Test and Strainer Flush	Revision 12 04/21/2008
10. PPM 15.4.8	Fire Protection System Annual Functional Test	Revision 12 12/12/2006
11. PPM 15.3.3	Fire Hose Hydrostatic Testing	Revision 7 07/22/2003
12. PPM 15.3.15	Fire Protection System Flushes and Inspection	Revision 18 03/21/2007
13. CR 2-05-01670	Ultrasonic Testing of 10" Piping Downstream of FP-V-33 and FP-V-172 Shows Internal Pipe Wall Thinning	(no rev. number) 03/22/2005
14. PER 201-0825	Foreign Material & Biofouling (MIC) found in Fire Protection System after Flushing and Internal Pipe Inspection per PPM 15.3.15	(no rev. number) 05/17/2001

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements. Aspects of these program elements were evaluated and are described below.

During the audit, the staff found that:

elements 2 (preventive actions), 3 (parameters monitored/inspected), 4 (detection of aging effects), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether element 1 (scope of program) of the LRA AMP was consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element number 1 is consistent with the corresponding element of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 1 of the LRA AMP it states the GALL AMP XI.M27 has been expanded to include components constructed of copper alloys, copper alloys >15% Zn, and stainless steel; manage cracking due to SCC of copper alloys; and manage loss of material due to selective leaching of copper alloys >15% Zn exposed to raw water. The Columbia AMP does not provide justification that the GALL AMP is adequate to manage loss of material due to corrosion, erosion, MIC, or biofouling, as well as cracking due to SCC of components constructed of these materials.

Element 1 of the LRA AMP states that the Columbia AMP is applicable to a variety of materials including carbon steel, gray cast iron, copper alloy, copper alloy >15% Zn, and stainless steel, for piping and piping components such as valve bodies, tubing, strainer bodies, standpipes (piping), sprinklers (spray nozzles), pump casings, and hydrants. The GALL Report AMP states that the GALL AMP applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, water storage tanks, and above and underground piping and components. It is not clear to the staff that these statements are consistent because the Columbia LRA does not provide sufficient details regarding the aging management for portions of fire water systems that are (a) normally empty (dry) and (b) below ground. Also, it is not clear whether normally-dry components are indoors or outdoors.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff's independent data base search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **New Program consistent with GALL**

#### **LRA AMP B.2.27, Flexible Connection Inspection**

In the Columbia LRA, the applicant states that AMP B.2.27, "Flexible Connection Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 27. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program

elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "elastomer," "flexible connection," "hose," and "cracking."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Flexible Connection Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9c	Aging Management Program Evaluation Results, Flexible Connection Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
4. PER 206-0136	The Boot on the Outlet Duct of DMA-AH-21 has a Tear	(no rev. no.) 03/14/2006
5. OE 13446	Degraded Expansion Joints	(no rev. no.) 03/19/2002
6. OE 21914	Loss of Essential Water Service Water Pump Function Due to Failure of Service Water Pump Discharge Expansion Joint (Cooper Nuclear Station)	(no rev. no.) 01/10/2006
7. WO Package 01107357	Install Tank Fire Protection Bladder Tank	(no rev. no.) 04/01/2008
8. LRPD-04	Operating Experience Review and Results	Revision 1 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 2 (Preventive Actions), 5 (Monitoring and Trending), and 6 (Acceptance Criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (Scope of Program), 3 (Parameters Monitored/Inspected), and 4 (Detection of Aging Effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3, and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 1, the applicant's AMP is presented as a stand-alone program designed to verify lack of degradation in the applicable components. In the GALL Report AMP it states that the program "includes measures to verify that unacceptable degradation is not occurring, thereby verifying the effectiveness of existing AMPs...." The SRP-LR (Table 3.1-2) further states in the FSAR Supplement guidelines that the One-Time Inspection Program "verifies the effectiveness of other aging management programs...." It is not clear to the staff that these statements are consistent because the applicant's AMP does not identify an underlying aging prevention or mitigation program for which it provides verification.

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established techniques...." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "the inspection locations will be determined by engineering evaluation...." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population...." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e. no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program

description, the staff will consider issuing an RAI as described above for program element 1 (scope of program).

Based on this audit the staff:

verified that half of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B.2.28, Flow-Accelerated Corrosion (FAC) Program**

In the CGS LRA, the applicant states that AMP B2.28, "Flow-Accelerated Corrosion (FAC) Program" is an existing program, with an enhancement, that is consistent with the program elements in GALL Report AMP XI.M17, "Flow-Accelerated Corrosion." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects LRA program element 1 (scope of program). This enhancement expands on the existing program element by adding the Containment Nitrogen System components supplied with steam from the Auxiliary Steam System and adding gray cast iron as a material identified as susceptible to FAC.

In B.2.28 Flow-Accelerated Corrosion Program of the LRA, the applicant committed to implement this enhancement prior to the period of extended operation.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "FAC" and "flow-accelerated corrosion."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. MAN PWTP-01 (FAC Ref.01)	Energy Northwest Columbia Generating Station Pipe Wall Thinning Monitoring Program Plan	Revision 7, 2/20/2007
2. CR 2-05-03313	Condition Report: "During FAC examination, piping downstream for MS-T-8 and bypass valve	05/11/2005
3. EPRI DPM 2135L	EPRI Letter to M. Humphreys, "Assessment to Energy Northwest's Program to control Flow-Accelerated Corrosion at the CGS"	Revision 1, 06/08/2004
4. Report 68867	Assessment of Energy Northwest's Program to control Flow-Accelerated Corrosion at the Columbia Generating Station	Revision 0, 8/31/2008
6. B.2.28	Flow-accelerated Corrosion program	04/06/2010

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements. Aspects of these program elements that are not associated with the exception were evaluated and are described below. During the audit, the staff found that:

elements 2 (preventive actions), 3 (parameters monitored/inspected), 5 (monitoring and trending) and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

elements 1 (scope of program) and 4 (detection of aging effects) of the LRA AMP were not strictly consistent with the corresponding elements of the GALL Report AMP but that sufficient information was available to allow the staff to determine that these elements of the LRA AMP are equivalent to the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3 and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 3 of the LRA AMP it states that CGS monitors and inspects pipe wall thickness but does not contain information regarding the accuracy of the FAC Program in predicting FAC degradation in components. The GALL Report states that the effects of FAC on the intended function of piping and components, is monitored by measuring wall thickness. It is not clear to the staff whether the FAC program is adequately predicting FAC degradation on wall thickness.

During the audit of program element 10 (operating experience), the staff found that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the

staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff verified:

that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.29 Fuel Oil Chemistry Program**

In the CGS LRA, the applicant states that AMP B.2.29, "Fuel Oil Chemistry," is an existing program, with exceptions, that is consistent with the program elements in GALL Report AMP XI.M30, "Fuel Oil Chemistry." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1 – 6 (scope, preventative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7 – 9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The first exception affects LRA program element 1 (scope). In the GALL Report AMP this program element recommends managing the conditions that cause corrosion of the diesel fuel tank internal surfaces in accordance with technical specifications and the guidelines of ASTM Standards D 1796, D 2276, D 2709, D 6217, and D 4057. Alternatively, this program element in the LRA states that the program does not include sampling and testing of new fuel in accordance with the above standards for the diesel-driven fire purrps. The applicant stated that stored fuel is periodically sampled and tested following the guidelines of the above mentioned ASTM Standards.

The second exception affects LRA program element 2 (preventative actions). In the GALL Report AMP this program element recommends the use of biocides, stabilizers, and corrosion inhibitors. Alternatively, this program does not include the addition of biocides, stabilizers, or corrosion inhibitors to the fuel oil for the emergency diesel generators. The applicant stated that the combination of specified physical and chemical properties of new fuel oil, and periodic cleaning and draining of the tanks mitigates corrosion inside the tanks.

The third exception affects LRA program element 3 (parameters monitored or inspected). In the GALL Report AMP this program element recommends the use of ASTM Standards D 4057, D 1796, D 2709, and D 2276, Method A for the determination of water, sediment contamination, and particulates. Alternatively, this program does not include testing of the fuel oil used for the diesel-driven fire pumps for particulates. The applicant stated that obtaining samples in accordance with ASTM Standards D 1796 and D 4057 have proven adequate. The applicant stated that the determination of adequacy is based on the absence of related problems reported through the corrective action program.

The fourth exception affects LRA program element 4 (detection of aging effects). In the GALL Report AMP this program states that compliance with diesel fuel oil standards mentioned in element 3 (parameters monitored or inspected) and periodic multilevel sampling provide assurance that fuel oil contaminants are below unacceptable levels. Alternatively, this program does not perform multilevel sampling of the fuel oil storage tanks. Rather, a representative fuel stream sample is drawn from the flushing line during recirculation and transfer and particulate testing is performed in accordance with ASTM Standard D 2276-93, step 4.3, laboratory filtration method.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "fuel," "oil," and "fouling."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

#### Relevant Documents Reviewed

Document	Title	Revision / Date
1. CR00033073	Diesel Fuel Oil was Transferred from FO-TK-1 to two emergency diesel generators storage tanks without satisfactory fuel oil property	Revision X M/D/YYYY
2. CR00026167	Technical Specification required sample could not be collected when scheduled due to system tagout	
3. CR0033806	The day tanks for Emergency Diesel Generators 1A1 and 1A2 fuel oil tank was found to have an excessive amount of water, sludge and bio fouling during cleaning of it ion 01098416-01.	
4. B.2.29	Fuel Oil Chemistry	04/06/2010

The staff conducted its audit of the LRA program elements 1 – 6 based on the contents of the existing program. Aspects of these program elements that are not associated with the exceptions were evaluated and are described below.

During the audit, the staff found that:

Elements 5 and 6 (monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

Elements 1, 2, 3, and 4 (scope of program, preventative actions, and parameters monitored or inspected, and detection of aging effects) of the LRA AMP were not strictly consistent with the corresponding elements of the GALL Report AMP but that sufficient information was available to allow the staff to determine that these elements of the LRA AMP are equivalent to the corresponding elements of the GALL Report AMP.

The basis for the staff's determination that elements 1, 2, 3, and 4 of the LRA AMP are equivalent to the corresponding GALL Report AMP is:

For element 1, the applicant provided information indicating that the stored fuel for the diesel-driven fire pumps is periodically sampled and tested in accordance with the ASTM Standards recommended by the GALL Report AMP.

