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PSEG | NUCLEAR

10 CFR 50.90

LR-N24-0012
LAR S24-01

July 24, 2024

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: **Application to Revise Salem Generating Station Units 1 and 2 Technical Specifications and 10 CFR 50.12 Exemption Request to Implement Optimized ZIRLO™ Fuel Rod Cladding**

References:

1. NRC letter to Westinghouse, "Final Safety Evaluation for Addendum 1 to Topical Report WCAP-12610-P-A and CENPD-404-P-A, 'Optimized ZIRLO™'," dated June 10, 2005 (ML051670403)

2. Westinghouse letter to NRC, LTR-NRC-06-45, "Issuance of Approved Version of WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A (Proprietary) 'Optimized ZIRLO™'," dated July 10, 2006 (ML062080563)

3. WCAP-14342-A & CENPD-404-NP-A, Addendum 1-A, "Optimized ZIRLO™," July 2006 (ML062080569)

In accordance with the provisions of 10 CFR 50.90, PSEG Nuclear LLC (PSEG) is submitting a request for an amendment to the Technical Specifications (TS) for Salem Generating Station (Salem) Unit 1 and Unit 2. The proposed change in Enclosure 1 will modify the Salem Unit 1 and 2 TS to allow the use of Optimized ZIRLO™[1] as an approved fuel rod cladding material.

This change is consistent with the Nuclear Regulatory Commission (NRC) safety evaluation that approved the use of Optimized ZIRLO fuel cladding material (Reference 1) as documented in the Reference 2 and Reference 3 Proprietary and Non-Proprietary documents respectively.

[1]Optimized ZIRLO is a trademark of Westinghouse Electric Company LLC

In support of this license amendment request, Enclosure 2 contains an exemption request in accordance with 10 CFR 50.12, "Specific exemptions," from certain requirements of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50, Appendix K, "ECCS Evaluation Models." This exemption request relates solely to the specific type of cladding material specified in these regulations for use in light water reactors. As written, the regulations presume use of either Zircaloy or ZIRLO®[2] fuel rod cladding. The exemption is required because Optimized ZIRLO has a slightly different composition than Zircaloy or ZIRLO®.

PSEG concludes that the proposed change does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

Enclosure 1 provides a description and assessment of the proposed change. Attachment 1 provides the existing TS pages marked up to show the proposed change.

PSEG requests approval of this LAR in accordance with the complexity of the submittal and established precedents from other Licensees. Approval is requested no later than August 30, 2025 to allow for sufficient time for design initialization and analyses to support loading of Optimized ZIRLO in support of the Salem Unit 2 Spring 2026 outage. Once approved, the amendment will be implemented within 90 days from the date of issuance.

There are no regulatory commitments contained in this letter.

In accordance with 10 CFR 50.91, a copy of this application, with attachments, is being provided to the designated State of New Jersey Official.

If there are any questions or if additional information is needed, please contact Mr. Michael Wiwel at Michael.Wiwel@pseg.com.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 24, 2024
(Date)

Respectfully,

David Sharbaugh
Site Vice President
Salem Generating Station

Enclosure 1: Evaluation of the Proposed Changes
Attachment 1: Technical Specification Page Markup
Enclosure 2: Request for Exemption from 10 CFR 50.46 and 10 CFR 50 Appendix K to Allow for the Use of Optimized ZIRLO™ Fuel Rod Cladding Material for Salem Generating Station Units 1 and 2.

[2]ZIRLO is a registered trademark of Westinghouse Electric Company LLC

cc: Administrator, Region I, NRC
Project Manager, NRC
NRC Senior Resident Inspector, Salem
Ms. A. Pfaff, Manager, NJBNE
PSEG Commitment Tracking Coordinator

Enclosure 1

Evaluation of the Proposed Change

Subject: License Amendment Request (LAR) to Implement Optimized ZIRLO™ Fuel Rod Cladding for Salem Generating Station Unit 1 and Unit 2

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1.0 SUMMARY DESCRIPTION

Pursuant to Title 10 of the *Code of Federal Regulations* (CFR) 50.90, PSEG Nuclear LLC (PSEG) is submitting a License Amendment Request (LAR) for a change to Facility Operating License (OL) Nos. DPR-70 and DPR-75 for the Salem Generating Station (Salem) Unit 1 and Unit 2, respectively. Specifically, PSEG is requesting a license amendment to revise the Salem Units 1 and 2 Technical Specification (TS) 5.3.1, "Fuel Assemblies," to allow the use of Optimized ZIRLO™[1] fuel rod cladding material.

Additionally, in support of this LAR, Enclosure 2 contains an exemption request from the provisions of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50, Appendix K, "ECCS Evaluation Models."

Optimized ZIRLO was developed to meet the needs of longer operating cycles with increased fuel discharge burnup and fuel duty. Fuel rod internal pressure (resulting from the increased fuel duty, use of integral fuel burnable absorbers, and corrosion and temperature feedback effects) has become more limiting with respect to fuel rod design criteria. Reducing the associated corrosion buildup and thus minimizing temperature feedback effects provides additional margin to the fuel rod internal pressure design criterion. Compared to ZIRLO®[2], the lower tin content and microstructure difference of Optimized ZIRLO provides a reduced corrosion rate while maintaining the benefits of mechanical strength and resistance to accelerated corrosion from abnormal chemistry conditions.

