Enclosure 3 contains Proprietary Information. Withhold from public disclosure under 10 CFR 2.390. When separated from Enclosure 3, this document is decontrolled.

PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, NJ 08038-0236

PSEG Nuclear LLC

MAR 23 2016

10 CFR 54

LR-N15-0254

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

Salem Generating Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket Nos. 50-272 and 50-311

Subject: Response to Request for Additional Information, RAI-4, Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150), dated March 31, 2015.

Reference: 1. NRC letter to PSEG, "Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150)," dated March 31, 2015 (ADAMS Accession No. ML15069A181)

2. PSEG letter to NRC, "Response to Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150)," dated May 28, 2015 (ADAMS Accession No. ML15148A426)

On March 31, 2015, the Nuclear Regulatory Commission (NRC) provided to Mr. Thomas Joyce of PSEG Nuclear LLC (PSEG) a request for additional information (RAI) (Reference 1). PSEG provided its response via letter LR-N15-0119 on May 28, 2015 (Reference 2). In that response, PSEG stated that it would provide a formal response to RAI-4 by late 2015 or early 2016. PSEG hereby provides its final response to RAI-4.

There are no regulatory commitments contained in this letter.

Enclosure 1 provides an affidavit for withholding signed by Westinghouse, the owner of the proprietary information provided in Enclosure 3.

Enclosure 2 provides PSEG's non-proprietary response to RAI-4 in Reference 1.

Enclosure 3 provides PSEG's proprietary response to RAI-4 in Reference 1.

Enclosure 3 contains proprietary information as defined by 10 CFR 2.390. Westinghouse Electric Company LLC, as the owner of the proprietary information, has executed the Enclosure 1 affidavit identifying that the proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. Westinghouse requests that the proprietary information in Enclosure 3 be withheld from public disclosure, in accordance with the requirements of 10 CFR 2.390(a)(4).

Should you have any questions regarding this submittal, please contact Mr. Thomas Cachaza at 856-339-5038.

Sincerely,

John F. Perry
Site Vice President
Salem Generating Station

Enclosure 1 Westinghouse Application for Withholding and Affidavit

Enclosure 2 Response to Request for Information RAI-4 of NRC Letter: Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150), dated March 31, 2015 (Non-Proprietary)

Enclosure 3 Response to Request for Information RAI-4 of NRC Letter: Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150), dated March 31, 2015 (Proprietary)

cc: Mr. D. Dorman, Administrator, Region I, NRC
Mr. T. Wengert, Project Manager, NRC
Mr. P. Finney, USNRC Senior Resident Inspector, Salem (X24)
Mr. P. Mulligan, Chief, NJBNE
Mr. T. Cachaza, Salem Commitment Tracking Coordinator
Mr. L. Marabella, Corporate Commitment Tracking Coordinator

LR-N15-0254

Enclosure 1

Westinghouse Application for Withholding and Affidavit

Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Direct tel: (412) 374-4643
Direct fax: (724) 940-8560
e-mail: greshaja@westinghouse.com

CAW-16-4375

February 8, 2016

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: LTR-REA-15-90-P, Rev. 1, "Salem Units 1 and 2 Summary Report for the Fuel Design / Fuel Management Assessments to Demonstrate MRP-227-A Applicability" (Proprietary)

The Application for Withholding Proprietary Information from Public Disclosure is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-16-4375 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The Affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by PSEG Nuclear LLC.

Correspondence with respect to the proprietary aspects of the Application for Withholding or the Westinghouse Affidavit should reference CAW-16-4375 and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

Very truly yours,

James A. Gresham, Manager
Regulatory Compliance

CAW-16-4375
February 8, 2016

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

I, James A. Gresham, am authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

James A. Gresham, Manager
Regulatory Compliance

(1) I am Manager, Regulatory Compliance, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitute Westinghouse policy and provide the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

(iii) There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iv) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(v) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(vi) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in LTR-REA-15-90-P, Rev. 1, "Salem Units 1 and 2 Summary Report for the Fuel Design / Fuel Management Assessments to Demonstrate MRP-227-A Applicability" (Proprietary), for submittal to the Commission, being transmitted by PSEG Nuclear LLC letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with the NRC letter, "Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150)," ML15069A181, March 31, 2015 and may be used only for that purpose.