For element 2, the applicant provided justification for not using biocides, stabilizers, and corrosion inhibitors by stating that periodic cleaning and draining of the tanks provides assurance that corrosion inside tanks is minimized. The applicant also stated that the operating experience element for this program confirms this justification.

For element 3, the applicant provided justification for not testing the diesel-driven fire pumps fuel oil for particulate by stating that the sampling and testing for water and sediments in accordance with ASTM D 1796 and ATSM D 4057 has proven to be adequate based on the absence of related problems reported through the corrective action program.

For element 4, the applicant provided justification for not performing multilevel sampling for the emergency diesel generator fuel oil storage tanks by stating that the current method of sampling is performed using the diesel fuel oil filter/polisher system. The tanks are sampled individually. During sampling, the applicable storage tank is recirculated for a minimum of five minutes and a sample is drawn from the recirculation flow. This is considered to be a more representative sample than multilevel sampling. The fuel oil polishing system can take suction from any of the four tanks and discharge to any of the four tanks. The system takes suction from the bottom of the tank and after five minutes draws a flowing sample.

In order to obtain the information necessary to verify whether the LRA program element number 4 is consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing an RAI for the following subject:

In element 4 of the LRA AMP, it states that multilevel sampling of the fuel oil storage tanks is not performed; rather, a representative fuel stream sample is drawn from the flushing line during recirculation and transfer. In the GALL Report AMP it states periodic multilevel sampling provides assurance that fuel oil contaminants are below unacceptable levels. It is not clear to the staff that these statements are consistent because information on the method of obtaining stream samples was not provided for

comparison with the recommended multilevel sampling. The applicant committed to providing the staff with the additional information.

During the audit of program element 10 (operating experience), the staff found that the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify whether the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing an RAI for the following subject:

The LRA does not provide information discussing the concerns of IN 2009 – 02 and the acceptable or unacceptable use of biodiesel at CGS.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 – 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 – 6 for which additional information or additional evaluation is required before consistency can be determined;  
identified that additional information regarding the operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached;

verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **New Program consistent with GALL LRA AMP B.2.30, Heat Exchangers Inspection**

In the CGS LRA, the applicant states that AMP B.2.30, "Heat Exchangers Inspection" is a new program that is consistent with the program elements in GALL Report AMP IX.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 30. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the

scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "heat exchanger," "fouling," "MIC" and "heat transfer."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Heat Exchangers Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9g	Aging Management Program Evaluation Results, Heat Exchangers Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
3. WO Package 01028053, Task 1	DLO-HX-2B1 Has Soldered Tubes	(no rev. no.) 04/10/2003
4. WO Package 01028053, Task 5	PMT—Visual Leakage Exam-DLO-HX-2B	(no rev. no.) 02/05/2003

5. WO Package 01028574, Task 1	DLO-HX-2A2 Has Soldered Tubes	(no rev. no.) 01/28/2003
6. WO Package 01028574, Task 2	PMT—Visual Leakage Exam-DLO-HX-2A	(no rev. no.) 01/28/2003
7. WO Package 01050739, Task 1	FPC-HX-1B Has a Small Leak	(no rev. no.) 01/27/2003
8. WO Package 01057295, Task 1	DCW-HX-2C—Rebuild Heat Exchanger	(no rev. no.) 05/04/2010
9. WO Package 01063141, Task 1	WMAAH52BINSP, Inspect Cooling Coil	(no rev. no.) 10/02/2003
10. WO Package 01121787, Task 1	WMA-AH-52B, Clean and Inspect Unit	(no rev. no.) 08/01/2006
10. Work Order Task CC77-01	RCIC-HX-2 Inspect and EC	(no rev. no.) 05/02/1994
11. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 1 (scope of program), 2 (preventive actions), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 3 (parameters monitored/inspected) and 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 3 and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Also under program element 3, the applicant states that the parameters monitored and inspected "include visual or volumetric evidence of surface fouling." However, under the subsequent "Detection of Aging Effects" program element, this AMP mentions only visual examination techniques (VT-3 or equivalent). It is not clear to the staff whether volumetric examination techniques are included in the applicant's program or how volumetric evidence of fouling is detected.

Under program element 4, the applicant's AMP states that "the sample population will be determined by engineering evaluation..." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population..." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff);

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **New Program consistent with GALL**

#### **LRA AMP B.2.32, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program**

In the CCGS LRA, the applicant states that AMP B.2.32, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program" is a new program that is consistent with the program elements in GALL Report AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements." The applicant committed to implementing this program prior to the period of extended operation in reference to LRA Appendix A, Table A-1, "Columbia License Renewal Commitments." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects,

monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the LRA FSAR Supplement, Section A.1.2.32. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords applicable to inaccessible medium-voltage cables (e.g., "manhole," "duct," "submergence," "cable," "water tree," "electrical tree," "underground," "splice" and, "vault.") Further, the staff performed a search of operating experience for at least a 10 year period up through March 2010. Databases were searched using various key word searches and then reviewed by technical auditor staff. Databases searched include Generic Letters, Bulletins, Regulatory Issue\_Summaries, Licensee Event Reports, Event Notifications, Inspection Findings, and Inspection Reports.

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05	Columbia License Renewal Project – Aging Management Program Results	Revision: 3 Date: 03/28/10
2. LRPD-05	Columbia License Renewal - ging management Program Evaluation Results - Attachment 4.3	Revision: 2 Date: N/A
3. AR 00204095	Deficiencies Noted During Electrical Manhole Inspections	Revision: N/A Date: 9/9/2009
4. AR 00204169	Water Found In Electrical Manhole E8	Revision: N/A Date: 9/10/2010
5. AR 00204201	Water Found In Electrical Manhole E7	Revision: N/A Date: N/A
6. AR1314-61	Inspection of Medium Voltage Manholes Subject to License Renewal Aging Management Program	Revision: N/A Date: N/A
7. DWG E823	Underground Duct Banks Plans and Profiles Sheet 1	Revision: 25 Date: N/A
8. DWG E824	Underground Duct Banks Plans and Profiles Sheet 2	Revision: 8 Date: 12/15/94

During the audit of program elements 1 - 6, the staff found that:

elements 1 thru 3, 5 and 6 (scope of program, preventive actions, parameters monitored or inspected, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether element 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element number 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subject:

In element 4 of the LRA AMP it states that cable testing and inspection for water collection will be performed at least once every 10 years, with the first test and inspection to occur during the 10-year period prior to the end of the current operating license. In the GALL Report AMP it states that the first tests and inspections for license renewal are to be completed before the period of extended operation. It is not clear to the staff that these statements are consistent because the inspection and testing period may not be performed such that the inspections or test results provide representative inaccessible cable data prior to the period of extended operation.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff's independent base data search and supplemented by the applicant is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify whether the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the following subject:

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 not may not mitigate event driven water collection and may allow inaccessible medium-voltage cables to be exposed to significant moisture.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP.

In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing RAIs for the following subject:

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 AMP XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." LRA FSAR Supplement Section A.1.2.32 does not include a discussion of specific type testing or inspection for water collection based on plant specific operating experience. The LRA FSAR Supplement lack of definitions and discussions for specific testing and inspection for water collection does not provide consistency with GALL AMP XI.E3 and SRP LR Table 3.6-2.

Based on this audit the staff:

verified that most of the LRA program elements (1 thru 3, 5 and 6) are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program element 4 for which additional information or additional evaluation is required before consistency can be determined;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement

### **LRA AMP B2.33, Inservice Inspection (ISI) Program**

In the CGS LRA, the applicant states that AMP B2.33, "Inservice Inspection (ISI) Program" is an existing program that is consistent with the program elements in GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent database search of the applicant's operating experience database using the keywords: "crack," "flaw," "indication," "ISI," "weld," "crevice," "partial penetration," "ASME Section XI," "summary report," "stress corrosion," and "loss of material."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LBD ISI-3	Columbia Generating Station, Inservice Inspection Program Plan	Revision 3 04/28/2009
2. ENG-ISI-01	Implementation and Monitoring of Risk-Informed Inservice Inspection Program	Revision 2 10/24/2006
3. ENG-ISI-02	Evaluation of Unacceptable Flaws	Revision 2 02/28/2007
4. SWP-ISI-01	ASME Section XI Inservice Inspection Program	Revision 5 12/22/2009
5. SWP-VIP-01	Management of Reactor Vessel And Internals Integrity	Revision 7 01/27/2010
6. SPS-7-1	Visual Examination	Revision 0 09/04/2008
7. BWRVIP-01	BWRVIP Program Plan	Revision 3 04/03/2008
8. CR 2-05-02966 PER 205-0309	HPCS-V-713 Indication	05/05/2005
9. CR 2-05-03812 H227879	Rejectable Linear Indications on RCIC-V-115	05/18/2005
10. CR 2-06-02245 PER 206-0158	Steam Dryer Cracking	03/27/2006
11. CR 2-07-05710	Core Shroud H3 Weld Indications	06/07/2007
12. PER 203-1954	Feedwater Sparger Flow Hole Cracks	05/25/2003
13. n/a	Columbia ISI Program Health Reports (Quarterly)	2008
14. EN Letter GO2-07-178	Request 3ISI-08 for Approval of Alternate Risk-Informed Inservice Inspection (RI-ISI) Requirements for the Third Ten-year Interval Inservice Inspection Program Plan	12/13/2007

During the audit of program elements 1 - 6, the staff found that:

element 2 (preventive actions) of the LRA AMP was consistent with the corresponding element of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (scope of program), 3 (parameters monitored/inspected), 4 (detection of aging effects), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3, 4, 5, and 6 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

The applicant's basis document appears to incorporate the GALL AMP XI.M1 basis of the 2001 edition, including the 2002 and 2003 Addenda, of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI. However, the applicant's "Program Description" of the ISI program under its LRA Section B2.33 does not explicitly specify the applicable Code edition(s) in current use. Neither the basis document nor the program description of the LRA AMP specify or confirm which Code edition will be incorporated by the applicant for inspection intervals during the period of extended operation. This issue affects the elements 1 (scope of program), 3 (parameters monitored/ inspected), 4 (detection of aging effects), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA.

