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

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PSEG
Nuclear LLC

United States Nuclear Regulatory Commission
Document Control Desk
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UPDATED RESPONSE TO GENERIC LETTER 2004-02 AND REQUEST FOR EXTENSION FOR INSULATION REPLACEMENT
SALEM GENERATING STATION – UNIT 2
DOCKET NO. 50-311
FACILITY OPERATING LICENSE NO. DPR-75

References: (1) Letter from PSEG to NRC: "Response to Generic Letter 2004-02 Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors, Salem Nuclear Generating Station, Units 1 and 2, Facility Operating Licenses DPR-70 and DPR-75, Docket Nos. 50-272 and 50-311", dated September 1, 2005

In response to GL 2004-02 (Reference 1), PSEG committed to amend the response when certain additional actions had been completed. This submittal provides updated information based on the completion of a number of the additional actions, and requests an extension for insulation removal for Salem Generating Station (SGS) Unit 2. Salem Unit 1 will be in full compliance prior to the GL 2004-02 compliance date of December 31, 2007. In accordance with 10 CFR 50.91(b)(1), a copy of this transmittal has been sent to the State of New Jersey.

PSEG committed to amend Reference 1 when the actions related to three topics had been completed; an update on these three topics is provided below:

1. Strainer Design

The Design Change Package (DCP) for Salem Unit 2 has been issued. The installation is scheduled in the fall 2006 outage (2R15). The new strainers will be approximately 5300 sq ft and will be installed in the outer annulus area. This is the maximum strainer surface area possible based on the containment configuration, and is a significant increase over the existing strainer surface area of 85 sq ft. The strainer will have pocket openings of 1/12-inch to trap the debris (vs. the existing 1/8-inch design). The strainers will be fully submerged underwater during a postulated DBA LOCA. A debris generation evaluation, the debris transport evaluation and the screen head loss / pump NPSH analysis have been completed providing acceptable results for the 5300 sq ft strainer design.

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2. Chemical Effects

Trisodium Phosphate is not used at Salem, and calcium silicate insulation within the zone of influence will be replaced prior to December 31, 2007; therefore the impact of these two chemicals has been adequately accounted for. Chemical effects testing for all other chemical debris is scheduled to be conducted during July of 2006. Initially, bench top testing will be conducted to determine the chemical behavior of the precipitates. Then the chemicals will be loaded with the fiber to perform a multi function loop test. In addition, the PWROG is performing chemical tests to determine the impact on sump strainers with a completion date of 12/31/06. It is expected that the new strainer design will have adequate margin to accommodate the chemical effects.

3. Downstream Effects

a. The ECCS downstream components (ex. valves, orifices, pumps, heat exchangers, instrument lines, etc.,) were reviewed for debris blockage potential and found acceptable. The long term wear effect on the downstream ECCS components due to pumping debris-laden sump water was also evaluated. The results showed that the wear of the high head charging/safety injection (CV) pumps, intermediate-head safety injection (SI) pumps, low head injection/residual heat removal (RHR) pumps, throttle valves, check valves, relief valves, orifices, containment spray nozzles, and RHR heat exchangers was acceptable.

b. The impact of the fiber bypass on the nuclear fuel was evaluated.

Westinghouse has performed an initial scoping evaluation of the long-term core coolability of the fuel with fibrous and particulate debris in the fluid recirculating from the containment sump. The evaluation was based on conservative assumptions regarding the collection of sufficient fibrous debris at the bottom of the fuel so as to cause a thin bed effect, and potentially affect core coolability.

The acceptance criterion for the scoping evaluation was the formation of a 1/8-inch fiber bed at the bottom of the fuel. This 1/8-inch fiber bed is generally accepted as the minimum fiber bed thickness needed to support a thin bed effect. This 1/8-inch fiber bed was evaluated to form with the passing of about 1 cu ft of fibrous debris through the sump screen.

Testing performed with the proposed replacement strainer design for Salem by the strainer vendor with the current fiber load demonstrated a fibrous debris bypass of approximately 5 cu ft. This amount of fibrous debris is a result of the large surface area of the strainer (5300 sq ft). The vendor testing indicates that the sump screen surface area is the critical parameter in setting fibrous debris bypass. With a sump screen surface area of 5300 sq ft, and greater than 25 cu ft of fibrous debris arriving at the sump screen surface, the resulting debris bypass could exceed 1 cu ft.

Currently, there are several actions underway to address this issue:

- Discussions with Westinghouse indicate that the assumptions for the formation of a 1/8-inch fiber bed at the bottom of the fuel are conservative and can possibly be relaxed when considering the physical characteristics of the fibrous debris that is by-passed by the replacement sump screens. The 1/8-inch fiber bed is based on the semi-empirical headloss model presented in NUREG/CR-6224. This model is based on long fibers that span the flow holes of a sump screen. The model further assumes that these fibers are captured on the first fuel element at a 95% capture rate.
- From vendor test results, the majority (90%) of the bypass fibers are relatively short (0.1 mm to 1.0 mm, i.e., .004 inches to .04 inches) chopped fibers. This length fiber is very short compared to a fuel bottom nozzle flow hole of about 0.2 inches. Therefore, these fibers will not mat across the bottom nozzle. Rather, these short fibers will catch on grids similar to hairs in a drain crucifix and will tend to stay vertical in the flow path. In addition, based on screen penetration data for well-chopped fibrous debris, the capture rate of fibrous debris on these grids will be 20 to 40% versus the 95% for longer fibers.
- Westinghouse is further refining the Salem specific acceptance criterion to quantify the amount of bypass that may be acceptable for long-term core cooling. This analysis is scheduled to be completed in the third quarter of 2006. Based on preliminary calculations, the bypass results from the Salem testing are expected to be acceptable.
- The following action is prudently being performed, concurrent with the Westinghouse work: the strainer vendor is evaluating a method of improving the filter efficiency by designing "debris catchers.