(a) This information is part of that which will enable Westinghouse to support reactor vessel internals aging management.

(b) Further this information has substantial commercial value as follows:

(i) Westinghouse plans to sell the use of similar information to its customers for the purpose of supporting reactor internals aging management

(ii) Westinghouse can sell support and defense of industry guidelines and acceptance criteria for plant-specific applications.

(iii) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluation justifications and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are the proprietary and non-proprietary versions of a document furnished to the NRC associated with the NRC letter, "Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150)," ML15069A181, March 31, 2015, and may be used only for that purpose.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the Affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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LR-N15-0254

Enclosure 2

Response to Request for Information RAI-4 of NRC Letter: Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals (TAC Nos. MF5149 and MF5150), dated March 31, 2015 (Non-Proprietary)

LR-N15-0254
Enclosure 2

RAI-4

In MRP-2013-025, "MRP-227-A Applicability Template Guideline," (ADAMS Accession Number ML13322A454) report MRP has identified two generic questions that all Combustion Engineering, Inc. and Westinghouse design plants referencing topical report MRP-227-A must address to close AI 1 related to plant-specific applicability of the topical report. If the answer to either or both questions is yes, then further evaluation will be necessary to demonstrate the applicability of MRP-227-A to Salem, Units 1 and 2. The NRC staff therefore requests the following information:

1. Do the Salem, Units 1 and 2, RVI components have non-weld or bolting austenitic stainless steel components with 20 percent cold work or greater, and if so, do the affected components have operating stresses greater than 30 ksi? In particular, the plant-specific information on the extent of cold work on its RVI components. The licensee can apply "Option 1" or "Option 2," as addressed in Appendix A of the MRP-2013-025 report. If "Option 2" is applicable to Salem, Units 1 and 2, the licensee should list plant-specific RVI components that have been exposed to cold work equal to or greater than 20 percent. Plant-specific information related to this issue as addressed in "Option 2" in Appendix A, should be provided.

2. Have Salem, Units 1 and 2, ever utilized atypical design or fuel management that could make the assumptions of MRP-227-A regarding core loading/core design non-representative for that plant, including power changes/uprates? The following guidelines provided by MRP should be followed. The licensee is requested to use the MRP document dated October 14, 2013, MRP-2013-025, and it can apply "Option 1" or "Option 2," as addressed in Appendix B of the MRP-2013-025 report.

   Option 1:

   Salem, Units 1 and 2, comply with the MRP-227-A assumptions regarding core loading/core design. Neutron fluence and heat generation rates are concluded to be Option A or Option B.

   Option A: acceptable based on the following assessment to the limiting MRP guidance threshold values.

   Option B: unacceptable based on an assessment to the limiting MRP guidance threshold values.

   If Option A as addressed under "Option 1" is applicable, the following plant-specific values should be submitted: (a) active fuel to fuel alignment plate distance; (b) average core power density; and, (c) heat generation figure of merit.

If Option B under "Option 1" is applicable to Salem, Units 1 and 2, the licensee should justify the usage of its fuel management program.

Option 2:

Salem, Units 1 and 2 do not comply with the MRP-227-A assumptions regarding core loading/core design. The licensee should provide a technical justification for the application of MRP-227-A criterion to Salem, Units 1 and 2.

Updated Response to RAI-4

The initial response in PSEG Letter No. LR-N15-0119 dated May 28, 2015, Response to Salem Nuclear Generating Station, Unit Nos. 1 and 2 – Request for Additional Information Re: Aging Management Program Plan for Reactor Vessel Internals, stated PSEG, as part of the Pressurized Water Reactor Owner's Group (PWROG) Materials Subcommittee (MSC), has authorized Westinghouse to develop a report to provide a basis for a response to the NRC's request in RAI-4. The response stated PSEG will formally respond to RAI-4 when the PWROG project is completed, which is expected late in 2015 or early 2016.

Westinghouse has completed the tasks required to respond to RAI-4 for the Salem Generating Station, Unit Nos. 1 and 2. Below is the updated response.

RAI-4 Request No. 1

This response is provided for each of the Salem Units Nos. 1 and 2.

Salem Unit 1

The following discussions are plant-specific for Salem Unit 1.