In element 1 (scope of program) of the LRA AMP the applicant has incorporated several augmentations to the ASME ISI program. One of these augmentations deals with the IGSCC of BWR piping components, discussed in NRC GL 88-01, which continues to be a significant aging effect. The nature and scope of this augmentation was not apparent from the LRA program description, nor could this be confirmed as consistent with the scope delineated under GALL AMP XI.M1 (as the issue of IGSCC in GL 88-01 is more specifically covered under GALL Report AMP XI.M7). In particular, it remains unclear if any current or planned reduction in ISI scope (frequency and locations), originally identified in response to the GL 88-01, as a result of plant-specific mitigation measures or related industry initiatives, will impact the scope of related inspections as required by the ASME Section XI ISI. Other elements of the LRA AMP with potential impact of this augmentation include: elements 4 (detection of aging effects), 5 (monitoring and trending), and 6 (acceptance criteria).

In its description of the ISI program, the applicant stated that its LRA AMP manages loss of fracture toughness due to thermal embrittlement of cast austenitic stainless steel pump casings and valve bodies. The GALL AMP XI.M1 does not include in its description and in the element 4 (detection of aging effects) the management of this loss of fracture toughness. Therefore, the consistency of element 1 (scope of program), element 3 (parameters monitored/inspected), and element 4 (detection of aging effect) of the LRA AMP to manage the loss of fracture toughness issue could not be confirmed with the respective elements of the GALL AMP XI.M1.

In its description under Section B2.33 of the LRA AMP, and elsewhere in various program elements, the applicant stated that the ISI program is described in FSAR Section 5.2.4 and is implemented by various plant procedures. The FSAR Section 5.2.4, which describes the applicant's ISI Program only by reference, indicated (page 5.2-22 of the FSAR) that about 16% of the reactor vessel weld volume is inaccessible. The GALL AMP XI.M1 elements 1 (scope of program) and 4 (detection of aging effects) require program adequacy and timely detection of aging effects for maintaining the structural integrity. Meeting this requirement with the 16% inaccessible weld volume will depend on the location and distribution of weld regions in the vessel. It is not clear to the staff if

or how the applicant has made this assessment to ensure the adequacy of existing ISI program over the extended period covered under the LRA.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff);

the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable, with the exceptions of its (missing) reference to the use of future editions of the ASME Code, the management of fracture toughness, and the augmentation of ISI concerning GL 88-01. These exceptions are discussed above for which it is already noted that the staff will consider issuing RAIs.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the applicant has committed to modify the FSAR Supplement so as to make the program description adequate.

#### **LRA AMP B.2.35, Inservice Inspection (ISI) Program - IWF**

In the CGS LRA, the applicant states that AMP XI.S3, "Inservice Inspection (ISI) Program - IWF" is an existing program that is consistent with the program elements in GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent data

base search of the applicant's operating experience database using the keywords: "bolt," "closure stud," "corrosion," "connection," "degrad," "hangar," "inspect," "loss of material," "piping," "preload," "rust," "SCC," "support," and "weld."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

<b>Relevant Documents Reviewed</b>		
<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05, Attachment 3.3	Aging Management Program Evaluation Results, Inservice Inspection (ISI) Program - IWF	Revision 3 4/7/2010
2. SWP-ISI-01	ASME Section XI Inservice Inspection	Revision 4 4/3/2008
3. A/R No. 00045706	Action Request Report	11/3/2006
4. Item No. 2088	License Renewal Audit Information Request Form	5/26/2010
5. SPS-7-3	Visual Examination – Component Supports	9/4/2008

During the audit of program elements 1 - 6, the staff found that:

elements 2, 4, 5, and 6 (preventive actions, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

element 3 (Parameters Monitored or Inspected) of the LRA AMP was not strictly consistent with the corresponding elements of the GALL Report AMP but that sufficient information was available to allow the staff to determine that this element of the LRA AMP is equivalent to the corresponding element of the GALL Report AMP; and

sufficient information was not available to determine whether element 1 (scope) of the LRA AMP was consistent with the corresponding elements of the GALL Report AMP.

The basis for the staff's determination that element 3 (parameters monitored or inspected) of the LRA AMP is equivalent to the corresponding GALL Report AMP is:

The LRA AMP for element 3 states that VT-3 visual examinations are conducted on designated Columbia component supports to determine general mechanical and structural conditions in accordance with IWF-2500. In the GALL Report AMP it states that ASME Section XI, Subsection IWF specifies visual examination (VT-3) of supports and identifies specific types of supports that require examination. It is not clear to the staff that these statements are consistent because the description of the applicant's Inservice Inspection (ISI) Program - IWF provided in LRPD-05, Attachment 3.3, Revision 3, Page 6 of 14, tabulates Category FA items that are within the scope of the applicant's Inservice Inspection (ISI) Program - IWF. However, Item F1.40 in this table covers

“Supports Other than Piping Supports” but the three items (F1.40A, F1.40B, and F1.40C) under F1.40 are designated as pipe supports. The applicant agreed to address this inconsistency by revising the tabulated information by changing “piping support” to “component support”. This commitment is documented in CR-AR: 176135-31.

In order to obtain the information necessary to verify whether the LRA program element number 1 is consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing an RAI for the following subject:

In element 1 of the LRA AMP it states that the scope of the IWF program includes ASME Class 1, 2, and 3 piping supports and supports other than piping supports (Class 1, 2, 3, and MC). The applicant also states in LRPD-05, Attachment 3.3, Revision 3, Reference IWF.4, that “one component in each multiple component group” is selected for examination. In the GALL Report AMP it states that ASME Section XI, Subsection IWF imposes inservice inspection (ISI) requirements for Class 1, 2, 3, and MC piping and components and their associated supports. However, Note 3 for Table IWF-2500-1 in ASME Section XI, Subsection IWF states that for multiple components other than piping, within a system of similar design, function, and service, the support of only one of the multiple components are required to be examined. It is not clear to the staff that these statements are consistent because the applicant’s component groups are not necessarily aligned with the multiple components referenced in ASME Section XI, Subsection IWF.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff’s independent base data search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff’s independent data base search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify whether the applicant’s operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the following subjects:

During the onsite audit walkdown, the staff observed evidence of loss of material due to corrosion in the above-water portions of structural steel supports for the spray pond ring header. To provide the information needed to verify consistency with GALL AMP X1.S3, the staff may request the applicant to (1) describe the inspection frequency and details of the supplemental examinations required in accordance IWF-3200 for the above-water and below-water portions of the structural steel supports for the spray pond ring header and (2) describe the methods used to protect the steel from corrosion, the process used to verify that the corrosion mitigation measures are effective, and the criteria used to initiate the corrective actions program.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.36 Lubricating Oil Analysis Program**

In the CBS LRA, the applicant states that AMP B.2.36, "Lubricating Oil Analysis," is an existing program, with an enhancement, that is consistent with the program elements in GALL Report AMP XI.M39, Lubricating Oil Analysis." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1 – 6 (scope, preventative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7 – 9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The enhancement affects LRA program element 1 (scope). This enhancement expands on the existing program element by including the following fire protection system components that are exposed to lubricating oil within the scope of the program: (1) fire protection diesel engine heat exchangers (lube oil coolers), (2) fire protection diesel engine lube oil piping, and (3) fire protection diesel engine lube oil pump casings.

In AMP B.2.36 of the LRA, the applicant committed to implement this enhancement prior to period of extended operation.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "oil," "foul," and "tank."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. A 248467	Lubrication Transfer & Storage and Equipment Oil Sampling – Effectiveness Evaluation Methods	08/08/2006
2. AR 00182276	Oil Analysis indicates reduced viscosity in the DG-ENG-1A1	08/26/2009
3. CR 2-06-00822	Current lubrication storage and transfer of lubricants on site does not meet industry Best Practice	02/02/2006
4. CR 2-07-06259	Water flooding of the feedwater turbine and subsequent foaming and greenish oil color	06/19/2007
5. CR 2-07-09875	Oil analysis results indicate increase in water in the upper oil reservoir	11/14/2007
6. PER 200-0145	The results from the oil analysis indicate that the RFT-LOC-1A and 1B samples have high levels of water in the oil in excess of .2%. The RFT-LOC-1A oil sample was estimated to be as high as 50%.	01/25/2000
7. B.2.36	Lubricating Oil Analysis Program	04/06/2010
8. PPM 1.19.3	Component Condition Monitoring Program	10/21/208
9. PPM 1.19.3c	Lubricating Oil Analysis	04/29/2008

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancement.

During the audit, the staff found that elements 1 – 6 (scope, preventative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

During the audit of program element 10 (operating experience), the staff found that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e. no previously unknown aging effects were identified by the applicant or the staff). In addition, the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1 – 6 are consistent with corresponding program elements in the GALL Report AMP;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging;

and verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **LRA AMP B.2.37, Lubricating Oil Inspection**

In the Columbia LRA, the applicant states that AMP B.2.37, "Lubricating Oil Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 37. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "lubricating," "oil," "corrosion," "pitting," "fouling," "heat transfer" and "leaching."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Lubricating Oil Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.8a	Aging Management Program Evaluation Results, Lubricating Oil Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
4. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 1 (scope of program), 2 (preventive actions), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 3 (parameters monitored/inspected), 4 (detection of aging effects), and 5 (monitoring and trending) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 3, 4, and 5 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "the sample population will be determined by engineering evaluation based on sound statistical methodology...." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

Under program element 5, the applicant's AMP begins by stating that "No actions are taken as part of the Lubricating Oil Inspection to monitor or trend inspection results." However, the GALL Report AMP XI.M32 includes guidelines for monitoring and trending inspection results under this program element. In addition, the applicant's statement appears to be inconsistent with its closing statement under this program element, which states that results of the inspection activities may result in "expansion of the sample size and inspection locations to determine the extent of the degradation."

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff);

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.38 Masonry Wall Program See AMP B.2.50**

#### **LRA AMP B2.39 Material Handling System Inspection Program**

In the CGS LRA, the applicant states that AMP B2.39, "Material Handling System Inspection Program" is an existing program with an enhancement that is consistent with the program elements in GALL Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The enhancement affects LRA program element 4 (detection of aging effects). This enhancement expands on the existing program element by adding visual inspection of loss of material due to corrosion for jib cranes and electrically operated hoists. During the audit, the staff found that the enhancement has already been implemented, and the LRA will be revised to delete this enhancement. The applicant provided the markup pages B-153 and B-154 of the CGS LRA Technical Information.

