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

June 5, 2013

Mr. Thomas Joyce
President and Chief Nuclear Officer
PSEG Nuclear LLC
P.O. Box 236, N09
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2 – REQUEST FOR ADDITIONAL INFORMATION RE: RELIEF REQUEST SC-I4R-133 (TAC NOS. MF1375 AND MF1376)

Dear Mr. Joyce:

By letter dated April 3, 2013,[1] PSEG Nuclear, LLC (the licensee) requested the Nuclear Regulatory Commission's (NRC's) approval of proposed relief request SC-14R-133 for Salem Nuclear Generating Station, Units 1 and 2 (Salem). The proposed relief will allow Salem to repair bell-and-spigot joints in the buried portions of Service Water System piping in lieu of defect removal requirements in the ASME Code, Section XI, IWA-4422.1. The NRC staff has reviewed the request submitted by the licensee and has determined that additional information is required, as provided in the enclosure, in order to complete its review.

The draft questions were sent to Ms. Emily Bauer of your staff, to ensure that the questions were understandable, the regulatory basis for the questions was clear, and to determine if the information was previously docketed. On June 4, 2013, Ms. Bauer indicated that the licensee will submit a response by August 16, 2013.

If you have any questions, please contact me at (301) 415-3204 or via e-mail at John.Hughey@nrc.gov.

Sincerely,

Jeffrey A. Whited
for John D. Hughey, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

Enclosure:
Request for Additional Information

cc: Distribution via ListServ

[1] Agencywide Documents and Access Management System (ADAMS) Accession No. ML13093A382.

REQUEST FOR ADDITIONAL INFORMATION

OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST SC-14R-133

ALTERNATIVE REPAIR FOR SERVICE WATER SYSTEM PIPING

SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2

PSEG NUCLEAR LLC

DOCKET NOS. 50-272 AND 50-311

By letter dated April 3, 2013,[1] PSEG Nuclear, LLC (the licensee) requested the Nuclear Regulatory Commission's (NRC's) approval of proposed relief request SC-14R-133 for Salem Nuclear Generating Station, Units 1 and 2 (Salem). The proposed relief will allow Salem to repair bell-and-spigot joints in the buried portions of Service Water System piping in lieu of defect removal requirements in the ASME Code, Section XI, IWA-4422.1. To complete its review, the NRC staff requests the following additional information.

Design

RAI 1 Provide legible design drawings that show plant-specific dimensions of the items (components) of the bell-and-spigot joint before and after the repair using the WEKO seal. If available, provide 3-dimensional perspective drawings to help the NRC staff to visualize the joint configuration. The drawing should also include the harness assembly.

RAI 2 Provide a detailed drawing of the square head set screws (bolts) and the spigot gasket (not a part of the WEKO seal) showing how the bell and spigot are connected to each other. These drawings will help the NRC staff understand how the pipe loading is distributed and evaluate any potential leak path through the joint.

RAI 3 Figures 1 and 2 show a spigot gasket that is located near the set screws and a fillet weld connecting the bell to the steel cylinder.

a. Discuss the gasket material and its potential degradation mechanism.
b. Discuss whether the spigot gasket will be replaced when the bell thickness is reduced due to corrosion because the ground water may leak into the pipe through the gap that may be created between the gasket and the reduced bell thickness.

[1] Agencywide Documents and Access Management System (ADAMS) Accession No. ML13093A382.

Enclosure

c. Specify the size of the fillet weld.

RAI 4 The fillet weld is sandwiched and enclosed between the concrete and mortar coating.

a. Discuss whether the fillet weld has ever been examined. If not, discuss how the fillet weld can be ensured to maintain its structural integrity to support the piping loads without nondestructive examinations.
b. What would the implications on structural integrity be if the fillet weld could not be relied upon?

RAI 5 Figures 1 and 2 identify an area in the joint as "Bell core hold–back shape assumed 1" offset." It appears that the 1-inch gap would form an enclosure once the WEKO seal is installed. The ground water may leak into the 1-inch gap space and eventually leak into the crevice between the stainless steel backing plate and the inside pipe wall. This may cause corrosion of the stainless steel backing plate underneath the rubber seal. The stainless steel is susceptible to stress-corrosion cracking in chlorine and high-stressed environment. Discuss whether the WEKO seal design has considered the potential for the ground water leaking into the pipe through the degraded joint and cause corrosion of the backing plate of the WEKO seal.

RAI 6 Section 4 states that the degradation of the joint is due to corrosion of the carbon steel bell and spigot components caused by exposure to either service water or ground water.

a. List specific joint items (e.g., set screws, wires, gasket, and steel cylinder) besides the bell and spigot that could be degraded and their potential degradation mechanism.
b. Provide the average and maximum corrosion rate of the bell-and-spigot joint based on operating experience in the nuclear and non-nuclear industry in the similar operating conditions.