Westinghouse has evaluated the Salem Unit 1 reactor internals components according to industry guideline MRP 2013-025 (Reference 1), as well as to the MRP-191 (Reference 2) industry generic component listings and screening criteria (including consideration of cold work as defined in MRP-175, noting the requirements of subsection 3.2.3 (Reference 3)). In addition to consideration of the material fabrication, forming, and finishing process, a general screening definition of "severe cold work" (a resulting reduction in wall thickness (material stock thickness) of 20 percent) was applied as an evaluation limit. The evaluation included a review of all plant modifications affecting reactor internals and the plant operating history. The components were procured according to American Society for Testing and Materials (ASTM) International or American Society of Mechanical Engineers (ASME) material specifications that were called out in the original plant construction drawings. Thus, material identification based on the material call outs and notes in the component drawings was an efficient and reasonable approach to identify the material of construction of components at Salem Unit 1.

Based on the specifications used in the Salem Unit 1 plant component drawings, it was possible to bin the Reactor Vessel Internal (RVI) components into the five material categories identified in MRP 2013-025 (Reference 1). Salem Unit 1 components were binned according to the following categories for the materials used in the component fabrication.

Categories based on MRP 2013-025 (Reference 1) include:

- Cast austenitic stainless steel (CASS) (Category 1)
- Hot-formed austenitic stainless steel (Category 2)
- Annealed austenitic stainless steel (Category 3)
- Fasteners austenitic stainless steel (Category 4)
- Cold-formed austenitic stainless steel without subsequent solution annealing (Category 5)

The potential for cold work is directly controlled by the material specifications. Essentially, all of the components that are binned (based on their specified materials) as Categories 1, 2, and 3 are non-cold worked; therefore, they have less than 20 percent cold work according to the NRC criterion. Similarly, any component binned under Category 5 has the potential to contain greater than 20 percent cold work. Category 4 materials are fasteners that may have been intentionally strain-hardened; however, manufacturer's specifications for fastener materials may have included limits on yield or tensile strength that would preclude cold work greater than 20 percent. Material definitions in drawings identify maximum yield stress restrictions on these materials, which allows for the identification of the cold work level. In some cases however, these restrictions are not present on drawings. Restrictions or limitations on the material yield stress (e.g., a maximum of 90 ksi) would indicate that the material cold work would be limited to less than 20 percent. In the absence of a maximum restriction yield stress of strain-hardened material, a conservative approach has been taken to indicate the potential for greater than 20 percent cold work.

Where multiple options existed for a component or assembly, the bounding condition was taken as the option that had the greater potential to include greater than 20 percent cold work. This option was then employed in the assessment of the component, and was selected for the purposes of the assessment. In some instances, sequential fabrication would appear to mitigate any potential for cold work; however, since the historical record was not detailed, the potential is noted but a conservative approach was selected for this assessment.

The evaluation, performed consistently with MRP 2013-025 (Reference 1), concluded that the reactor internals Categories 1, 2, and 3 (non-bolting) components at Salem Unit 1 contain no cold work greater than 20 percent as a result of material specification and controlled fabrication

construction. Category 4 components were already assumed to have the potential for cold work in the MRP-191 (Reference 2) generic assessments.

Material fabrication specifications used for Salem Unit 1 suggest that processes were limiting, which precluded the introduction of severe cold work in some of the Category 4 and 5 components. No Category 5 components with severe cold work were identified for Salem Unit 1. The detailed evaluation for the Licensee Action Item 1 (LAI 1) for the Salem Unit 1 cold work assessments concluded that the plant-specific fabrication and design were consistent with the MRP-191 (Reference 2) basis and that the MRP-227-A (Reference 4) sampling inspection aging management requirements, as related to cold work, are directly applicable to Salem Unit 1.

Salem Unit 2

The following discussions are plant-specific for Salem Unit 2.

Westinghouse has evaluated the Salem Unit 2 reactor internals components according to industry guideline MRP 2013-025 (Reference 1), as well as to the MRP-191 (Reference 2) industry generic component listings and screening criteria (including consideration of cold work as defined in MRP-175, noting the requirements of subsection 3.2.3 (Reference 3)). In addition to consideration of the material fabrication, forming, and finishing process, a general screening definition of "severe cold work" (a resulting reduction in wall thickness (material stock thickness) of 20 percent) was applied as an evaluation limit. The evaluation included a review of all plant modifications affecting reactor internals and the plant operating history. The components were procured according to ASTM International or ASME material specifications that were called out in the original plant construction drawings. Thus, material identification based on the material call outs and notes in the component drawings was an efficient and reasonable approach to identify the material of construction of components at Salem Unit 2.