In Table A-1 of Appendix A of the LRA, the applicant had committed to implement this enhancement prior to the period of extended operation. However, since the enhancement has been implemented, the LRA Section A.1.2.39 (page A-21) will be revised to incorporate this change.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "wear," "corrosion," "crack," "degradation" and "aging."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

Document	Title	Revision / Date
1. WO 01107110	MT-HOI-18 Inspect Maintain and Test Hoist	08/16/06
2. WO 01120116	MT-HOI-7 CRHOI-1-1-12.3 Inspect test Hoist	08/30/06
3. WO 01124391	CRHOI-1-1-12.3 Annual MT-CRA-9A	10/15/07
4. WO 01125243	MT-CRA-6B CRHOI-1-1-12.4 Inspect and Test	01/10/07
5. WO 01125656	CRHOI-1-1-12.1 Overhead Traveling Crane	01/10/07
6. WO 01126381	MT-CRA-6A Inspect, Maintain, and Test Crane	01/10/07
7. WO 01128724	MT-HOI-8 Inspect Maintain Test Hoist Annually	05/15/07
8. WO 01128725	MT-MOI-6 Inspect Maintain Test Hoist Annually	05/15/07
9. WO01137463	MT-HOI-9 Inspection/Maintain/Test Hoist Annually	09/17/07
10. WO 01137469	MT-CRA-2 CRHOI-1-1-12.1 Overhead Crane	10/11/07
11. WO 01137499	MT-HOI-10 Inspect/Maintain/Test Hoist	09/14/07
12. PPM 10.4.1	Pendant Controlled Crane Inspection, Maintenance and Testing	08/27/09
13. PPM 10.4.5	Reactor (MT CRA 2) and Turbine Building (MTCRA) Overhead Travel Crane Inspection, Maintenance and Testing	06/21/07
14. PPM 10.4.10	Jib cranes and Electrically Operated Hoists inspection, maintenance, and Testing	09/17/08
15. PPM 10.4.12	Crane, Hoist, Lifting Device and Rigging Program Control	05/10/09
16. LRPD-05 Attachment 3.1	Material Handling System Inspection Program	Revision 3

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancement.

During the audit, the staff found that:

LRA program elements 1 (scope of program), 2 (preventive actions), 3 (parameters monitored or inspected), 4 (detection of aging effects), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

During the audit of program element 10 (operating experience), the staff found that:

The operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff);

The operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report AMP.

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.40, Metal-Enclosed Bus Program**

In the CGS LRA, the applicant states that AMP B.2.40, "Metal-Enclosed Bus Program" is a new program with exceptions that is consistent with the program elements in GALL Report AMP B.2.40, "Metal-Enclosed Bus Program." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The first exception affects LRA program element 3 (parameters monitored/inspected). In the GALL Report AMP, this program element recommends using Structure Monitoring Program to inspect the various bus joints, seals, and gaskets. Alternatively, this program element in the LRA will perform the inspection of the various bus joints, seals, and gaskets when the bus assembly covers are removed for inspection of the internal components, rather than the Structures Monitoring Program (as listed in NUREG-1801, Item VI.A-12).

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant.

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05	Columbia License Renewal Project Aging Management Program Evaluation Results Metal-Enclosed Bus Program	Rev. 3
2. AR 202384	Root Cause Evaluation E-BUS-NONSEG/N2/X Connection Failure on August 5, 2009	Rev. 2 1/27/2010
3. 1.19.3D	Columbia Generating Station, Plant Procedures Manual, Thermographic Monitoring and Analysis	Rev. 3 4/22/2009
4. ISP-IRM-X301	Columbia Generating Station, Plant Procedures Manual Intermediate Range Monitor Channel A Calibration	Rev. 10 4/13/2010
5. GO2-09-141	Columbia Generating Station Licensee Event Report No. 2009-004-00 6.9 kV Non-Segregated Electrical Bus Failure	Rev. 0 10/05/2009

The staff conducted its audit of LRA program elements 1 – 6 based without considering aspects of program element 3 (parameters monitored/inspected) of the LRA AMP which are associated with the exception. Aspects of these elements not associated with the exception were evaluated and are described below

During the audit, the staff found that:

elements 1, 2, 4, 5, and 6 (scope, preventive actions, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

In order to obtain the information necessary to verify whether the LRA program element number 10 (operating experience) is consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 10 of the LRA AMP it states that the Metal-Enclosed Bus Program is a new program for which there is no direct site-specific operating experience. In the GALL Report AMP it states that operating experience has shown that bus connections in Metal-Enclosed Buses exposed to appreciable ohmic heating during operation may experience loosening due to repeated cycling of connected load. It is not clear to the staff that these statements are consistent. During the walkdown on May 25 2010, the staff found smoked trace on the metal-enclosed bus of the 6.9kV E-BUS –NONSEG/N2/X and the surrounding 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 or relaxing the bolted connections on the central phase flexible link due to repeated thermal cycles over time. Even though these MEBs are not in-scope of the LRA, the staff was concerned of the same failure mode to the in-scope MEBs over extended period of operation.

During the audit of program element 10 (operating experience), the staff found that the operating experience identified by the staff's independent database search and supplemented by the applicant is not sufficient to allow the staff to verify that the LRA AMP, to be implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1, 2, 4, 5, and 6 are consistent with corresponding program elements in the GALL Report AMP;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

#### **LRA AMP B.2.41, Monitoring and Collection Systems Inspection**

In the CGS LRA, the applicant states that AMP B.2.41, "Monitoring and Collection Systems Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 41. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "drain," "corrosion," "pitting," "erosion," "MIC," and "waste."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Monitoring and Collection Systems Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9h	Aging Management Program Evaluation Results, Monitoring and Collection Systems Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010
4. CR 2-04-06232	Evaluate Whether the Fuel Pool Liner Leakage Should be Evaluated on a Routine Basis**	(no rev. no.) 11/09/2004
5. PER 203-0201	Projected Wall Thinning of 3" FDR(48)-1 Piping May Exceed the Specified Design Corrosion Allowance of 0.80 Inches before 2023**	(no rev. no.) 01/21/03
6. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 2 (Preventive Actions), 5 (Monitoring and Trending), and 6 (Acceptance Criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (Scope of Program), 3 (Parameters Monitored/Inspected), and 4 (Detection of Aging Effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3 and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 1, the applicant's AMP is presented as a stand-alone program designed to verify lack of degradation in the applicable components. In the GALL Report AMP it states that the program "includes measures to verify that unacceptable degradation is not occurring, thereby verifying the effectiveness of existing AMPs...." The SRP-LR (Table 3.1-2) further states in the FSAR Supplement guidelines that the One-Time Inspection Program "verifies the effectiveness of other aging management programs...." It is not clear to the staff that these statements are consistent because the applicant's AMP does not identify an underlying aging prevention or mitigation program for which it provides verification.

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques." The GALL Report

AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "the sample population will be determined by engineering evaluation based on sound statistical methodology...." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population...." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e. no previously unknown aging effects were identified by the applicant or the staff);

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing an RAI as described above for program element 1 ("Scope of Program").

Based on this audit the staff:

verified that half of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B.2.42, Open-Cycle Cooling Water Program**

In the CGS LRA, the applicant states that AMP B.2.42, "Open-Cycle Cooling Water Program" is an existing program with enhancements and exceptions that is consistent with the program elements in GALL Report AMP XI.M20, "Open-Cycle Cooling Water System." To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. This audit report does not consider the sufficiency of exceptions. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects LRA program element 1 (scope of program). This enhancement expands on the existing program element by adding loss of material due to cavitation erosion with activities including opportunistic inspections that have had indications of cavitation erosion.

The second enhancement affects LRA program element 1 (scope of program). This enhancement expands on the existing program element by adding the nonsafety related components within the license renewal scope in the standby service water system, circulating water system, plant service water system and tower makeup water system Systems and NSR components served by or connected to the plant service water system that are in the process sampling system, process sampling radioactive system, radwaste building mixed air system, radwaste building return air system, reactor building return air system, and reactor closed cooling water system.

In Section A.1.5 of the LRA, the applicant committed to implement these enhancements prior to the period of extended operation

The first exception affects LRA program element 2 (preventive actions). In the GALL Report AMP, this program element recommends that the system components are lined or coated to protect the underlying metal surfaces from being exposed to aggressive cooling water environments. Alternatively, this program element in the LRA states, that protective coatings on the inner walls are not used in the service water system that are within the scope of license renewal.

The second exception affects LRA program element 5 (monitoring and trending). In the GALL Report AMP, this program element recommends that testing and inspections are performed annually and during refueling outages. Alternatively, this program element in the LRA states, that inspection frequencies for the Open-Cycle Cooling Water Program are based on operating conditions and past history; flow rates, water quality, lay-up, and heat exchanger design.