PSEG currently plans to install Optimized ZIRLO clad fuel rods during the Salem Unit 2 Spring 2026 Refueling Outage and the Salem Unit 1 Fall 2026 Refueling Outage.

2.0 DETAILED DESCRIPTION

2.1 Description of the Proposed Change

The proposed changes to the current Salem Unit 1 and Unit 2 TS are shown below with additions in bold italicized text. The mark-ups provided in Attachment 1 reflect the details of the current Salem TS.

- TS 5.3.1, "Reactor Core - Fuel Assemblies
  The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of ***Z***ircaloy, ZIRLO® ***or Optimized ZIRLO™*** clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with NRC-approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

[1] Optimized ZIRLO is a trademark of Westinghouse Electric Company LLC

[2] ZIRLO is a registered trademark of Westinghouse Electric Company LLC

2.2 Reason for the Proposed Change

The proposed change allows the use of Optimized ZIRLO fuel rod cladding material in support of the Salem Unit 2 Spring 2026 Refueling Outage and the Salem Unit 1 Fall 2026 Refueling Outage. Optimized ZIRLO provides a reduced corrosion rate while maintaining the benefits of mechanical strength and resistance to accelerated corrosion from off-normal chemistry conditions

3.0 TECHNICAL EVALUATION

3.1 Review of the Conditions in the NRC Safety Evaluation

Optimized ZIRLO is described in Westinghouse Topical Report WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A "Optimized ZIRLO™" (Reference 6.1). Reference 6.1 provides the details and test results of Optimized ZIRLO compared to ZIRLO fuel rod cladding material currently in use at Salem. Reference 6.2 is the non-proprietary version of Reference 6.1. Reference 6.1 also contains the material properties to be used in various models and methodologies when analyzing Optimized ZIRLO fuel rod cladding. The NRC safety evaluation (SE) for Reference 6.1 (Reference 6.3) contains ten conditions and limitations that are addressed below:

NRC Condition 1
Until rulemaking to 10 CFR Part 50 addressing Optimized ZIRLO has been completed, implementation of Optimized ZIRLO fuel clad requires an exemption from 10 CFR 50.46 and 10 CFR Part 50, Appendix K.

PSEG Response to Condition 1
A request for the required exemption from 10 CFR 50.46 and 10 CFR 50, Appendix K is provided in Enclosure 2.

NRC Condition 2
The fuel rod burnup limit for this approval remains at currently established limits: 62 gigawatt days per metric ton of uranium (GWd/MTU) for Westinghouse fuel designs and 60 GWd/MTU for Combustion Engineering (CE) fuel designs.

PSEG Response to Condition 2
Salem Units 1 and 2 use Westinghouse fuel designs and the current design basis rod burnup limit is 62 GWd/MTU. For any fuel using Optimized ZIRLO fuel rod cladding, the maximum fuel rod burnup limit for Westinghouse fuel designs will continue to be 62 GWd/MTU until such time that a new fuel rod burnup limit is approved for use. The fuel burnup limit will be confirmed as part of the normal reload design process.

NRC Condition 3
The maximum fuel rod waterside corrosion, as predicted by the best-estimate model, will [satisfy proprietary limits (included in the topical report and proprietary version of the NRC SE)] of hydrides for all locations of the fuel rod.

PSEG Response to Condition 3
The maximum fuel rod waterside corrosion for fuel using Optimized ZIRLO fuel rod cladding will be confirmed to be less than the specified proprietary limits for all locations of the fuel rod. Evaluations will be performed to confirm that the appropriate corrosion limits are satisfied as part of the normal reload design process.

NRC Condition 4
All the conditions listed in previous NRC SE approvals for methodologies used for standard ZIRLO and Zircaloy-4 fuel analysis will continue to be met, except that the use of Optimized ZIRLO cladding in addition to standard ZIRLO and Zircaloy-4 cladding is now approved.

PSEG Response to Condition 4
The Optimized ZIRLO fuel rod analysis will continue to meet all conditions associated with approved methods. Confirmation of these conditions is required as part of the normal reload process.

NRC Condition 5
All methodologies will be used only within the range for which ZIRLO and Optimized ZIRLO data were acceptable and for which the verifications discussed in Addendum 1 and responses to requests for additional information (RAIs) were performed.

PSEG Response to Condition 5
The application of ZIRLO and Optimized ZIRLO in approved methodologies will be made consistent with the approach accepted in Reference 6.1. Confirmation of these conditions is required as part of the normal reload design process.

NRC Condition 6
The licensee is required to ensure that Westinghouse has fulfilled the following commitment: Westinghouse shall provide the NRC staff with a letter(s) containing the following information (based on the schedule described in response to RAI 3 of Reference 6.4):

a. Optimized ZIRLO lead test assembly (LTA) data from Byron, Calvert Cliffs, Catawba, and Millstone.

