LR-N02-0108

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

RESPONSE TO NRC BULLETIN 2002-01,
REACTOR PRESSURE VESSEL HEAD DEGRADATION AND
REACTOR COOLANT PRESSURE BOUNDARY INTEGRITY
SALEM GENERATING STATION UNITS 1 AND 2
FACILITY OPERATING LICENSES NOS. DPR-70 AND DPR-75
DOCKET NOS. 50-272 AND 50-311

On March 18, 2002 the NRC issued Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity." This bulletin was issued to require pressurized-water reactor (PWR) addressees to submit:

1) Information related to the integrity of the reactor coolant pressure boundary including the reactor pressure vessel head and the extent to which inspections have been undertaken to satisfy applicable regulatory requirements, and

2) The basis for concluding that plants satisfy applicable regulatory requirements related to the structural integrity of the reactor coolant pressure boundary and future inspections will ensure continued compliance with applicable regulatory requirements.

The Bulletin requires this information be submitted in accordance with 10CFR 50.54(f), in order to determine whether any license should be modified, suspended, or revoked. This information is sought to verify licensee compliance with the current licensing basis.

The required 15-day response for Salem Generating Station Units 1 and 2 is included as Attachments 1, 2, and 3 to this letter. Commitments contained in this response include (1) a visual examination of all CRDM nozzles during the next refueling outages and (2) provide results of those examinations within 30 days after plant restart.

Based on the information provided in the attachments to this letter, we conclude that there is reasonable assurance that both Salem Units 1 and 2 are in compliance with applicable regulatory requirements and our current licensing basis.

Should you have any questions regarding this request, please contact Michael Mosier at (856) 339-5434.

Sincerely,

Mark B. Bezilla
Vice President Nuclear Technical Support

Attachment

C: Mr. H. J. Miller, Administrator - Region I
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I declare under penalty of perjury that the foregoing is true and correct.

Executed on _____ _____
Mark B. Bezilla
Vice President Nuclear Technical Support

1. Within 15 days of the date of this bulletin, all PWR addresses are required to provide the following:

REQUESTED INFORMATION:

A. A summary of the reactor pressure vessel head inspection and maintenance programs that have been implemented at your plant,

PSEG RESPONSE:

A summary of inspection and maintenance programs for the Salem Units 1 and 2 reactor pressure vessel (RPV) heads is as follows:

The inspection and maintenance programs at Salem Units 1 and 2 are comprised of the ASME Section XI examinations as shown in Attachments 2 and 3. Containment walkdown inspections are performed in accordance with S1.OP-PT.CAN-0001 (Q) and S2.OP-PT.CAN-0001 (Q) for Salem Units 1 and 2. The RPV head is part of the aforementioned "Containment Walkdown" procedures. PSEG Nuclear LLC (PSEG) has committed to perform "effective" visual examinations in accordance with Bulletin 2001-01. Preventive maintenance activities for previously installed Mechanical Seal Clamp Assemblies (MSCA) are planned for year 2003.

REQUESTED INFORMATION:

B. An evaluation of the ability of your inspection and maintenance programs to identify degradation of the reactor pressure vessel head including, thinning, pitting, or other forms of degradation such as the degradation of the reactor pressure vessel head observed at Davis-Besse,

PSEG RESPONSE:

Davis-Besse reported control rod drive mechanism (CRDM) nozzle cracking, which may have contributed to significant RPV head wastage. The root cause analysis at Davis-Besse has not been completed. Based on recent industry operational experience, Davis-Besse was classified as a high susceptibility plant and CRDM cracking from primary water stress corrosion cracking (PWSCC) was likely. EPRI report No. 1006284, titled "PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48), " dated August 2001 shows the ranking of the PWR fleet.