During its audit, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "copper," "chemistry," "foul," "MIC," "cavitation," and "eddy."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05, Attachment 2.10	Open-Cycle Cooling Water Program	Revision 2 4/13/10
2. Letter GO2-91-041	Nuclear Plant No. 2, Operating License NPF-21 Response to Generic Letter 89-13, Service Water System Problems Affecting Safety Related Equipment	No Revision 3/28/1991
3. Appendix 2	Appendix 2 SW Reliability Program	Revision 5 1/27/2005
4. SWP-CHE-02	Chemical Process Management and Control	Revision 16 4/7/2009
5. CR 20952	Higher than desired corrosion rates in the TSW and SSW systems	No Revision 3/4/2004
6. PER 202-1977	Pinhole Leak on Weld on the Downstream side of SW-V-12B	No Revision 7/7/2002
7. ME-02-96-28	Evaluation of Cavitation Potential in the SW System	No Revision 10/31/1996
8. ME-02-02-39	Evaluation of Localized Pipe Wall Thinning in Service Water System	No Revision 9/30/2002
9. MES-14	Columbia Generating Station Guide for Evaluation of Pressure Boundary Wall Thinning	Revision 0 4/10/2009

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements. Aspects of program elements 2 and 5 (preventive actions and monitoring and trending) of the LRA AMP associated with the exceptions were not evaluated during this audit. Aspects of these program elements that are not associated with the exceptions were evaluated and are described below

During the audit, the staff found that:

elements 2 through 6 (preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

sufficient information was not available to determine whether element 1 (scope of program) of the LRA AMP was consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element number 1 is consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 1 of the LRA AMP it states that this program will manage cracking as one of the aging effects. In the GALL Report AMP it states that only loss of material and fouling are managed by this aging effect. It is not clear to the staff that these statements are consistent because cracking is not an aging effect that is covered by this program in the GALL Report.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent data base search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify whether the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the following subjects:

The LRA AMP states that erosion due to cavitation has occurred and that the corrective actions have not fully eliminated this aging issue. The LRA basis documents further indicates that the components susceptible to this aging effect will be monitored. In addition, the applicant has indicated that components susceptible to this aging affect have been modified by applying a stainless steel weld overlay and no longer need to be inspected. The staff was unable to determine how the extent of condition was developed, and why modification of the piping material to a stainless steel would bound the aging effect through the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

verified that the description provided in the FSAR Supplement is an adequate description of the program

**Existing Program consistent with GALL  
LRA AMP B.2.45, Reactor Head Closure Studs Program**

In the CGS LRA, the applicant states that AMP B.2.45, "Reactor Head Closure Studs Program" is an existing program that is consistent with the program elements in GALL Report AMP XI.M3, "Reactor Head Closure Studs" program. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent database search of the applicant's operating experience database using the keywords: "closure stud," "stud corrosion," "RPV stud crack."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems that Credit Reactor Head Closure Studs Program	(no rev. number) (no date)
2. LRPD-05 Attachment 1.8	Aging management Program Evaluation Results Reactor Head Closure Studs Program	Revision 3
3. GO2-05-196	ISI-3, "Inservice Inspection Program Plan Interval 3"	(no rev. number) 12/15/2005
4. PPM 10.2.13	Approve Lubricants	Revision 47 07/21/2008
5. PPM 10.3.21	Reactor Pressure Vessel Disassembly	Revision 30 05/27/2010
6. PDI-UT-5	Generic Procedure for Straight Beam Ultrasonic Examination of Bolts and Studs	Revision C 03/15/2001
7. SPS-4-3	Magnetic Particle Examination Columbia Generating Station - ISI	Revision 0 09/04/2008
8. ISI Summary Report R13	WNP-2 Inservice Inspection Summary Report for Refueling Outage RF13	08/12/1998
9. ISI Summary Report R16	Columbia Generating Station Inservice Inspection Summary Report for Refueling Outage RF16	08/21/2003

Document	Title	Revision / Date
10. ISI Summary Report R19	Inservice Inspection Summary Report for Third Inspection Interval First Inspection Period Refueling Outage RF19	08/31/2009

The staff conducted its audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements. Aspects of these program elements were evaluated and are described below.

During the audit, the staff found that:

elements 2 (preventive actions), 3 (parameters monitored/inspected), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (scope of program) and 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1 and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

The program description of LRA Section B.2.45 states that the Columbia Reactor Head Closure Studs program manages cracking due to SCC and loss of material due to corrosion for reactor head closure studs assemblies. The GALL Report AMP states that the Reactor Head Closure Studs program includes inservice inspection to detect cracking due to SCC or IGSCC, loss of material due to corrosion or wear, and leakage of coolant. It is not clear to the staff that these statements are consistent because loss of material due to wear is not included in the CGS AMP.

LRA Section B.2.45 states that inspection of the reactor vessel closure studs, performed in accordance with ASME Code, Section XI, Subsection IWB, Table IWB 2500-1 (2003 addenda), includes volumetric examinations rather than the surface examinations called out in paragraph NB-2545 or NB-2546 of Section III of the ASME Code. This is consistent with the GALL Report. However, in LRA Appendix C, Table C-11, in response to license renewal applicant action item (1) of NRC SER for BWRVIP-74 "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," the applicant stated "The BWR Vessel Internals Program requires the inspection and evaluation guidelines of this BWRVIP report to be implemented at Columbia. Site procedures require a technical justification to be documented for any deviation from the guidelines. Columbia has not identified any deviation from the BWRVIP-74-A guidelines. Therefore, Columbia is bounded by the BWRVIP-74-A report." The staff noted that Section 4.1.2 of the BWRVIP-74-A report states that vessel closure head studs (Category B-G-1, greater than 2 inches in diameter) require ultrasonic examination inservice when the examination is done in place, and both surface and ultrasonic examination if they are removed for examination. Therefore, since the applicant's program includes only volumetric examination, for the Columbia program to be consistent with the GALL AMP

XI.M3 and also with BWRVIP-74-A guidelines, the applicant seems to be committing to only one option for ISI of studs, i.e., volumetric examination of the studs in place.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **LRA AMP B2.47, Selective Leaching Inspection**

In the CGS LRA, the applicant states that AMP B.2.47, "Selective Leaching Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M33, "Selective Leaching of Materials." The applicant committed to implement this program within the 10 year period prior to the period of extended operation in the FSAR Supplement, Table A-1 item 47. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff conducted interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent database

search of the applicant's operating experience database using the keywords: "rust," "corrosion," "iron," "copper," "fire protection" and "aluminum."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. B.2.47	Columbia Generating Station LRA, B.2.47 Selective Leaching Inspection	No Revision 1/2010
2. LRPD-5 Att 2.9	Selective Leaching Inspection	Revision 1 10/9/2009
3. SL1.2	LRAMR-M08, Screening and Aging Management Review of the Fire Protection System	Revision 1 No Date
4. NUREG-1801	GALL Report Section XI.M33	Revision 1 9/2005
5. NRC Information Notice 94-59	Accelerated Dealloying of Cast Aluminum-Bronze Valves Caused by Microbiologically Induced Corrosion	No Revision 8/17/1994
6. PTL H100534	Plant Tracking Log Detail Report and Energy Northwest: Accelerated Dealloying of Cast Aluminum-Bronze Valves Caused by Microbiologically Induced Corrosion	No Revision 9/16/1994
7. LPRI 08	Operational Experience Review	Revision 1 3/29/10

During the audit of program elements 1 - 6, the staff found that:

elements 1-6 (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

During the audit of program element 10 (operating experience), the staff found that:

the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

verified that LRA program elements 1 - 6 are consistent with corresponding program elements in the GALL Report AMP;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage; and

verified that the description provided in the FSAR Supplement is an adequate description of the program

### **LRA AMP B.2.48, Service Air System Inspection**

In the Columbia LRA, the applicant states that AMP B.2.48, "Service Air System Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implement this program within the 10-year period prior to the period of extended operation in LRA Table A-1, Item 48. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "pipe," "valve," "corrosion," and "air."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Service Air System Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9j	Aging Management Program Evaluation Results, Service Air System Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010

Document	Title	Revision / Date
4. AED M510-3	Flow Diagram Control, Service, and Breathing Air Systems	Revision 20 (no date)
5. System Health Report CAS-SA, January-March, 2008	System Health Report CAS-SA, January-March, 2008**	(no rev. no.) (no date)
6. System Health Report CAS-SA, April-June, 2008	System Health Report CAS-SA, April-June, 2008	(no rev. no.) (no date)
7. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 2 (preventive actions), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (scope of program), 3 (parameters monitored/inspected), and 4 (detection of aging effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3 and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 1, the applicant's AMP is presented as a stand-alone program designed to verify lack of degradation in the applicable components. In the GALL Report AMP it states that the program "includes measures to verify that unacceptable degradation is not occurring, thereby verifying the effectiveness of existing AMPs." The SRP-LR (Table 3.1-2) further states in the FSAR Supplement guidelines that the One-Time Inspection Program "verifies the effectiveness of other aging management programs...." It is not clear to the staff that these statements are consistent because the applicant's AMP does not identify an underlying aging prevention or mitigation program for which it provides verification.

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "the sample population will be determined by engineering evaluation based on sound statistical methodology...." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population...." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing an RAI as described above for program element 1 (scope of program).

Based on this audit the staff:

verified that half of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B.2.49, Small Bore Class 1 Piping Inspection**

In the LRA, the applicant states that AMP B.2.49, "Small Bore Class 1 Piping Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping." The applicant committed to implement this program within the portion of the fourth 10-year ISI interval that occurs prior to the period of extended operation in LRA Table A-1, Item 49. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects,

monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "cracking," "piping," "line," "corrosion," "fatigue," "weld" and "socket."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems that Credit Small Bore Class Piping Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 1.10	Aging Management Program Evaluation Results, Small Bore Class Piping Inspection	Revision 2 (no date)
3. CR 2-05-02966	HPCS-V-713 Has a Crack-like Indication Discovered During NDE Examination	(no rev. no.) 05/05/2005
4. PER 203-2488	Cracked Pipe Between HPCS-V-713 and HPCS-V-714	(no rev. no.) 06/20/2003
5. PER 293-635	Small Magnitude Leak at Junction Between the RHR Shut-down Cooling Line and Instrument Line	(no rev. no.) 05/18/1993
6. PER 298-1021	(SPER)RCS Pressure Boundary Leakage Found at Weld to 3/4-inch PI(1)-4S-X62D Inside Primary Containment	(no rev. no.) 08/08/1998
7. PER 299-2268	During RPV Pressure Test a Leak Was Discovered on the RRC Loop B Suction Line Instrument Connection	(no rev. no.) 10/16/1999
8. Interoffice Memo SS2-PE-93-969	Instrumentation Line P1(1)-4S-X37E Weld 20R2 Failure	(no rev. no.) 2/13/1993
9. (not numbered)	WNP-2 Inservice Inspection Summary Report for Refueling Outage RF011, Spring 1996	(no rev. no.) 09/06/1996
10. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 1 (scope of Program), 2 (preventive actions), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP;

element 3 (parameters monitored/inspected) of the LRA AMP was not strictly consistent with the corresponding elements of the GALL Report AMP but that sufficient information was available to allow the staff to determine that this element of the LRA AMP are equivalent to the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 4 (detection of aging effects) and 5 (monitoring and trending) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

The basis for the staff's determination that element 3 (parameters monitored/inspected) of the LRA AMP is equivalent to the corresponding GALL Report AMP is as follows:

Element 3 of the applicant's AMP fails to state that the program detects cracking in ASME Code Class 1 small-bore piping in accordance with GALL XI.M35. However, this statement is made in the opening paragraph of the applicant's AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 4 (detection of aging effects) and 5 (monitoring and trending) are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 4 of the LRA AMP it states that CGS has not experienced cracking due to stress corrosion or thermal or mechanical loading, and therefore this one-time inspection is appropriate. The GALL Report AMP elements 4 and 5 state that one-time inspection is applicable to plants that have not experienced cracking in ASME Class 1 small-bore piping resulting from stress corrosion or thermal and mechanical loading. It is not clear to the staff that these statements are consistent because the applicant's operating experience includes a significant number of small-bore piping failures due to high-cycle fatigue and at least one due to stress corrosion cracking. The applicant therefore needs to justify its proposed use of a one-time inspection program for ASME Class 1 small-bore piping.