   (1) Visual
   (2) Oxidation of fuel rods
   (3) Profilometry
   (4) Fuel rod length
   (5) Fuel assembly length

b. Using the standard and Optimized ZIRLO database including the most recent LTA data, confirm applicability with currently approved fuel performance models (e.g., measured versus predicted).

Confirmation of the approved models' applicability up through the projected end of cycle burnup for the Optimized ZIRLO fuel rods must be completed prior to their initial batch loading and prior to the startup of subsequent cycles. For example, prior to the first batch application of Optimized ZIRLO, sufficient LTA data may only be available to confirm the models' applicability up through 45 GWd/MTU. In this example, the licensee would need to confirm the models up through the end of the initial cycle. Subsequently, the licensee would need to confirm the models, based upon the latest LTA data, prior to re-inserting the Optimized ZIRLO fuel rods in future cycles. Based upon the LTA schedule, it is expected that this issue may only be applicable to the first few batch implementations, since sufficient LTA data up through the burnup limit should be available within a few years.

PSEG Response to Condition 6
Westinghouse has provided the NRC with information related to test data and models. As a result, the NRC has confirmed that this condition has been satisfied as stated in Reference 6.5. No further information is necessary in response to this condition.

NRC Condition 7
The licensee is required to ensure that Westinghouse has fulfilled the following commitment: Westinghouse shall provide the NRC staff with a letter containing the following information (based on the schedule in response to RAI 11 of Reference 6.4):

a. Vogtle growth and creep data summary reports.

b. Using the standard ZIRLO and Optimized ZIRLO database including the most recent Vogtle data, confirm applicability with currently approved fuel performance models (e.g., level of conservatism in Westinghouse rod pressure analysis, measured versus predicted, predicted minus measured versus tensile and compressive stress).

Confirmation of the approved models' applicability up through the projected end of cycle burnup for the Optimized ZIRLO fuel rods must be completed prior to their initial batch loading and prior to the startup of subsequent cycles. For example, prior to the first batch application of Optimized ZIRLO, sufficient LTA data may only be available to confirm the models' applicability up through 45 GWd/MTU. In this example, the licensee would need to confirm the models up through the end of the initial cycle. Subsequently, the licensee would need to confirm the models, based upon the latest LTA data, prior to re-inserting the Optimized ZIRLO fuel rods in future cycles. Based upon the LTA schedule, it is expected that this issue may only be applicable to the first few batch implementations since sufficient LTA data up through the burnup limit should be available within a few years.

PSEG Response to Condition 7
Westinghouse has provided the NRC with information related to test data and models. As a result, the NRC has confirmed that this condition has been satisfied as stated in Reference 6.5. No further information is necessary in response to this condition.

NRC Condition 8
The licensee shall account for the relative differences in unirradiated strength (yield strength (YS) and ultimate tensile strength (UTS)) between Optimized ZIRLO and standard ZIRLO in cladding and structural analyses until irradiated data for Optimized ZIRLO has been collected and provided to the NRC staff.

a. For the Westinghouse fuel design analyses:

   i. The measured, unirradiated Optimized ZIRLO strengths shall be used for beginning of life (BOL) analyses.

   ii. Between BOL up to a radiation fluence of 3.0E21 neutrons/centimeter^2 (n/cm^2) [E > 1 (million electron volts (MeV)], pseudo-irradiated Optimized ZIRLO strength set equal to linear interpolation between the following two strength level points: at zero fluence, strength of Optimized ZIRLO equal to measured strength of Optimized ZIRLO and at a fluence of 3.0E21 n/cm^2 (E > 1 MeV), irradiated strength of standard ZIRLO at the fluence of 3.0E21 n/cm^2 (E > 1 MeV) minus 3 kilopound per square inch (ksi).

   iii. During subsequent irradiation from 3.0E21 n/cm^2 up to 12E21 n/cm^2, the differences in strength (the difference at a fluence of 3.0E21 n/cm^2 due to tin content) shall be decreased linearly such that the pseudoirradiated Optimized ZIRLO strengths will saturate at the same properties as standard ZIRLO at 12.0E21 n/cm2

b. For the CE fuel design analyses, the measured, unirradiated Optimized ZIRLO strengths shall be used for all fluence levels (consistent with previously approved methods).

PSEG Response to Condition 8
The Optimized ZIRLO fuel rod analysis for Salem will use the yield strength and ultimate tensile strength as modified per conditions and limitations 8.a.i., 8.a.ii., and 8.a.iii. Confirmation of this condition is required as part of the reload design process.

Condition 8.b does not apply because Salem uses a Westinghouse fuel design and not a CE fuel design.

NRC Condition 9
As discussed in response to RAI 21 of Reference 6.4, for plants introducing Optimized ZIRLO that are licensed with LOCBART or STRIKIN-II and have a limiting peak cladding temperature (PCT) that occurs during blowdown or early reflood, the limiting LOCBART or STRIKIN-II calculation will be rerun using the specified Optimized ZIRLO material properties. Although not a condition of approval, the NRC strongly recommends that, for future evaluations, Westinghouse update all computer models with Optimized-ZIRLO-specific material properties.