Salem Units 1 and 2, in accordance with the MRP – 48 susceptibility rankings are classed as greater than 5 effective full power years (EFPYs) to less than 30 EFPY plants. Specifically, Salem Unit 1 is 13.8 EFPYs and Salem Unit 2 is 17.4

EFPYs to the same parameters and conditions that resulted in the detection of PWSCC at Oconee 3 at the top of the RPV head. Oconee 3 is the basis for the MRP susceptibility ranking. The equivalent Oconee 3 parameters and conditions would not be reached for Salem Unit 1 until the year 2014 and similarly for Salem Unit 2 until the year 2017. Therefore, it is unlikely for PWSCC of the CRDM nozzles to be experienced at Salem Units 1 and 2 in the near term.

Although PWSCC due to CRDM nozzle cracking at the Salem units in the near term is unlikely, we recognize that there are other potential sources of boric acid leakage. Our boric acid inspections are standardized in procedures titled "Containment Walkdown" S1.OP-PT.CAN-0001 (Q) and S2.OP-PT.CAN-0001 (Q) for Salem Units 1 and 2. The RPV head is part of the aforementioned "Containment Walkdown" procedures.

During selected operating evolutions, containment walk downs are performed to detect RCS and other leaks. Specifically, during a refueling outage (RFO), walk downs are performed when the unit enters Mode 3 prior to cool down, at normal operating pressure (NOP) and normal operating temperature (NOT) and at the conclusion of the RFO prior to reactor startup. Should the unit be removed from service at some mid-cycle interval, again, containment walk downs are performed to detect leaks.

We are confident that we can identify degradation of the RPV head including, thinning, pitting, or other forms of degradation similar to Davis – Besse. In 1987 at Salem Unit 2 we identified nine areas of pitting as a result of the seal weld leakage reported in GL 88-05. The pits were from 1-3 inches in diameter and the deepest pits were 0.36-0.40 deep. The pitting was evaluated and did not exceed the minimum required vessel head thickness. PSEG Nuclear has physically inspected the Salem Unit 1 and 2 RPV heads performing inspections in accordance with ASME Section XI requirements and visually observing the condition of the RPV heads during the periodic inspections. The RPV heads at Salem Units 1 and 2 are examined as described in Attachments 2 and 3. If boric acid crystals were deposited on the RPV head, we are confident in our ability, based on our standardized procedures, to detect boric acid leakage.

REQUESTED INFORMATION:

C. A description of any conditions identified (chemical deposits, head degradation) through the inspection and maintenance programs described in 1.A that could have led to degradation and the corrective actions taken to address such conditions,

The RPV head at Salem Unit 1 was inspected during RFO 1R14 (April 2001). We reviewed Bulletin 2001-01 in August of 2001 and concluded that the Salem Unit 1 inspection was consistent with the Bulletin requirements to perform an "effective" visual examination. The Salem Unit 1 examination was performed on all 79 RPV head penetrations by a certified level II examiner qualified in VT, 1-3

examination methods. All required insulation was removed to allow a direct visual mirror aided examination, looking for any signs of boric acid crystals. The top of the RPV head inspection provided a reasonable confidence that PWSCC degradation would be identified prior to posing an undue risk. This visual examination was not compromised by the presence of insulation, existing deposits on the RPV head, or other factors that could interfere with the detection of leakage. The examination revealed no signs of boric acid on the Salem Unit 1 RPV head.

The Salem Unit 2 RPV head degradation in 1987 from leakage through three pinholes in the seal weld at the base of a thermocouple instrumentation threaded connection is highlighted in NRC Generic Letter 88-05 and is reported as an operational experience in the Electric Power Research Institute (EPRI) report No. 1000975, titled “Boric Acid Corrosion Guidebook, Revision 1: Managing Boric Acid Corrosion Issues at PWR Power Stations,” Dated November 2001.

Nine areas of pitting as a result of the seal weld leakage were identified. The pits were from 1-3 inches in diameter and the deepest pits were 0.36-0.40 deep. The pitting was evaluated and did not infringe upon the minimum required vessel head thickness.

Corrective action included removing boric acid crystal deposits from the RPV head and installing Mechanical Seal Clamp Assemblies (MSCA) on the affected leaking seal and three other CRDMs.