In element 4 of the LRA AMP it also states that CGS will perform volumetric examinations on selected weld locations. The GALL Report AMP element 4 likewise states that one-time inspections using volumetric examination are performed on selected weld locations to detect cracking. However, the staff notes that the volumetric NDE of socket welds is complicated by weld geometry and accessibility considerations, and the results of such volumetric examinations are often difficult to interpret. The applicant therefore needs to provide additional information on the volumetric examinations to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff);

the operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

However, as noted above, the applicant's operating experience appears to preclude the use of a one-time inspection program for the components under consideration, and the staff will consider issuing an RAI requesting the applicant to justify its proposed use of a one-time inspection program for ASME Class 1 small-bore piping.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable with the following exception. This exception is that the staff noted that the applicant again states in the FSAR Supplement that it has not experienced cracking of small-bore Class 1 piping from stress corrosion or thermal and mechanical loading. Because this statement appears to be inconsistent with the applicant's operating experience and because such cracking would preclude the applicant's proposed use of a one-time inspection program, the staff will consider issuing the relevant RAI described above.

Based on this audit the staff:

verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA AMP B.2.50, Structures Monitoring Program**

In the CGS LRA, the applicant stated that AMP B.2.50, Structures Monitoring Program, encompasses and implements AMP B.2.38, Masonry Wall Program, and AMP B.2.53, Water Control Structures Inspection Program, and that these are existing programs that are consistent with the program elements in GALL AMP, XI.S5, "Masonry Wall Program," GALL AMP XI.S6, "Structures Monitoring Program," and GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control

Structures Associated with Nuclear Power Plans, with enhancements. To verify this claim of consistency the staff audited the LRA AMPs. This audit report considers program elements 1-6 (scope, preventative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience), and the description as contained in the UFSAR supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects Program Element 1 (scope). This enhancement expands the scope of the Structures Monitoring Program to include and list the structures within the scope of license renewal that credit the Structures Program for aging management. The enhancement also expands the scope of the Water Control Structures Inspection Program to include and list water control structures within the scope of license renewal and include RG 1.127 Revision 1 inspection elements for water control structures.

The second enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program procedure and the excavation procedure to specify that if a below grade structural wall or structural component becomes accessible through excavation a follow-up action is initiated for the responsible engineer to inspect the exposed surfaces for age-related degradation of this area.

The third enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program to identify that the term "structural component" for inspection includes component types that credit the Structures Monitoring Program for aging management.

The fourth enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program to include the potential degradation mechanism checklist as an attachment to the procedure and includes aging effect terminology (e.g., loss of material, cracking, change in material properties, and loss of form).

The fifth enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program to specify that the responsible engineer shall review site groundwater and raw water testing results for pH, chlorides, and sulfates prior to inspection to validate that the below-grade or raw water environments remain non-aggressive during the period of extended operation and groundwater chemistry data shall be collected at least once every four years and account for seasonal variations.

The sixth enhancement affects Program Element 6 (acceptance criteria). This enhancement expands the Masonry Wall Program to specify that for each masonry wall the extent of observed masonry cracking or degradation of steel edge supports and bracing are evaluated to ensure that the current evaluation basis is still valid, requires corrective action if the extent of masonry cracking and steel degradation is sufficient to invalidate the evaluation basis, and provides an option to develop a new evaluation basis that accounts for the degraded condition of the wall (i.e., acceptance by further evaluation).

In Appendix A, Table A-1 of the LRA, the applicant committed to implement these enhancements prior to the period of extended operation.

During its on-site audit, the staff conducted field walk downs, interviewed the applicant's staff, and reviewed on-site documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "concrete," "corrosion," "cracking," "masonry wall," "water-control structures," and "spent fuel pool."

The table below lists the documents that were reviewed by the staff and found relevant to the on-site audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05	Columbia License Renewal Project – Aging Management Program Evaluation Results, Attachment 3.4 <ul style="list-style-type: none"> <li>- Structures Monitoring Program – B.2.50</li> <li>- Masonry Wall Program – B.2.38</li> <li>- Water Control Structures Inspection – B.2.53</li> </ul>	Revision 3
2. SMP.8	Maintenance Rule Program - Columbia Procedure PPM 1.5.11	Revision 10 12/10/2007
3. SMP.9	Maintenance Rule Program - Columbia System Engineering Instruction PPI SYS-4-22	Major Rev. 001 Minor Rev. N/A 5/07/2010
4. SMP.10	Maintenance Rule Structural Baseline Inspections - Columbia System Engineering Instruction PPI SYS-4-23	Revision 0 4/24/2009
5. SMP.11	Columbia Maintenance Rule Structural Inspection Checklist	
6. SMP.12	Columbia Procedure PPM 10.2.32 – Soil, Excavation, Backfill and Compaction	Major Rev. 020 Minor Rev. N/A 7/28/2009
7. A/R 00031540	Previously identified cracks in coating have changed in condition	5/21/2005
8. A/R 00026719	Evaluate whether the fuel pool liner should be checked	11/9/2004
9. A/R 00034432	Grout/mortar patch used on spray pond walls is cracking	8/31/2005

The staff conducted its on-site audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements.

During the on-site audit, the staff found that:

Elements 1, 2, and 5 (scope of program, preventive actions, and monitoring and trending) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

Sufficient information was not available to determine whether elements 3 (parameters monitored or inspected), 4 (detection of aging effects), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain information necessary to verify whether the LRA program element numbers 3, 4 and 6 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 3 of the CGS Structures Monitoring Program it is recommended to list ACI 349.3R-96 and ANSI/ASCE 11-90 as references to indicate that they provide guidance for selection of parameters monitored or inspected. The listing of these documents is provided as a recommended enhancement. The staff believes recommended enhancements provided in the LRA should be included in the scope of the program. It is not clear to the staff if the recommended enhancements such as these are required to meet GALL criteria or if CGS will commit to the recommended enhancements prior to the period of extended operation.

In element 3 of the CGS Structures Monitoring Program it states that the Structures Monitoring Program procedure and the excavation procedure will be enhanced to specify that if a below-grade structural wall or structural component becomes accessible through excavation, a follow-up action is initiated for the responsible engineer to inspect the exposed surfaces for age-related degradation. It is not clear to the staff how aging management of below-grade structures and structural components will be addressed during the period of extended operation in order to meet industry standards for inspection.

In element 3 of the CGS Structures Monitoring Program it was noted during review of the LRA that data provided from the groundwater study indicated that although the data met limits provided in the GALL Report, historical data, seasonal variation of results, and location of monitoring sites relative to safety-related and important-to-safety embedded concrete walls and foundations was not provided. The staff considered an RAI to confirm that aging of inaccessible areas will be managed so that the intended functions of the structures and structural components below-grade will be maintained during the period of extended operation. During discussions with CGS staff documentation was provided demonstrating that historical data from monitoring of the groundwater are available, the sampling wells provide results representative of safety-related and important-to-safety embedded concrete walls and foundations, and samples will be obtained at a frequency of four years and address seasonal variations. Based on the discussions the requirement for a RAI was eliminated.

In element 4 of the CGS Masonry Wall Program, Structures Monitoring Program, and Water Control Structures Inspection Program it states that inspections are performed by

individuals normally assigned to maintenance rule activities or if individuals are used that are not normally assigned to maintenance rule activities they are briefed prior to conduct of inspections or accompanied by a maintenance rule staff engineer. It is not clear to the staff how the qualifications of the inspection personnel are commensurate with those identified in industry codes, standards, and guidelines.

In element 6 of the CGS Masonry Wall Program, Structures Monitoring Program, and Water Control Structures Inspection Program it states that inspection criteria used to assess the condition of structures and structural components is found in the structures inspection checklist. The inspection checklist, however, provides only a listing of conditions to check related structures or structural components. It is unclear to the staff what criteria are utilized to provide a basis for acceptance of the condition of the structures and structural components and if criteria utilized meet or exceed the criteria commensurate with industry codes, standards, and guidelines such as provided in ACI 349.3R-96.

During the on-site audit of program element 10 (operating experience), the staff found that:

The operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation. In order to obtain the information necessary to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation, the staff will consider issuing RAs for the following subjects:

A/R 00026719 (11/09/2004) notes that when the NRC asked the question of how often leakage from the fuel pool liner is checked, CGS could not find any surveillances, PMs, or operator logs that check for this leakage. The staff is uncertain if leakage of the fuel pool is occurring and if leakage is present that it is being confined to the tell tale drains and is not impacting structures or structural components.

During the walk down of the Spray Pond the staff noted that there were numerous narrow cracks visible at the top of the reinforced concrete wall that went through the entire thickness of the wall. The cracks appeared to be shrinkage cracks and there was no evidence of corrosion. The staff is unclear if a corrective action program will be implemented to address these cracks to ensure the leak tight and structural integrity of the Spray Pond.

It was noted in document A/R Number 00031540 dated May 24, 2005, that while addressing a coating repair cracks were observed in the concrete that were estimated as being between 1/16 in. and 1/32 in. wide. During subsequent coating inspections it was noted that the cracks had grown in width, but not length, and the coating appears to be peeling away from the concrete creating a wider crack. It was noted that the cracks were not considered to be a concern unless the width increased to 1/8 in. or greater. The staff is unclear about what criteria were utilized to evaluate these cracks and if there are any plans to repair the cracks in the concrete to ensure

that corrosion of the embedded steel (i.e., steel reinforcement and containment metallic pressure boundary) does not occur.

The staff also audited the description of the LRA AMP provided in the UFSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

Verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 3, 4 and 6 for which additional information or additional evaluation is required before consistency can be determined;

Verified that the operating experience is not sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

Verified that the description provided in the FSAR Supplement is an adequate description of the program.