Based on the specifications used in the Salem Unit 2 plant component drawings, it was possible to bin the RVI components into the five material categories identified in MRP 2013-025 (Reference 1). Salem Unit 2 components were binned according to the following categories for the materials used in the component fabrication.

Categories based on MRP 2013-025 (Reference 1) include:

- CASS (Category 1)
- Hot-formed austenitic stainless steel (Category 2)
- Annealed austenitic stainless steel (Category 3)
- Fasteners austenitic stainless steel (Category 4)
- Cold-formed austenitic stainless steel without subsequent solution annealing (Category 5)

The potential for cold work is directly controlled by the material specifications. Essentially, all of the components that are binned (based on their specified materials) as Categories 1, 2, and 3 are non-cold worked; therefore, they have less than 20 percent cold work according to the NRC criterion. Similarly, any component binned under Category 5 has the potential to contain greater than 20 percent cold work. Category 4 materials are fasteners that may have been intentionally strain-hardened; however, manufacturer's specifications for fastener materials may have included limits on yield or tensile strength that would preclude cold work greater than 20 percent. Material definitions in drawings identify maximum yield stress restrictions on these materials, which allows for the identification of the cold work level. In some cases however, these restrictions are not present on drawings. Restrictions or limitations on the material yield stress (e.g., a maximum of 90 ksi) would indicate that the material cold work would be limited to less than 20 percent. In the absence of a maximum restriction yield stress of strain-hardened material, a conservative approach has been taken to indicate the potential for greater than 20 percent cold work.

Where multiple options existed for a component or assembly, the bounding condition was taken as the option that had the greater potential to include greater than 20 percent cold work. This option was then employed in the assessment of the component, and was selected for the purposes of the assessment. In some instances, sequential fabrication would appear to mitigate any potential for cold work; however, since the historical record was not detailed, the potential is noted but a conservative approach was selected for this assessment.

The evaluation, performed consistently with MRP 2013-025 (Reference 1), concluded that the reactor internals Categories 1, 2, and 3 (non-bolting) components at Salem Unit 2 contain no cold work greater than 20 percent as a result of material specification and controlled fabrication construction. Category 4 components were already assumed to have the potential for cold work in the MRP-191 (Reference 2) generic assessments. Material fabrication specifications used for Salem Unit 2 suggest that processes were limiting, which precluded the introduction of severe cold work in some of the Category 4 and 5 components. No Category 5 components with severe cold work were identified for Salem Unit 2. The detailed evaluation for the LAI 1 for the Salem Unit 2 cold work assessments concluded that the plant-specific fabrication and design were consistent with the MRP-191 (Reference 2) basis and that the MRP-227-A (Reference 4) sampling inspection aging management requirements, as related to cold work, are directly applicable to Salem Unit 2.

LR-N15-0254
Enclosure 2

RAI-4 Request No. 2

This response refers to certain proprietary information that has been redacted from a proprietary version of a Westinghouse document. The proprietary information that has been redacted is shown as brackets ([ ]) with lower case letters (a) through (f) located as superscripts immediately following the brackets. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of Westinghouse Affidavit CAW-16-4375, dated February 8, 2016, pursuant to 10 CFR 2.390(b)(1).

This response is provided for each of the Salem Units Nos. 1 and 2.

Salem Unit 1

The following discussions are plant-specific for Salem Unit 1.

Westinghouse has evaluated the Salem Unit 1 reactor internals components with regard to fuel designs and fuel management according to industry guideline MRP 2013-025 (Reference 1).

Salem Unit 1 has not utilized atypical fuel designs or fuel management that could make the assumptions of MRP-227-A (Reference 4) regarding core loading/core design non-representative, including power changes/uprates that have occurred over the operating lifetime of the unit. This conclusion is based on comparisons of the Salem Unit 1 core geometry and operating characteristics with the MRP-227-A (Reference 4) applicability guidelines for Westinghouse-designed reactors specified in MRP 2013-025 (Reference 1).