The MSCA were initially installed in 1988. In May 1993, the original MSCA assemblies were removed and replaced with four new MSCA. A recurring preventive maintenance task was initiated at that time to periodically verify that the clamp torque values are in accordance with installation requirements after 5 fuel cycles or 8 years, (whichever comes first).

PSEG correspondence with the NRC (Reference NLR N93076 dated June 15, 1993), committed to initially inspect at the 3rd refueling outage and if found satisfactory, to relax the inspection frequency based on the vendor inspection recommendations.

This preventive maintenance program was implemented and determined to be acceptable by the NRC. The next scheduled verification is scheduled for the Fall of 2003 during RFO 2R13.

Salem Unit 2, in accordance with the requirements of ASME Section XI IWB-2500-1, Category B-A, has performed several examinations of the meridional welds and dollar weld during 1990, 1991, 1994 and 1999 (all on top of the head). There has been no visual indication or observation of boric acid crystals or other

evidence of boric acid leakage during the performance of these ASME Section XI examinations.

Based on the inspections to date, the installation of the MSCA clamps remains effective as a barrier to boric acid leakage.

REQUESTED INFORMATION:

D. Your schedule, plans, and basis for future inspections of the reactor pressure vessel head and penetration nozzles. This should include the inspection method(s), scope, frequency, qualification requirements, and acceptance criteria, and

PSEG RESPONSE:

For Salem Units 1 and 2, which are considered to have a moderate susceptibility to PWSCC based upon a susceptibility ranking of more than 5 EFPY but less than 30 EFPY from the ONS3 condition, an "effective" visual examination will be performed during the spring 2002 (Salem Unit 2 RFO 2R12) and fall 2002 (Salem Unit 1 RFO 1R15) respective refueling outages. A certified examiner will perform this visual examination. All CRDM nozzles will be examined with the capability of detecting and discriminating small amounts of boric acid deposits from CRDM nozzle leaks, such as were identified at ONS2 and ONS3. They provide a reasonable confidence that PWSCC degradation would be identified prior to posing an undue risk. These visual examinations of Salem Units 1 and 2 RPV heads are not expected to be compromised by the presence of insulation, existing deposits on the RPV head, or other factors that could interfere with the detection of leakage.

If boric acid deposits are detected based on the top-of-reactor head visual examination and the root source of the boric acid deposits are determined to be emanating at the CRDM nozzle welds under the reactor head; PSEG Nuclear, using available technology, will characterize the degradation. The balance of the CRDM nozzle welds under the head will be inspected. Based on extent of the condition, repairs will be initiated.

Salem Units 1 and 2, in accordance with the MRP – 48 susceptibility ranking are classed as a greater than 5 effective full power years (EFPYs) to less than 30 EFPY plants. Specifically, Salem Unit 1 is 13.8 EFPYs and Salem Unit 2 is 17.4 EFPYs to the same parameters and conditions that resulted in the detection of PWSCC at Oconee 3 at the top of the RPV head. Oconee 3 is the basis for the MRP susceptibility ranking. The equivalent Oconee 3 parameters and conditions would not be reached for Salem Unit 1 until the year 2014 and similarly for Salem

Unit 2 until the year 2017. Therefore, it is unlikely for PWSCC of the CRDM nozzles to be experienced at Salem Units 1 and 2 in the near term.

Future RPV head examinations are planned in accordance with ASME Section XI as shown in Attachments 2 and 3.

PWSCC cracking of CRDM nozzles is unlikely to occur at Salem Units 1 and 2 in the near term. This is based on the lower susceptibility ranking for Salem Unit 1 and 2 when compared to Oconee 3. Therefore, RPV head leakage is unlikely to occur for Salem Unit 1 prior to October 2002 and similarly for Salem Unit 2 prior to April 2002. Based on the susceptibility ranking for the Salem Units 1 and 2 at this time, industry experience with CRDM nozzle cracking and the prior "effective" visual examination for Salem 1 in April of 2001, we have reached the conclusion that Salem Units 1 and 2 are safe to operate.