PSEG Response to Condition 9
Salem Units 1 and 2 are licensed with the Best Estimate Analysis of Reflood Transients (LOCBART) code. A review of the Salem Large Break LOCA calculations reveals that in all pertinent cases, the peak cladding temperature (PCT) does not occur during the

blowdown or early reflood portion of the transient; therefore, a LOCBART calculation using the Optimized ZIRLO specific heat model is not required for Salem. Salem is not licensed with STRIKIN II, therefore this condition does not apply to Salem.

NRC Condition 10
Due to the absence of high temperature oxidation data for Optimized ZIRLO, the Westinghouse coolability limit on PCT during the locked rotor event shall be [proprietary limits included in topical report and proprietary version of safety evaluation].

PSEG Response to Condition 10
Confirmation of this condition is required as part of the normal reload design process.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

Title 10 of the Code of Federal Regulations (10 CFR) Part 50.36, “Technical Specifications,” requires that design features be included that described the facility in terms of materials of construction and geometric arrangement, which, if altered or modified, would have a significant effect on safety..

4.1.1 Regulations and Regulatory Guidance

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 4.2, "Fuel System Design," provides regulatory guidance to the NRC staff for the review of fuel rod cladding materials and fuel system. In addition, the SRP provides guidance for compliance with the applicable General Design Criteria (GDC) of 10 CFR Part 50, Appendix A. According to SRP Section 4.2, the fuel system safety review provides assurance that:

- The fuel system is not damaged as a result of normal operation and anticipated operational occurrences (AOOs).
- Fuel system damage is never so severe as to prevent control rod insertion when it is required.
- The number of fuel rod failures is not underestimated for postulated accidents.
- Coolability is always maintained.

In Reference 6.3, the NRC approved Addendum 1 to WCAP-12610-P-A and CENPD-404-P-A for the use of Optimized ZIRLO as an acceptable fuel rod cladding material for Westinghouse fuel designs.

10 CFR 50.46 requires, in part, that each boiling or pressurized light-water nuclear power reactor fueled with uranium oxide pellets within cylindrical Zircaloy or ZIRLO cladding must be provided with an emergency core cooling system (ECCS) that must be designed so that its

calculated cooling performance following postulated loss-of-coolant accidents conforms to the criteria set forth in 10 CFR 50.46(b). Appendix K to 10 CFR Part 50 establishes the regulations for conservative ECCS evaluation models. Enclosure 2 contains an exemption request from 10 CFR 50.46 and Appendix K to 10 CFR Part 50.

4.1.2 General Design Criteria

10 CFR 50, Appendix A, General Design Criteria (GDC)

Salem was designed in accordance with Atomic Energy Commission (AEC) proposed General Design Criteria published in July 1967. The applicable AEC proposed criteria, as documented in Salem UFSAR Section 3.1, were compared to 10 CFR 50 Appendix A General Design Criteria (GDC) as discussed below. The GDC criteria applicable to this LAR and its associated Exemption Request, are GDC 10, 27 and 35 as discussed below.

Criterion 10 - Reactor Design
The reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

GDC 10 is similar to the contents of AEC Criterion 6 (*Reactor Core Design*)

Criterion 27 - Combined Reactivity Control System Capability
The reactivity control systems shall be designed to have a combined capability in conjunction with poison addition by the ECCS of reliably controlling reactivity changes to assure that under postulated accident conditions and with appropriate margin for stuck rods, the capability to cool the core is maintained.

GDC 27 is similar to the contents of AEC Criterion 13 (*Fission Process Monitors and Controls*), Criterion 14 (*Core Protection Systems*), Criterion 27 (*Redundancy of Reactivity Control*), Criterion 28 (*Reactivity Hot Shutdown Capability*), Criterion 29 (*Reactivity Shutdown Capability*), Criterion 30 (*Reactivity Holddown Capability*), Criterion 31 (*Reactivity Control Systems' Malfunction*) and Criterion 32 (*Maximum Reactivity Worth of Control Rods*).

Criterion 35 - Emergency Core Cooling
A system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts.

Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

GDC 35 is similar to the contents of AEC Criterion 37 (*Engineered Safety Features Basis for Design*), Criterion 39 (*Emergency Power for Engineered Safety Features*), Criterion 41 (*Engineered Safety Features Performance Capability*) and Criterion 44 (*Emergency Core*

Cooling Systems' Capability)

There will be no changes to the Salem design such that compliance with any of the regulatory requirements above would come into question as a result of using Optimized ZIRLO. As such, Salem Units 1 and 2 will continue to comply with the applicable regulatory requirements of the licensing basis.