RAI 7 Section 5.2 states that joints with bell wall thickness less than 0.1 inches are required to be repaired and that if the bell thickness is between 0.042 inches and 0.1 inches, a WEKO seal with backing plate will be used to perform the repair, although inspection of the harness assembly for axial capacity is not required. Section 5.2 further states that if the bell thickness is below 0.042 inches, the WEKO seal with backing plate will be installed and the harness assembly is required to be inspected.

a. Justify why the harness assembly does not need to be inspected for axial capacity if the bell thickness is between 0.042 inches and 0.1 inches. The NRC staff finds that when the bell thickness is degraded, the harness assembly needs to be ensured to carry the axial pipe load to maintain a defense-in-depth protection.
b. Justify why the WEKO seal can be used to repair the joint when the bell thickness falls below 0.042 inches.

c. Discuss the bell thickness beyond which the WEKO seal cannot be used to repair a degraded joint.
d. Discuss how the bell thickness is measured during an inspection.
e. Discuss the design and nominal thickness of the bell and spigot.
f. Discuss whether the above acceptance criterion (0.1 and 0.042 inches) also applies to the spigot wall thickness. That is, if the spigot thickness is reduced to the acceptance limit (even if the bell thickness is not reduced to the acceptance limit), is the joint required to be repaired?
g. If the bell or spigot thickness is reduced, discuss whether the bell bolts (set screws) need to be re-torqued to reduce the gap between the bell and spigot.
h. Discuss whether the proposed WEKO seal can only be applied at the bell-and-spigot joint of the pre-stressed concrete cylinder pipe (PCCP) and not on any other area or region of the PCCP.

RAI 8 The WEKO seal is attached to the inside surface of the pipe by the retaining bands which may degrade and lose their strength overtime. As a consequence, the retaining bands, the rubber gasket and backing plate may fall from the pipe inside wall into the flow stream.

a. Discuss the safety consequences of the loose WEKO seal parts in the flow stream that may either block the water flow or damage downstream equipment or components.
b. Identify the potential safety-related systems and non-safety-related systems that support the safety-related systems downstream of the service water piping that may be affected by the loose seal parts.
c. Discuss how the operator can determine if the service water flow has been changed as a result of loose WEKO seal parts falling in the flow stream.

RAI 9 Figure 1 identifies an item as "Cylinder to spigot connection Unknown, assumed butt welded." However, Section 5.1.1, page 3 states that the spigot is welded to the cylinder. Clarify how the steel cylinder is connected to the spigot.

Analysis

RAI 10 Provide NRC staff access to References 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10 and 7.11.

RAI 11 Section 5.3.2 states that *ethylene propylene diene monomer* (EPDM) rubber sheet is aging resistant.

a. Discuss how many years and under what pressure the EPDM rubber sheet is qualified (EPDM is qualified up to 200 degrees F).
b. Provide the design and normal operation temperature and pressure of the service water supply and discharge piping.

RAI 12 The relief request states that the harness assembly and the bell bolts will provide longitudinal strength (axial loading) for the joint. Identify which components of the joint support the hoop stresses (radial loadings).

RAI 13 Section 5.3.1 states that axial piping loads due to internal pressure or seismic are carried by the external harness assembly and that the bell bolts provide axial restraint in the event of a failure of the harness assembly. The NRC staff believes that in addition to the bolts that provide axial restraint, the bolt holes in the bell, and the spigot (i.e., the bell cross-sectional thickness in the vicinity of the bolt holes) also provide axial restraint. If there is degradation on these components, how is the degradation assessed to ensure structural integrity?

RAI 14 Section 5.3.1 states that the bell-and-spigot joints form the piping pressure boundary and are designed to provide 2 inches of axial deflection and one degree of articulation.

a. Discuss if a 2-inch axial deflection occurs (the NRC staff interprets this as a 2-inch axial separation at the joint), whether water in the pipe would leak into or out of the joint.
b. After the WEKO seal is placed in service, if the joint experiences 2 inches of axial deflection, discuss whether the WEKO seal will also be stretched for 2 inches along with the joint.
c. If the pipe contracts after the expansion, discuss whether the WEKO seal will also contract (i.e., would the WEKO seal move axially with the joint like an accordion?).
d. In this scenario, a gap may be created between the WEKO seal and the concrete inside surface as a result of the joint expansion and contraction. The ground water may leak into the pipe through the bell-and-spigot joint. Discuss the potential for this scenario and the associated consequences.

RAI 15 The last paragraph on page 10 states that WEKO seals have been installed as a preventive measure at all joints in the service water supply headers.

a. Identify what inspections of the bell-and-spigot joints were conducted at the time of installation and the results of the inspections.
b. Clarify whether the WEKO seals were credited as structural components for the joint or if they were preventive measures to reduce degradation of the bell-and-spigot joint.
c. Provide the year when the WEKO seals were installed and how many seals were installed.
d. Clarify whether the proposed alternative will be applied to the service water discharge piping only because the WEKO seals have already been installed at all bell-and-spigot joints in the service water supply headers.
e. For WEKO seals that have already been installed, will they be removed and the bell-and-spigot components inspected to the proposed standards in this relief request and then reinstalled? If not, what is the plan for inspection of the existing seals and bell-and-spigot components?

f. Have there been inspections of the WEKO seals subsequent to their installation? If so, provide the inspection criteria and the results of the inspections.