**LRA AMP B.2.50, Structures Monitoring Program  
Includes AMP B.2.38, Masonry Wall Program, and AMP B.2.53, Water Control Structures Inspection Program See AMP B.2.50**

In the CGS LRA, the applicant stated that AMP B.2.50, Structures Monitoring Program, encompasses and implements AMP B.2.38, Masonry Wall Program, and AMP B.2.53, Water Control Structures Inspection Program, and that these are existing programs that are consistent with the program elements in GALL AMP, XI.S5, "Masonry Wall Program," GALL AMP XI.S6, "Structures Monitoring Program," and GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, with enhancements. To verify this claim of consistency the staff audited the LRA AMPs. This audit report considers program elements 1-6 (scope, preventative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience), and the description as contained in the FSAR supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

The first enhancement affects Program Element 1 (scope). This enhancement expands the scope of the Structures Monitoring Program to include and list the structures within the scope of license renewal that credit the Structures Program for aging management. The enhancement also expands the scope of the Water Control Structures Inspection Program to include and list water control structures within the scope of license renewal and include RG 1.127 Revision 1 inspection elements for water control structures.

The second enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program procedure and the excavation

procedure to specify that if a below grade structural wall or structural component becomes accessible through excavation a follow-up action is initiated for the responsible engineer to inspect the exposed surfaces for age-related degradation of this area.

The third enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program to identify that the term "structural component" for inspection includes component types that credit the Structures Monitoring Program for aging management.

The fourth enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program to include the potential degradation mechanism checklist as an attachment to the procedure and includes aging effect terminology (e.g., loss of material, cracking, change in material properties, and loss of form).

The fifth enhancement affects Program Element 3 (parameters monitored or inspected). This enhancement expands the Structures Monitoring Program to specify that the responsible engineer shall review site groundwater and raw water testing results for pH, chlorides, and sulfates prior to inspection to validate that the below-grade or raw water environments remain non-aggressive during the period of extended operation and groundwater chemistry data shall be collected at least once every four years and account for seasonal variations.

The sixth enhancement affects Program Element 6 (acceptance criteria). This enhancement expands the Masonry Wall Program to specify that for each masonry wall the extent of observed masonry cracking or degradation of steel edge supports and bracing are evaluated to ensure that the current evaluation basis is still valid, require corrective action if the extent of masonry cracking and steel degradation is sufficient to invalidate the evaluation basis, and provides an option to develop a new evaluation basis that accounts for the degraded condition of the wall (i.e., acceptance by further evaluation).

In Appendix A, Table A-1 of the LRA, the applicant committed to implement these enhancements prior to the period of extended operation.

During its on-site audit, the staff conducted field walk downs, interviewed the applicant's staff, and reviewed on-site documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "concrete," "corrosion," "cracking," "masonry wall," "water-control structures," and "spent fuel pool."

The table below lists the documents that were reviewed by the staff and found relevant to the on-site audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRPD-05	Columbia License Renewal Project – Aging Management Program Evaluation Results, Attachment 3.4	Revision 3

Document	Title	Revision / Date
	<ul style="list-style-type: none"> <li>- Structures Monitoring Program – B.2.50</li> <li>- Masonry Wall Program – B.2.38</li> <li>- Water Control Structures Inspection – B.2.53</li> </ul>	
2. SMP.8	Maintenance Rule Program - Columbia Procedure PPM 1.5.11	Revision 10 12/10/2007
3. SMP.9	Maintenance Rule Program - Columbia System Engineering Instruction PPI SYS-4-22	Major Rev. 001 Minor Rev. N/A 5/07/2010
4. SMP.10	Maintenance Rule Structural Baseline Inspections - Columbia System Engineering Instruction PPI SYS-4-23	Revision 0 4/24/2009
5. SMP.11	Columbia Maintenance Rule Structural Inspection Checklist	
6. SMP.12	Columbia Procedure PPM 10.2.32 – Soil, Excavation, Backfill and Compaction	Major Rev. 020 Minor Rev. N/A 7/28/2009
7. A/R 00031540	Previously identified cracks in coating have changed in condition	5/21/2005
8. A/R 00026719	Evaluate whether the fuel pool liner should be checked	11/9/2004
9. A/R 00034432	Grout/mortar patch used on spray pond walls is cracking	8/31/2005

The staff conducted its on-site audit of LRA program elements 1 – 6 based on the contents of the existing program as modified by the proposed enhancements.

During the on-site audit, the staff found that:

Elements 1, 2, and 5 (Scope of Program, Preventive Actions, and Monitoring and Trending) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

Sufficient information was not available to determine whether elements 3 (parameters monitored or inspected), 4 (detection of aging effects), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain information necessary to verify whether the LRA program element numbers 3, 4 and 6 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

In element 3 the CGS Structures Monitoring Program it is recommended to list ACI 349.3R-96 and ANSI/ASCE 11-90 as references to indicate that they provide guidance for selection of parameters monitored or inspected. The listing of these documents is provided as a recommended enhancement. The staff believes recommended enhancements provided in the LRA should be included in the scope of the program. It is not clear to the staff if the recommended enhancements such as these are required to meet GALL criteria or if CGS will commit to the recommended enhancements prior to the period of extended operation.

In element 3 of the CGS Structures Monitoring Program it states that the Structures Monitoring Program procedure and the excavation procedure will be enhanced to specify that if a below-grade structural wall or structural component becomes accessible through excavation, a follow-up action is initiated for the responsible engineer to inspect the exposed surfaces for age-related degradation. It is not clear to the staff how aging management of below-grade structures and structural components will be addressed during the period of extended operation in order to meet industry standards for inspection.

In element 3 of the CGS Structures Monitoring Program it was noted during review of the LRA that data provided from the groundwater study indicated that although the data met limits provided in the GALL Report, historical data, seasonal variation of results, and location of monitoring sites relative to safety-related and important-to-safety embedded concrete walls and foundations was not provided. The staff considered an RAI to confirm that aging of inaccessible areas will be managed so that the intended functions of the structures and structural components below-grade will be maintained during the period of extended operation. During discussions with CGS staff documentation was provided demonstrating that historical data from monitoring of the groundwater are available, the sampling wells provide results representative of safety-related and important-to-safety embedded concrete walls and foundations, and samples will be obtained at a frequency of four years and address seasonal variations. Based on the discussions the requirement for a RAI was eliminated.

In element 4 of the CGS Masonry Wall Program, Structures Monitoring Program, and Water Control Structures Inspection Program it states that inspections are performed by individuals normally assigned to maintenance rule activities or if individuals are used that are not normally assigned to maintenance rule activities they are briefed prior to conduct of inspections or accompanied by a maintenance rule staff engineer. It is not clear to the staff how the qualifications of the inspection personnel are commensurate with those identified in industry codes, standards, and guidelines.

In element 6 of the CGS Masonry Wall Program, Structures Monitoring Program, and Water Control Structures Inspection Program it states that inspection criteria used to assess the condition of structures and structural components is found in the structures inspection checklist. The inspection checklist, however, provides only a listing of conditions to check related structures or structural components. It is unclear to the staff what criteria are utilized to provide a basis for acceptance of the condition of the structures and structural components and if criteria utilized meet or exceed the criteria

commensurate with industry codes, standards, and guidelines such as provided in ACI 349.3R-96.

During the on-site audit of program element 10 (operating experience), the staff found that:

The operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff);

The operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

In order to obtain the information necessary to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation, the staff will consider issuing RAIs for the following subjects:

A/R 00026719 (11/09/2004) notes that when the NRC asked the question of how often leakage from the fuel pool liner is checked, CGS could not find any surveillances, PMs, or operator logs that check for this leakage. The staff is uncertain if leakage of the fuel pool is occurring and if leakage is present that it is being confined to the tell tale drains and is not impacting structures or structural components.

During the walk down of the Spray Pond the staff noted that there were numerous narrow cracks visible at the top of the reinforced concrete wall that went through the entire thickness of the wall. The cracks appeared to be shrinkage cracks and there was no evidence of corrosion. The staff is unclear if a corrective action program will be implemented to address these cracks to ensure the leak tight and structural integrity of the Spray Pond.

It was noted in document A/R Number 00031540 dated May 24, 2005, that while addressing a coating repair, cracks were observed in the wetwell concrete that were estimated as being between 1/16 in. and 1/32 in. wide. During subsequent coating inspections it was noted that the cracks had grown in width, but not length, and the coating appears to be peeling away from the concrete creating a wider crack. It was noted that the cracks were not considered to be a concern unless the width increased to 1/8 in. or greater. The staff is unclear about what criteria were utilized to evaluate these cracks and if there are any plans to repair the cracks in the concrete to ensure that corrosion of the embedded steel (i.e., steel reinforcement and containment metallic pressure boundary) does not occur.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found this description to be consistent with the description provided in the SRP-LR and, therefore, acceptable.

Based on this audit the staff:

Verified that most of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 3, 4 and 6 for which additional information or additional evaluation is required before consistency can be determined;

Identified that additional information regarding operating experience is required before an indication regarding the sufficiency of the LRA AMP, as implemented by the applicant, to detect and manage aging can be reached; and

Verified that the description provided in the FSAR Supplement is an adequate description of the program.

### **LRA AMP B.2.51, Supplemental Piping/Tank Inspection**

In the CGS LRA, the applicant states that AMP B.2.51, "Supplemental Piping/Tank Inspection" is a new program that is consistent with the program elements in GALL Report AMP XI.M32, "One-Time Inspection." The applicant committed to implementing this program insert time frame of implementation e.g. prior to the period of extended operation in LRA Table A-1, Item 51. To verify this claim of consistency the staff audited the LRA AMP. This audit report considers program elements 1-6 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria) and 10 (operating experience) and the description of the program as contained in the FSAR Supplement. Program elements 7-9 (corrective actions, confirmation process, and administrative controls) are audited as part of the scoping and screening methodology audit. Issues identified but not resolved in this report are addressed in the SER.

During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience database using keywords: "piping," "tank," "drain," "corrosion," "pitting," and "MIC."

The table below lists the documents which were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's operating experience database.