A significant amount of the design and analyses work for GL 2004-02 has been completed. The remainder of the design and analyses work is scheduled to be completed by the fourth quarter of 2006. The Unit 2 redesigned strainer will be installed in 2006.

Extension Request for Insulation Removal for Salem Unit 2

PSEG is confident, based on the preceding discussion that no additional insulation will need to be removed to comply with the allowable fiber bypass. However, because this has not been confirmed and quantified at this time, PSEG would like to defer insulation replacements, as discussed below.

(a) There is a small possibility that the Original Steam Generators (OSG) insulation design may not comply with the fiber bypass limit. Coincidental with the GL 2004-02 actions, PSEG has scheduled the replacement of the Unit 2 Steam Generators. The Replacement Steam Generators (RSG) and their insulation design (Reflective Metallic Insulation) will be in full compliance with the GL 2004-02 design basis and analysis, regardless of the outcome of the refined fiber bypass analysis. Based on current outage

scheduling, the RSGs will be installed in the Spring 2008 Outage, scheduled to start March 12, 2008. This is 2 months and 12 days beyond the GL 2004-02 compliance date of December 31, 2007.

If the OSG insulation were redesigned and replaced as a contingency action to comply with the conservative 1 cu ft bypass limit, for the 2 month 12 day period, the following negative consequential actions would result:

- An estimated ALARA penalty of approximately 22 Rem
- An additional cost of approximately $3.5 million, for material that will be discarded in April 2008.
- An additional generation of radwaste of approximately 1800 cu ft

(b) There is also a small possibility that the Pressurizer insulation and piping insulation within the zone of influence (ZOI) may have to be replaced to comply with the fiber bypass limit. If the Pressurizer insulation and piping insulation were replaced as a contingency action to comply with the conservative 1 cu ft bypass limit, for the 2 month 12 day period, then an estimated ALARA penalty of approximately 50 Rem would result.

Risk

It is anticipated, based on the Westinghouse analysis discussed above, that it will be acceptable to leave fibrous insulation in place. However, if the analytical result is adverse, some additional risk will exist. The risk of the delayed insulation replacement comes from the potential for the fibrous insulation on the existing steam generators, pressurizer and ZOI piping to be dislodged and cause downstream effects during recirculation. The likelihood of LOCAs occurring during this short extension is low. This small risk is more than offset by the significant additional exposure that would be incurred by plant workers if the insulation replacement were to be undertaken prior to the steam Spring, 2008 outage. All of the sump strainer modifications will be completed prior to 2008, so the ECCS recirculation capability (relative to sump blockage) will be assured.

Also, as a further mitigating action, as discussed in Reference 1, PSEG will review and enhance the procedures associated with the process controlling potential debris sources, or provide new additional controls, as necessary, to ensure that the analyses that support ECCS and CSS recirculation functions remain valid.

It is concluded that the risk impacts of delaying the insulation replacement of the steam generator, and the possible insulation replacement of the pressurizer and piping within the zone of influence, are very small.

Summary and Conclusion

In summary, a significant number of actions have been completed, or will be completed, prior to the December 31, 2007 compliance date:

- The maximum amount of strainer surface area will be installed for the containment configuration (5300 sq ft versus the existing 85 sq ft)
- The strainer mesh size will be reduced from 1/8 inch to 1/12 inch
- The Downstream Effects Analysis
- The Long Term Wear Analysis
- The Chemical Analysis
  - Salem Units do not contain Trisodium Phosphate
  - Calcium silicate insulation within ZOI will be replaced in 2006.
- The Debris Generation Evaluation
- The Debris Transport Evaluation
- The Head Loss / Pump NPSH Analysis

In conclusion, based on (1) the completion of all GL 2004-02 design work in 2006 (well before the GL 2004-02 compliance date), (2) the completed installation of the re-designed strainers in 2006, (3) the fiber bypass testing results that indicate no additional insulation will need to be replaced, (4) the negative consequences of replacing insulation as purely contingency actions, (5) the mitigating and completed actions that will be in place, and (6) the small increase in risk for the short extension period, PSEG requests the 2 month 12 day extension to GL 2004-02.

Should you have any questions regarding this request, please contact Mr. James Mallon at (610) 765-5507.

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

Executed on 6/7/06
(Date)

Sincerely,

Thomas P. Joyce
Site Vice President
Salem Generating Station

C: Mr. S. Collins, Administrator – Region I
U. S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. S. Bailey, Licensing Project Manager - Salem
U. S. Nuclear Regulatory Commission
Mail Stop 08B1
Washington, DC 20555

USNRC Senior Resident Inspector – Salem (X24)

Mr. K. Tosch, Manager IV
Bureau of Nuclear Engineering
PO Box 415
Trenton, New Jersey 0862