Specifically, the following comparisons with the MRP-227-A (Reference 4) applicability guidelines in MRP 2013-025 (Reference 1) were established for the key reactor internals components at Salem Unit 1.

Components Located Beyond the Outer Radius of the Reactor Core – Salem Unit 1

Guideline 1 - The reactor has been operated with out-in fuel management for 30 years or less and all future operation will use low leakage fuel management.

Comparison - Salem Unit 1 initiated low leakage fuel management strategy in the thirteenth fuel cycle following 18.2 years of operation and has been implementing low leakage core designs since that time. There are no current plans to return to out-in fuel management.

Guideline 2 - For operation going forward, the average power density of the reactor core (as defined in MRP 2013-025 (Reference 1)) shall be less than 124 W/cm^3.

Comparison - For the last five operating fuel cycles (Cycles 19 through 23), Salem Unit 1 has been operating at a rated power level of 3459 MWt. For the 193 fuel assembly core geometry, the 3459 MWt power level corresponds to a core power density of 105.97

W/cm^3. This level of power generation is also representative of anticipated future operation.

Guideline 3 - For operation going forward, the nuclear heat generation rate figure of merit (HGR-FOM) (as defined in MRP 2013-025 (Reference 1)) shall not exceed 68 W/cm^3.

Comparison - For the last five operating fuel cycles (Cycles 19 through 23) at Salem Unit 1, the HGR-FOM at key baffle locations has ranged between [ ]^{a,c}, which is less than 68 W/cm^3. This range of HGR-FOM is representative of anticipated future operation.

Components Located Above the Reactor Core – Salem Unit 1

Guideline 1 - Considering the entire operating lifetime of the reactor, the average power density of the core (as defined in MRP 2013-025 (Reference 1)) shall be less than 124 W/cm^3 for a period of more than two years.

Comparison - Over the operating lifetime of the Salem Unit 1 reactor, the rated core power level, including power uprates, has varied between 3338 MWt and 3459 MWt. This variation of rated power level corresponds to a power density range of 102.26 W/cm^3 to 105.97 W/cm^3.

Guideline 2 - Considering the entire operating lifetime of the reactor, the distance between the top of the active fuel stack and the bottom of the upper core plate (UCP) shall be greater than 12.2 inches for a period of more than two years.

Comparison - For the Salem Unit 1 reactor internals and fuel assembly geometry, the nominal distance between the top of the active fuel stack and the bottom of the upper core plate (UCP) averaged over the first 23 fuel cycles of operation was [ ]^{a,c}. However, during that period of time, the nominal distance between the UCP and the top of the active fuel was less than 12.2 inches for an operating period of more than two years during Cycles 9 and 10.

Although, a fuel assembly to upper core plate gap of less than 12.2 inches for a period greater than two calendar years violates the established MRP-227-A criterion, further evaluation demonstrates that the increase in neutron fluence rate caused by the loss of shielding over that time period is offset by the margin afforded by the lower operating power density over the entire plant lifetime.

This evaluation demonstrates that, for all fuel cycles, the MRP-227-A (Reference 4) power density criterion is met with margins of approximately [ ]^{a,c}. This margin in power density translates directly into a neutron fluence rate reduction relative to that which would be allowed for plant operation at 124.0 W/cm^3 criterion. Conversely,

the increase in neutron fluence rate for the fuel cycles associated with the smaller gaps would exceed the limit value corresponding to a 12.2 inch gap by approximately [ ]^{a,c} for Cycles 10 and 9, respectively. For all other fuel cycles, the fuel to upper core plate criterion is met with associated margins in the resulting fluence rate varying from [ ]^{a,c}.

When the entire operating period of Salem Unit 1 is considered, the significantly larger margins associated with the lower power densities compensate for the small increase in fluence due to the loss of attenuation during Cycles 9 and 10. Therefore, it can be concluded that for Salem Unit 1, the combined effects of cycle dependent power densities and fuel configurations would result in fluence rates less than would be allowed for operation with power densities and fuel to upper core plate configurations based directly on the values specified as the MRP-227-A (Reference 4) criteria.

Components Located Below the Reactor Core – Salem Unit 1

Based on the discussion provided in MRP 2013-025 (Reference 1), plant-specific applicability of MRP-227-A (Reference 4) for components located below the reactor core with no further evaluation required is demonstrated by meeting the MRP-227-A, Section 2.4 criteria (Reference 4).