4.2 Precedents

This proposed change is similar in nature to the following LARs and associated Requests for Exemption from 10 CFR 50.46 and Appendix K to 10 CFR Part 50 approved by the NRC that authorized the use of Optimized ZIRLO fuel rod cladding:

1. Letter from NRC to J. Shea, "Watts Bar Nuclear Plant, Units 1 and 2 – Issuance of Amendment Nos. 127 and 30 regarding the use of Optimized ZIRLO™ Fuel Rod Cladding (EPID L-2018-LLA-0197)," dated July 25, 2019 (ADAMS Accession No. ML19112A004)

2. Letter from NRC to J. Shea, "Watts Bar Nuclear Plant, Units 1 and 2 – Exemption from the Requirements of 10 CFR Section 50.46 and Appendix K to 10 CFR part 50 to Allow the Use of Optimized ZIRLO™ Fuel Rod Cladding (EPID L-2018-LLE-0012)," dated July 25, 2019 (ADAMS Accession No. ML19112A011).

3. Letter from NRC to R. Bologna, "Beaver Valley Power Station, Unit Nos. 1 and 2 – Issuance of Amendment Nos. 302 and 191 Regarding the Use of Optimized ZIRLO™ Fuel Rod Cladding (CAC Nos. MF9580 and MF9581; EPID L-2017-LLA-0201)," dated March 1, 2018 (ADAMS Accession No. ML18022B116)

4. Letter from NRC to R. Bologna, "Beaver Valley Power Station, Unit Nos. 1 and 2 – Exemption from the Requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 to Allow the Use of Optimized ZIRLO™ Fuel Rod Cladding (CAC Nos. MF9582 and MF9583; EPID L-2017-LLE-0011)," dated March 1, 2018 (ADAMS Accession No. ML17313A550)

5. Letter from NRC to A. Heflin, "Wolf Creek Generating Station – Issuance of Amendment RE: Use of Optimized ZIRLO™ Fuel Rod Cladding (CAC No. MF7285)," dated August 3, 2016 (ADAMS Accession No. ML16179A293)

6. Letter from NRC to A. Heflin, "Wolf Creek Generating Station – Exemption from the Requirements of 10 CFR 50.46 and Appendix K of 10 CFR Part 50 to allow the use of Optimized ZIRLO™ Clad Fuel Rods (CAC No. MF7286)," dated August 2, 2016 (ADAMS Accession No. ML16179A440)

4.3 No Significant Hazards Consideration

In accordance with 10 CFR 50.90, PSEG Nuclear LLC (PSEG) requests an amendment to the Salem Unit 1 and Unit 2 Technical Specifications (TS) to allow the use of Optimized ZIRLO™[3] fuel rod cladding material. The current acceptable rod cladding material is identified in Salem

[3] Optimized ZIRLO is a trademark of Westinghouse Electric Company LLC

TS 5.3.1, “Reactor Core - Fuel Assemblies.” The proposed amendment would revise TS 5.3.1 to add Optimized ZIRLO to the approved rod cladding materials.

PSEG has evaluated whether a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The proposed change will allow the use of Optimized ZIRLO clad nuclear fuel at Salem Units 1 and 2. The NRC approved Westinghouse topical report WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, which addresses Optimized ZIRLO fuel rod cladding and demonstrates that Optimized ZIRLO fuel rod cladding has essentially the same properties as ZIRLO®[4] fuel rod cladding currently licensed at Salem. The use of Optimized ZIRLO fuel rod cladding material does not alter or prevent the ability of structures, systems, and components (SSCs) to perform their intended function to mitigate the consequences of an analyzed event. The fuel cladding itself is not an accident initiator and does not affect the probability of an accident from occurring. Therefore, the proposed change does not adversely affect accident initiators or precursors or alter the design assumptions, conditions, or configuration of the facility.

   Based on the approved analyses of the above topical report, use of Optimized ZIRLO will continue to meet the fuel design acceptance criteria and hence does not significantly affect the consequences of an accident. The proposed change does not affect the source term, containment isolation, or radiological release assumptions used in evaluating the radiological consequences of an accident previously evaluated. The proposed change is consistent with, and continues to support, the assumptions and resultant consequences of the Safety Analyses contained in Chapter 15 of the Updated Final Safety Analysis Report (UFSAR).

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No

   The use of Optimized ZIRLO fuel rod cladding will not result in adverse changes to the operation or configuration of the facility. WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A demonstrated that the material properties of Optimized ZIRLO fuel rod cladding are similar to those of ZIRLO fuel rod cladding currently licensed for Salem. Therefore, Optimized ZIRLO fuel rod cladding will perform similarly to ZIRLO fuel rod cladding, thus precluding the possibility of the fuel rod cladding from becoming an accident initiator. This change does not affect the design or operation of any plant SSCs to become initiators of a new or different type of accident. All plant systems and components will be

[4] ZIRLO is a registered trademark of Westinghouse Electric Company LLC

operated in the same configuration and manner for which the systems were analyzed and designed.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No

   WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, demonstrated that the material properties of the Optimized ZIRLO fuel rod cladding are similar to those of ZIRLO fuel rod cladding. Optimized ZIRLO fuel rod cladding is expected to perform similarly to ZIRLO fuel rod cladding for normal operating and accident scenarios, including both loss-of-coolant accident (LOCA) and non-LOCA analyzed events. The use of Optimized ZIRLO fuel rod cladding will not result in adverse changes to the operation or configuration of the facility.