REQUESTED INFORMATION:

E. Your conclusion regarding whether there is reasonable assurance that regulatory requirements are currently being met. This discussion should also explain your basis for concluding that the inspections discussed in response to Item 1.D will provide reasonable assurance that these regulatory requirements will continue to be met.

PSEG RESPONSE:

The technical basis for concluding that regulatory bases are met for Salem Units 1 and 2 is provided in MRP-48 (reference 1).

If boric acid deposits are detected based on the top-of reactor head visual examination and the root source of the boric acid deposits are determined to be emanating at the CRDM nozzle and/or "J" groove welds under the reactor head, PSEG [using available technology] will characterize the degradation including examination for RPV head wastage. The balance of the CRDM nozzles under the head will be inspected. Based on extent of condition, repairs would be initiated.

Other potential sources of boric acid leakage such as a canopy seal weld failure will also be evaluated in accordance with our corrective action program and resolved accordingly.

Based on the information provided in this letter, we conclude that there is reasonable assurance that both Salem Units 1 and 2 are in compliance with applicable regulatory requirements and our current licensing basis.

References:

1. NEI letter from Mr. Alexander Marion to Dr. Brian Sheron, dated August 21, 2001, subject: “EPRI Report TP-1006284, “PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48).”

Attachment 2
Salem Unit 1 Reactor Pressure Vessel Closure Head Exam History
ASME Section XI Category IWB Examinations

1st Ten-Year ISI Interval (Complete)	2nd Ten-Year ISI Interval (Complete)	3rd Ten-Year ISI Interval (Future)
1R2- 1979-1980 Meridional Welds Head to Flange Weld (partial)* CRD Housings **1R3- 1982** Meridional Welds Head to Flange Weld (partial)* **1R5- 1984** Meridional Welds Head to Flange Weld (partial)*	**1R7- 1987-1988** CRD Housings (partial)* **1R8- 1989** Meridional Welds Head to Flange Weld (partial) CRD Housings (partial)* **1R11- 1993** CRD Housings (partial)* **1R14- 2001 – "Effective" Visual of Head** Dollar Plate Weld Meridional Welds VT2 Penetration Welds	**1R18- 2007** Head to Flange Weld (partial)* **1R19- 2008** Head to Flange Weld (partial) CRD Housings (partial)* **1R21- 2010** Head to Flange Weld (partial)* **1R21- 2011** Meridional Welds Dollar Plate Weld
In summary, the above historical and planned periodic and repetitive inspections provide PSEG Nuclear with the confidence to detect boric acid leakage on the RPV head.		
* NOTE: The term 'partial' refers to meeting an acceptable portion of total code required exams.		

Attachment 3
Salem Unit 2 Reactor Pressure Vessel Closure Head Exam History
ASME Section XI Category IWB Examinations

1st Ten-Year ISI Interval (Complete)	2nd Ten-Year ISI Interval (Partially Complete)	3rd Ten-Year ISI Interval (Future)
2R1- 1983 Dollar Plate Weld Meridional Welds Head to Flange Weld (partial) CRD housings (partial) **2R4- 1988** CRD housings (partial) Econo Seals Meridional Welds (Partial) Head to Flange Weld (partial) **2R6- 1991-1992** Dollar Plate Weld	**2R8- 1994-1995** Meridional Welds Dollar Plate Weld CRD Housing Welds (partial) **2R10- 1999** Flange to Head (Partial) **2R12- 2002 (pending "Effective" Visual Examination, April 2002)** Head to Flange Weld (partial) VT2 Penetration Welds	**2R15- 2006** Meridional Welds Dollar Plate Weld CRD housings (partial)
In summary, the above historical and planned periodic and repetitive inspections provide PSEG Nuclear with the confidence to detect boric acid leakage on the RPV head.		
* NOTE: The term 'partial' refers to meeting an acceptable portion of total code required exams.		