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. (not numbered)	Systems That Credit Supplemental Piping/Tank Inspection	(no rev. no.) (no date)
2. LRPD-05, Attachment 2.9k	Aging Management Program Evaluation Results, Supplemental Piping/Tank Inspection	Revision 1 (no date)
3. LRPD-05	Aging Management Program Evaluation Results	Revision 3 05/03/2010

Document	Title	Revision / Date
3. LRPD-04	Operating Experience Review and Results	Revision 2 10/28/2009

During the audit of program elements 1 - 6, the staff found that:

elements 2 (preventive actions), 5 (monitoring and trending), and 6 (acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP; and

sufficient information was not available to determine whether elements 1 (Scope of Program), 3 (Parameters Monitored/Inspected), and 4 (Detection of Aging Effects) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

In order to obtain the information necessary to verify whether the LRA program element numbers 1, 3, and 4 are consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing RAIs for the following subjects:

Under program element 1, the applicant's AMP is presented as a stand-alone program designed to verify lack of degradation in the applicable components. In the GALL Report AMP it states that the program "includes measures to verify that unacceptable degradation is not occurring, thereby verifying the effectiveness of existing AMPs...." The SRP-LR (Table 3.1-2) further states in the FSAR Supplement guidelines that the One-Time Inspection Program "verifies the effectiveness of other aging management programs...." It is not clear to the staff that these statements are consistent because the applicant's AMP does not identify an underlying aging prevention or mitigation program for which it provides verification.

Under program element 3, the applicant's AMPs states that "inspections will be performed by qualified personnel using established NDE techniques...." The GALL Report AMP XI.M32 states under this program element that inspections are to be performed by qualified personnel following procedures consistent with the requirements of the ASME Code and 10 CFR 50, Appendix B. It is not clear to the staff that these statements are consistent because the applicant fails to reference ASME Code and 10 CFR 50, Appendix B procedure requirements.

Under program element 4, the applicant's AMP states that "the sample population will be determined by engineering evaluation." The GALL Report AMP XI.M32 states under this program element that "the inspection includes a representative sample of the system population...." It is not clear to the staff that these statements are consistent because the applicant provides insufficient detail on the sampling methodology to be employed.

During the audit of program element 10 (operating experience), the staff found that:

the operating experience identified by the staff's independent database search and supplemented by the applicant is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff); and the

operating experience identified by the staff's independent database search and supplemented by the applicant is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging effects during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR Supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR Supplement was an adequate description of the LRA AMP. In order to obtain the information necessary to verify the sufficiency of the FSAR Supplement program description, the staff will consider issuing an RAI as described above for program element 1 ("Scope of Program").

Based on this audit the staff:

verified that half of the LRA program elements 1 - 6 are consistent with the corresponding program elements in the GALL Report while identifying certain aspects of LRA program elements 1 - 6 for which additional information or additional evaluation is required before consistency can be determined;

verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage aging; and

identified a need for additional information regarding the adequacy of the program description in the FSAR Supplement.

### **LRA B.2.52, Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) Program**

In the CGS LRA, Section B.2.52, the applicant stated that the Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) Program at Columbia is a new aging management program (AMP) for Columbia that will manage reduction of fracture toughness due to thermal aging and neutron embrittlement of CASS reactor vessel internals (RVI) components so that their intended function is maintained. This AMP entails the screening of RVI components to determine their susceptibility to reduction in fracture toughness due to the combination of thermal aging and neutron embrittlement on the basis of component casting method, molybdenum content, and ferrite content. For components identified as susceptible to reduction in fracture toughness, this AMP will include supplemental non-destructive examination (NDE), based on exposure to neutron fluence, as part of the Columbia Inservice Inspection (ISI) Program and the Boiling Water Reactor Vessel and Internals Project (BWRVIP) guidelines. The applicant further stated that this AMP will be consistent with the program elements in GALL AMP XI.M13, "Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel."

During the audit, the staff reviewed the applicant's on-site basis documentation for the CGS Thermal Aging and Neutron Embrittlement of CASS Program in order to determine whether the program elements will be consistent with the 10 elements in GALL AMP XI.M13. The staff also interviewed the applicant's technical staff and reviewed other on-site documentation for determining whether the Columbia Thermal Aging and Neutron Embrittlement of CASS

Program, as described in LRA Section B.2.52, will be consistent with GALL AMP XI.M13 and in compliance with regulatory requirements. The staff reviewed the following CGS site documents:

**Relevant Documents Reviewed**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRPD-05, Attachment 1.11	Columbia License Renewal Project, XI.M13, Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel Program (On-Site Basis Document)	Rev 2 1/11/2010

The staff reviewed the applicant's on-site basis documentation for the Columbia Thermal Aging and Neutron Embrittlement of CASS Program in order to verify that the elements of this program will be consistent with GALL AMP XI.M13 program elements 1 through 10. The staff found that these program elements, as discussed in LRA Section B.2.52 and the supporting basis documentation, will be consistent with the GALL AMP XI.M13 program elements with the following exceptions: (1) acceptance criteria for flaws detected in CASS components; (2) the applicability of GALL AMP XI.M13 screening criteria for CASS components containing Niobium; (3) lack of justification as to why CASS reactor coolant pressure boundary (RCPB) components are not included in the scope of this AMP; and (4) the lack of a specific timeline for the completion of CASS component screening for CGS.

With respect to the operating experience program element in GALL AMP XI.M13, the staff verified that the applicant's program description in LRA Section B.2.52 and supporting basis documentation adequately identified industry operating experience applicable to this AMP. The applicant stated that recent industry operating experience has been reviewed for applicability to this AMP, and future operating experience will be captured through the normal operating experience review process at CGS, which will continue through the period of extended operation. The applicant stated that all applicable industry operating experience will be considered when implementing this program. There is no Columbia site-specific operating experience for the Thermal Aging and Neutron Embrittlement of CASS Program at Columbia because this is a new AMP for CGS. However, the applicant performed a review of other CGS site-specific operating experience, with respect to ISI indications in RVI components, and identified no age-related degradation for CASS RVI components at Columbia.

During the AMP audit, the staff identified several issues related to the consistency of this CGS AMP with the GALL AMP XI.M13 program elements. These issues are (1) the applicability of the ASME Code, Section XI, Article IWB-3000 acceptance standards to the AMP acceptance criteria for flaws detected in CASS components at CGS; (2) the applicability of GALL AMP XI.M13 screening criteria for CASS components containing Niobium; (3) the lack of sufficient justification in LRA Section B.2.52 and the supporting on-site basis documentation concerning why CASS RCPB components are not included in the scope of this AMP; and (4) the lack of a specific timeline for the completion of CASS component screening for CGS. The staff issued an RAI to address these issues, and the resolution of these RAIs will be discussed in the staff's safety evaluation for LRA Section B.2.52. With the exception of the above issues, the staff confirmed that the other elements of the CGS Thermal Aging and Neutron Embrittlement of CASS Program will be consistent with and bounded by the program elements described in GALL AMP XI.M13.

**AMP B.2.53, Water Control Structures Inspection Program**  
**See AMP B.2.50**

The staff reviewed the Water Control Structures Inspection Program under the applicant's Structures Monitoring Program.

During the audit, the staff found that:

Elements 5 and 6 (monitoring and trending, and acceptance criteria) of the LRA AMP were consistent with the corresponding elements of the GALL Report AMP.

Elements 1, 2, 3, and 4 (scope of program, preventative actions, and parameters monitored or inspected, and detection of aging effects) of the LRA AMP were not strictly consistent with the corresponding elements of the GALL Report AMP but that sufficient information was available to allow the staff to determine that these elements of the LRA AMP are equivalent to the corresponding elements of the GALL Report AMP.

The basis for the staff's determination that elements 1, 2, 3, and 4 of the LRA AMP are equivalent to the corresponding GALL Report AMP is:

For element 1, the applicant provided information indicating that the stored fuel for the diesel-driven fire pumps is periodically sampled and tested in accordance with the ASTM Standards recommended by the GALL Report AMP.

For element 2, the applicant provided justification for not using biocides, stabilizers, and corrosion inhibitors by stating that periodic cleaning and draining of the tanks provides assurance that corrosion inside tanks is minimized. The applicant also stated that the operating experience element for this program confirms this justification.

For element 3, the applicant provided justification for not testing the diesel-driven fire pumps fuel oil for particulate by stating that the sampling and testing for water and sediments in accordance with ASTM D 1796 and ATSM D 4057 has proven to be adequate based on the absence of related problems reported through the corrective action program.

For element 4, the applicant provided justification for not performing multilevel sampling for the emergency diesel generator fuel oil storage tanks by stating that the current method of sampling is performed using the diesel fuel oil filter/polisher system. The tanks are sampled individually. During sampling, the applicable storage tank is recirculated for a minimum of five minutes and a sample is drawn from the recirculation flow. This is considered to be a more representative sample than multilevel sampling. The fuel oil polishing system can take suction from any of the four tanks and discharge to any of the four tanks. The system takes suction from the bottom of the tank and after five minutes draws a flowing sample.

In order to obtain the information necessary to verify whether the LRA program element number 4 is consistent with the corresponding elements of the GALL Report AMP, the staff will consider issuing an RAI for the following subject:

In element 4 of the LRA AMP, it states that multilevel sampling of the fuel oil storage tanks is not performed; rather, a representative fuel stream sample is drawn from the flushing line during recirculation and transfer. In the GALL Report AMP it states periodic multilevel sampling provides assurance that fuel oil contaminants are below unacceptable levels. It is not clear to the staff that these statements are consistent because information on the method of obtaining stream samples was not provided for

January 21, 2011

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

SUBJECT: AUDIT REPORT REGARDING THE COLUMBIA GENERATING STATION,  
LICENSE RENEWAL APPLICATION

Dear Mr. Gambhir:

By letter dated January 19, 2010, Energy Northwest submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54), to renew operating license NPF-21 for Columbia Generating Station, for review by the U.S. Nuclear Regulatory Commission (NRC or the staff). On May 28, 2010, the staff completed the onsite audit of aging management programs. The audit report is enclosed.

If you have any questions, please contact me at 301-415-4029 or by e-mail at [evelyn.gettys@nrc.gov](mailto:evelyn.gettys@nrc.gov).

Sincerely,

*/RA/*

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

Docket No. 50-397

Enclosure:  
As stated

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Letter to S.K. Gambhir from Evelyn H. Gettys dated January 21, 2011

**SUBJECT:    AUDIT REPORT REGARDING THE COLUMBIA GENERATING STATION,  
              LICENSE RENEWAL APPLICATION**

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