   The proposed change does not alter the permanent plant design, nor does it change the assumptions contained in the UFSAR Safety Analyses.

   There is no reduction in capability or change in operation, design or configuration of any accident mitigating system as a result of the proposed change. Therefore, the plant's ability to respond to a design basis accident is unaffected. The proposed change does not alter any design basis or safety limit.

   Therefore, it is concluded that the proposed change does not involve a significant reduction in a margin of safety.

Based upon the above, PSEG concludes that the proposed change presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusion

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure.

Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

6.1 Westinghouse letter to NRC, LTR-NRC-06-45, “Issuance of Approved Version of WCAP-12610-P-A & CENPD-404-P-A, Addendum I-A (Proprietary)/WCAP-14342-A & CENPD-404-NP-A, Addendum 1-A (Non-Proprietary) ‘Optimized ZIRLO™,’ “ dated July 10, 2006 (ML062080563)

6.2 WCAP-14432-A & CENPD-404-NP-A, Addendum 1-A, "Optimized ZIRLO™," July 2006 (ML062080569)

6.3 NRC letter to Westinghouse, "Final Safety Evaluation for Addendum 1 to Topical Report WCAP-12610-P-A & CENPD-404-P-A, 'Optimized ZIRLO™,'" dated June 10, 2005 (ML051670403)

6.4 Westinghouse letter to NRC, LTR-NRC-04-44, "Westinghouse Responses to NRC Request for Additional Information (RAIs) on Optimized ZIRLO™ Topical - Addendum 1 to WCAP-12610-P-A," dated August 4, 2004 (ML042240411)

6.5 NRC letter to Westinghouse, "Satisfaction of Conditions 6 and 7 of the U. S. Nuclear Regulatory Commission Safety Evaluation for Westinghouse Electric Company Addendum 1 to WCAP-12610-P-A & CENP-404-P-A, 'Optimized ZIRLO™,' Topical Report," dated August 3, 2016 (ML16173A354)

Technical Specification Page Markups

The following Technical Specifications page for Renewed Facility Operating License DPR-70 is affected by this change request:

Technical Specification	Page
5.3.1	5-4

The following Technical Specifications page for Renewed Facility Operating License DPR-75 is affected by this change request:

Technical Specification	Page
5.3.1	5-4

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The reactor containment is designed and shall be maintained for a maximum internal pressure of 47 psig. Containment air temperatures up to 351.3°F are acceptable providing the containment pressure is in accordance with that described in the UFSAR.

5.3 REACTOR CORE

FUEL ASSEMBLIES

Zircaloy, ® or Optimized ZIRLO™

5.3.1 The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of ~~zircaloy or~~ ZIRLO clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with NRC-approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

CONTROL ROD ASSEMBLIES

5.3.2 The reactor core shall contain 53 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The reactor coolant system is designed and shall be maintained:

DESIGN PRESSURE AND TEMPERATURE

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5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The reactor coolant system is designed and shall be maintained:

a. In accordance with the code requirement specified in Section 4.1 of the FSAR, with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 680°F.

Enclosure 2

Subject: **Request for Exemption from 10 CFR 50.46 and 10 CFR 50 Appendix K to Allow the Use of Optimized ZIRLO™ Fuel Rod Cladding Material for Salem Generating Station Units 1 and 2**

Contents

1.0 PURPOSE

Pursuant to Title 10 of the *Code of Federal Regulations* (CFR) CFR 50.12, "Specific exemptions," PSEG Nuclear LLC (PSEG) requests an exemption from the provisions of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50, Appendix K, "ECCS Evaluation Models," for the Salem Generating Station Units 1 and 2 (Salem). The requested exemption would permit the use of Optimized ZIRLO™[5] fuel rod cladding material in future core reload applications for Salem. The regulations in 10 CFR 50.46 contain acceptance criteria for the emergency core cooling system (ECCS) for reactors that have fuel rods fabricated either with Zircaloy or ZIRLO®[6] fuel rod cladding material. Concurrently, 10 CFR 50, Appendix K, Section I.A.5, requires the Baker-Just equation be used to calculate the rate of energy release, hydrogen generation, and cladding oxidation from the metal-water reaction in the core. The Baker-Just equation assumes the use of a zirconium alloy other than Optimized ZIRLO material.

Therefore, an exemption is required from both 10 CFR 50.46 and 10 CFR 50, Appendix K to support the use of Optimized ZIRLO fuel rod cladding at Salem Units 1 and 2. This exemption request relates solely to the specific cladding material identified in these regulations (fuel rods with Zircaloy or ZIRLO cladding) and will provide for the application of 10 CFR 50.46 and 10CFR 50, Appendix K acceptance criteria to fuel assembly designs utilizing Optimized ZIRLO fuel rod cladding at Salem Units 1 and 2.