RAI 16 The fourth paragraph on page 10 states that the maximum shear stress in the push tab welds during installation is 66 percent of the allowable stress. Identify the push tab welds in the design drawings with respect to the WEKO seal assembly and provide a detailed sketch of the push tab itself.

RAI 17 The WEKO seal has 4 retaining bands to attach the rubber gasket seal to the inside surface of the pipe.

a. Provide the radial force that the retaining bands will exert to the inside surface of the pipe wall in order to attach the rubber gasket to the inside pipe wall.
b. The retaining bands will exert a tensile load on the inside surface of the pipe, which is covered with concrete. Tensile loading is not favorable for concrete as concrete cannot support tensile loads. The pre-stressed wires that wrap the steel cylinder provide compressive load on the concrete. Demonstrate by analysis that the compressive loading of the wires exceed the tensile loading of the retaining bands such that the concrete would not be negatively affected by the tensile loading of the retaining bands.

Installation

RAI 18 Describe the installation of the WEKO seal in detail.

RAI 19 Clarify whether a compound or coating is applied to the interface between the EPDM rubber gasket (edge) and the pipe inside surface to minimize leakage to the backing plate and through the seal assembly.

RAI 20 The ends of the EPDM gasket have grooves. Discuss the function of these grooves.

RAI 21 Clarify whether a sealant will be used between the backing plate and the pipe inside surface.

Examinations

RAI 22 Discuss the acceptance examination and associated acceptance criteria of the WEKO seal assembly.

a. That is, what and how to examine the installed WEKO seal for acceptance?
b. What are the criteria to accept or reject an installed WEKO seal for service?

RAI 23 Section 5.4 discusses post-installation pressure testing.

a. Provide the pressure that will be used in the pressure testing and the associated hold time.
b. Clarify whether a visual examination of the repaired joint will be performed as part of the pressure testing.
c. List the subarticle(s) of the ASME Code, Section XI, that the pressure testing will be performed in accordance with.

RAI 24 Section 5.4 states that periodic inspections of the degraded joint and the installed WEKO seal will be performed in conjunction with Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment".[2]

a. Clarify whether after installing the WEKO seal, the degraded portion of the buried pipe will be exposed (i.e., the excavation will not be backfilled) so that the repaired joint is accessible for periodic inspections for the remaining life of the repair.
b. Discuss the inspection techniques that will be used in the periodic inspections of the repaired joint and the WEKO seal, what items will be inspected, whether the inspection will be performed from the inside or outside surface of the pipe, and what are the acceptance criteria of the inspection.
c. Provide references for the acceptance criteria to disposition the inservice inspection results.
d. Discuss how often the repaired joint will be inspected as part of the GL 89-13 inspections.

RAI 25 The NRC staff finds that it is appropriate to inspect the harness assembly when the WEKO seals are installed, and periodically thereafter.

a. Provide the plans for future inspections of the harness assembly after the seals are installed.
b. Provide justification if this is not an examination requirement of the proposed alternative.

RAI 26 Section 5.4 states that the external harness assembly will also be periodically inspected in the area of the repaired joint, if credited for axial load carrying capability.

a. If degradation of the harness assembly exists, what are the criteria used to accept for further use?
b. Does this criterion take into account degradation that exists in the bell-and-spigot joint? If not, justify.

[2] ADAMS Accession No. ML031150348.

RAI 27 The NRC staff finds that if both the harness assembly and the joint are degraded, there is no defense-in-depth to maintain the structural integrity of the joint. As stated in the relief request, the WEKO seal does not carry pipe axial loads.

a. Discuss what instances the harness assembly is not credited for axial load carrying capability.
b. Justify why the WEKO seal can be used at a location when both the bell-and-spigot joint and harness assembly are degraded.

RAI 28 Section 5.4 states that VT-2 examination of the exposed portion of piping is to be performed any time external harness assembly inspections are performed.

a. Explain how often the harness assembly is inspected.
b. Discuss what the harness assembly inspection criteria and acceptance criteria are for the harness assembly inspection.

Regulatory Issues

RAI 29 The NRC staff understands that for Unit 2, the fourth 10-year inservice inspection (ISI) interval starts on November 27, 2013, and ends on November 27, 2023, as stated in the licensee's fourth 10-year ISI submittal dated June 7, 2012.[3] Provide the beginning and end dates for the fourth 10-year ISI interval for Unit 1.

RAI 30 Confirm that the proposed relief request will be effective starting the fourth 10-year ISI interval at both units.

[3] ADAMS Accession No. ML12159A084.

Mr. Thomas Joyce
President and Chief Nuclear Officer
PSEG Nuclear LLC
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John D. Hughey, Project Manager
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