Salem Unit 2

The following discussions are plant-specific for Salem Unit 2.

Westinghouse has evaluated the Salem Unit 2 reactor internals components with regard to fuel designs and fuel management according to industry guideline MRP 2013-025 (Reference 1).

Salem Unit 2 has not utilized atypical fuel designs or fuel management that could make the assumptions of MRP-227-A (Reference 4) regarding core loading/core design non-representative, including power changes/uprates that have occurred over the operating lifetime of the unit. This conclusion is based on comparisons of the Salem Unit 2 core geometry and operating characteristics with the MRP-227-A (Reference 4) applicability guidelines for Westinghouse-designed reactors specified in MRP 2013-025 (Reference 1).

Specifically, the following comparisons with the MRP-227-A applicability guidelines in MRP 2013-025 (Reference 1) were established for the key reactor internals components at Salem Unit 2.

Components Located Beyond the Outer Radius of the Reactor Core – Salem Unit 2

Guideline 1 - The reactor has been operated with out-in fuel management for 30 years or less and all future operation will use low leakage fuel management.

Comparison - Salem Unit 2 initiated low leakage fuel management strategy in the tenth fuel cycle following 14.1 years of operation and has been implementing low leakage core designs since that time. There are no current plans to return to out-in fuel management.

Guideline 2 - For operation going forward, the average power density of the reactor core (as defined in MRP 2013-025 (Reference 1)) shall be less than 124 W/cm^3.

Comparison - For the last five operating fuel cycles (Cycles 16 through 20), Salem Unit 2 has been operating at a rated power level of 3459 MWt. For the 193 fuel assembly core geometry, the 3459 MWt power level corresponds to a core power density of 105.97 W/cm^3. This level of power generation is also representative of anticipated future operation.

Guideline 3 - For operation going forward, the nuclear heat generation rate figure of merit (HGR-FOM) (as defined in MRP 2013-025 (Reference 1)) shall not exceed 68 W/cm^3.

Comparison - For the last five operating fuel cycles (Cycles 16 through 20) at Salem Unit 2, the HGR-FOM at key baffle locations has ranged between [ ]^{a,c}, which is less than 68 W/cm^3. This range of HGR-FOM is representative of anticipated future operation.

Components Located Above the Reactor Core – Salem Unit 2

Guideline 1 - Considering the entire operating lifetime of the reactor, the average power density of the core (as defined in MRP 2013-025 (Reference 1)) shall be less than 124 W/cm^3 for a period of more than two years.

Comparison - Over the operating lifetime of the Salem Unit 2 reactor, the rated core power level, including power uprates, has varied between 3411 MWt and 3459 MWt. This variation of rated power level corresponds to a power density range of 104.50 W/cm^3 to 105.97 W/cm^3.

Guideline 2 - Considering the entire operating lifetime of the reactor, the distance between the top of the active fuel stack and the bottom of the UCP shall be greater than 12.2 inches for a period of more than two years.

Comparison - For the Salem Unit 2 reactor internals and fuel assembly geometry, the nominal distance between the top of the active fuel stack and the bottom of the UCP averaged over the first 20 fuel cycles of operation was [ ]^{a,c}. During that period of time the nominal distance between the UCP and the top of the active fuel was greater than 12.2 inches for all fuel cycles.

Components Located Below the Reactor Core – Salem Unit 2

Based on the discussion provided in MRP 2013-025 (Reference 1), plant-specific applicability of MRP-227-A (Reference 4) for components located below the reactor core with no further evaluation required is demonstrated by meeting the MRP-227-A, Section 2.4 criteria (Reference 4).

References:

1. EPRI Letter MRP 2013-025, "MRP-227-A Applicability Template Guidelines," October 14, 2013.

2. Materials Reliability Program: Screening, Categorization, and Ranking of Reactor Internals Components for Westinghouse and Combustion Engineering PWR Design (MRP-191). EPRI, Palo Alto, CA: 2006. 1013234.

3. Materials Reliability Program: PWR Internals Material Aging Degradation Mechanism Screening and Threshold Values (MRP-175). EPRI, Palo Alto, CA: 2005. 1012081.

4. Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A). EPRI, Palo Alto, CA: 2011. 1022863.