2.0 BACKGROUND

As the nuclear industry pursues longer operating cycles with increased fuel discharge burnup and fuel duty, the corrosion performance requirements for nuclear fuel cladding become more demanding. Optimized ZIRLO was developed to be more resistant to accelerated corrosion, due to abnormal chemistry conditions, than ZIRLO, while retaining its mechanical strength benefits. In addition, fuel rod internal pressure (resulting from the increased fuel duty, use of integral fuel burnable absorbers, and corrosion and temperature feedback effects) have become more limiting with respect to fuel rod design criteria. Reducing the associated corrosion buildup, and thus, minimizing the temperature feedback effects, provides additional margin to the fuel rod internal pressure design limit. A Technical Specification (TS) amendment for Salem Units 1 and 2 is required to allow the use of Optimized ZIRLO fuel rod cladding. The License Amendment Request is provided in Enclosure 1 to this submittal.

3.0 TECHNICAL JUSTIFICATION OF ACCEPTABILITY

Westinghouse topical report WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™," (References 1 and 2), provide the details and results of tests comparing Optimized ZIRLO and ZIRLO along with the material properties to be used in various models and methodologies when analyzing Optimized ZIRLO fuel rod cladding. The Nuclear Regulatory Commission (NRC) Safety Evaluation (SE) (Reference 3) for the topical report contains ten conditions and limitations. The first condition requires an exemption from 10 CFR 50.46 and 10 CFR 50, Appendix K before implementing Optimized ZIRLO. This exemption request fulfills this condition. Westinghouse has provided the NRC with information

[5] Optimized ZIRLO is a trademark of Westinghouse Electric Company LLC

[6] ZIRLO is a registered trademark of Westinghouse Electric Company LLC

related to test data and models (References 4 through 11) to address conditions and limitations 6, 7, and 8a. The NRC has confirmed by letter (Reference 12) that the data has satisfied conditions 6 and 7 and that no further information needs to be provided specific to conditions 6 and 7 when referencing WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A. Condition 8a must continue to be addressed as documented in Reference 3. Condition and Limitation 9 requires a LOCBART or STRIKIN II calculation if the limiting peak clad temperature (PCT) occurs during blowdown or early reflood. Salem is licensed to use the LOCBART code however, Salem is not licensed to use STRIKIN II. A review of the Salem Units 1 and 2 Large Break LOCA calculations reveals that in all pertinent cases, the peak cladding temperature does not occur during the blowdown or early reflood portion of the transient; therefore, a LOCBART calculation using the Optimized ZIRLO specific heat model is not required for Salem Units 1 and 2. The remaining conditions and limitations are addressed with changes to the Salem Units 1 and 2 TS (Enclosure 1) and the evaluations that are part of the reload design process. There are no additional commitments necessary to support NRC approval of this exemption request.

Future reload evaluations will ensure that acceptance criteria are met for the insertion of fuel assemblies composed of fuel rods clad with Optimized ZIRLO. These fuel assemblies will be evaluated using NRC-approved methods and models.

4.0 JUSTIFICATION OF EXEMPTION

10 CFR 50.12, "Specific exemptions," states that the Commission may grant exemptions from the requirements of the regulations of this part provided two criteria are met. These criteria are: (1) the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security; and (2) the Commission will not consider granting an exemption unless special circumstances are present. The requested exemption to allow the use of Optimized ZIRLO fuel rod cladding material in addition to Zircaloy or ZIRLO at Salem satisfies these criteria as described below.

Criterion 1

a. This exemption is authorized by law. The selection of a specified cladding material in 10 CFR 50.46 and implied in 10 CFR 50, Appendix K, was adopted at the discretion of the Commission consistent with its statutory authority. No statute required the NRC to adopt this specification. Additionally, the NRC has the authority under 10 CFR 50.12 to grant exemptions from the requirements of Part 50 upon showing proper justification. PSEG is not seeking an exemption from the acceptance and analytical criteria of 10 CFR 50.46 and 10 CFR 50, Appendix K. The intent of this request is solely to allow the use of criteria set forth in these regulations for application to the Optimized ZIRLO fuel rod cladding material.

b. This exemption will not present an undue risk to public health and safety. The reload design process ensures that the acceptance criteria are met for the insertion of fuel assemblies with fuel rods clad with Optimized ZIRLO. Fuel assemblies using Optimized ZIRLO fuel rod cladding will be evaluated using NRC-approved analytical methods and plant-specific models to address the differences in the cladding material properties. Thus, the granting of this exemption request will not pose an undue risk to public health and safety.

c. This exemption is consistent with the common defense and security. As noted above, this exemption request is only to allow the application of the aforementioned regulations to an improved fuel rod cladding material. The requirements and acceptance criteria will

be maintained. The special nuclear material in these assemblies is required to be handled and controlled in accordance with approved procedures. Use of Optimized ZIRLO fuel rod cladding at Salem will not affect plant operations and is consistent with common defense and security.

Criterion 2

Special circumstances support the issuance of an exemption.

10 CFR 50.12(a)(2) states that the Commission will not consider granting an exemption to the regulations unless special circumstances are present. This exemption request meets the special circumstances criteria of 10 CFR 50.12(a)(2)(ii), "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." For Salem, application of the subject regulations is not necessary to achieve the underlying purpose of the rule.

10 CFR 50.46 identifies acceptance criteria for ECCS performance at nuclear power plants. As part of the Salem reload design process, Westinghouse performs an evaluation of the core using loss-of-coolant accident (LOCA) methods approved for the site to ensure that fuel assemblies with Optimized ZIRLO fuel rod cladding meet the LOCA safety criteria.

The intent of 10 CFR 50, Appendix K, paragraph I.A.5 is to apply an equation for rate of energy release, hydrogen generation, and cladding oxidation from a metal-water reaction that conservatively bounds all post-LOCA scenarios (the Baker-Just equation).

Application of the Baker-Just equation has been demonstrated to be appropriate for Optimized ZIRLO. Due to the similarities in material composition of the Optimized ZIRLO and ZIRLO fuel rod cladding, the application of the Baker-Just equation will continue to conservatively bound all post-LOCA scenarios.

Based on the above, the underlying purpose of 10 CFR 50.46 and 10 CFR 50, Appendix K would continue to be met if the requested exemption to allow for the use of Optimized ZIRLO were granted.

5.0 CONCLUSION

The 10 CFR 50.46 and 10 CFR 50, Appendix K regulations are currently limited in applicability to the use of fuel rods with Zircaloy or ZIRLO cladding. 10 CFR 50.46 and 10 CFR 50, Appendix K do not apply to the proposed use of Optimized ZIRLO fuel rod cladding material because Optimized ZIRLO has a slightly different composition than Zircaloy or ZIRLO. With the approval of this exemption request, these regulations will be applied to Optimized ZIRLO fuel rod cladding at Salem.

Pursuant to 10 CFR 50.12, the requested exemption is authorized by law, does not present undue risk to public health and safety, and is consistent with the common defense and security. Approval of this exemption request does not violate the underlying purpose of the rule. In addition, special circumstances exist to justify the approval of an exemption from the subject requirements.

6.0 REFERENCES

1. Westinghouse letter to NRC, LTR-NRC-06-45, “Issuance of Approved Version of WCAP-12610-P-A & CENPD-404-P-A, Addendum I-A (Proprietary)/WCAP-14342-A & CENPD-404-NP-A, Addendum 1-A (Non-Proprietary) ‘Optimized ZIRLO™’," dated July 10, 2006 (ML062080563)
2. WCAP-14432-A & CENPD-404-NP-A, Addendum 1-A, "Optimized ZIRLO™," July 2006 (ML062080569)

3. NRC letter to Westinghouse, "Final Safety Evaluation for Addendum 1 to Topical Report WCAP-12610-P-A & CENPD-404-P-A, 'Optimized ZIRLO™’,” dated June 10, 2005 (ML051670403)

4. Westinghouse letter to NRC, LTR-NRC-07-1, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™' (Proprietary/Non-proprietary)," dated January 4, 2007 (ML070100385 and ML070100388)

5. Westinghouse letter to NRC, LTR-NRC-07-58, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™' (Proprietary/Non-proprietary)," dated November 6, 2007 (ML073130556 and ML073130560)

6. Westinghouse letter to NRC, LTR-NRC-07-58 Rev. 1, "SER Compliance with WCAP-12610P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™' Proprietary/Nonproprietary)," Revision 1, dated February 5, 2008 (ML080390451 and ML080390452)

7. Westinghouse letter to NRC, LTR-NRC-08-60, "SER Compliance of WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™' (Proprietary/Non-proprietary)," dated December 30, 2008 (ML090080380 and ML090080381)

8. Westinghouse letter to NRC, LTR-NRC-10-43, "SER Compliance of WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A 'Optimized ZIRLO™' (Proprietary/Non-proprietary)," dated July 26, 2010 (ML102140213 and ML102140214)

9. Westinghouse letter to NRC, LTR-NRC-13-6, "SER Compliance of WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™' (Proprietary/Non-proprietary)," dated February 25, 2013 (ML13070A188 and ML13070A189)

10. Westinghouse letter to NRC, LTR-NRC-15-7, "Submittal of Responses to Draft RAIs and Revisions to Select Figures in LTR-NRC-13-6 to Fulfill Conditions 6 and 7 of the Safety Evaluation for WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A (Proprietary/Non-Proprietary)," dated February 9, 2015 (ML15051A427, ML15051A428, and ML15051A429)

11. Westinghouse letter to NRC, LTR-NRC-15-84, "Submittal of Response to Condition 8.a of the Safety Evaluation Report (SER) on WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO™' (Proprietary/Non-Proprietary)," dated September 29, 2015 (ML15279A113 and ML15279A114)

12. NRC letter to Westinghouse, "Satisfaction of Conditions 6 and 7 of the U. S. Nuclear Regulatory Commission Safety Evaluation for Westinghouse Electric Company Addendum 1 to WCAP-12610-P-A & CENP-404-P-A, 'Optimized ZIRLO™,' Topical Report," dated August 3, 2016 (ML16173A354)