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SOUTHERN COMPANY
Energy to Serve Your World SM

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NL-04-0924

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

Joseph M. Farley Nuclear Plant Units 1 and 2
Application for License Renewal – Errata and Responses to Follow-up Questions

Ladies and Gentlemen:

This letter provides the following items related to the review of the Joseph M. Farley Nuclear Plant, Units 1 and 2, License Renewal Application:

1. Application errata, with draft requests for additional information (D-RAIs) referenced where applicable.

2. Responses to requests for follow-up information related to RAIs 3.3-6, 3.3-11, 3.3.2.1.15-2, and 3.4-3.

3. Revised response to RAI 3.3-16.

(Affirmation and signature are on the following page.)

A099

Mr. L. M. Stinson states he is a vice president of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

If you have any questions, please contact Charles Pierce at 205-992-7872.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

L. M. Stinson

Sworn to and subscribed before me this 28 *day of* May*, 2004.*

Valerie A. O'Brien
Notary Public

My commission expires: 4/28/07

LMS/JAM/slb

Enclosures:
1. Joseph M. Farley Nuclear Plant, Units 1 and 2 Application for License Renewal – Errata
2. Joseph M. Farley Nuclear Plant, Units 1 and 2 Application for License Renewal – Responses to RAI Follow-up Questions
3. Joseph M. Farley Nuclear Plant, Units 1 and 2 Application for License Renewal – Revised response to RAI 3.3-16

cc: <u>Southern Nuclear Operating Company</u>
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<u>U. S. Nuclear Regulatory Commission</u>
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<u>Alabama Department of Public Health</u>
Dr. D. E. Williamson, State Health Officer

ENCLOSURE 1

Joseph M. Farley Nuclear Plant Units 1 and 2

Application for License Renewal

ERRATA

Application Errata

1. LRA page 2.3-31: In Table 2.3.3.7, the entry "Air Dryer" should be "Air Dryers." All of the air dryers shown in scope on the compressed air system license renewal boundary drawings are subject to an AMR.

   Reference: D-RAI 2.3.3.7-2c

2. LRA Page 3.2-18: In Table 3.2.2-2, the grid line for "Valve Bodies" in an Inside environment with Aging Effects Requiring Management column entry "None" inadvertently extends into the Material column, causing the appearance that the items in the last two rows on this page are of a different material. This is not the case. This grid line is a typographical error. The material is Stainless Steel for both the Air/Gas and Dried Gas environment and the Inside environment.

   Reference: D-RAI 3.2-1

3. LRA Page 3.3-27: In LRA Section 3.3.2.2.2, first paragraph, "The External Surfaces Monitoring Program (Appendix B.5.3)" should have read "The One-Time Inspection Program (Appendix B.5.5)" for aging management of elastomer seals and collars in ventilation systems.

   However, in a supplemental response to RAI 3.3-6 (see Enclosure 2 of this letter), the SNC aging management strategy is revised to credit the External Surfaces Monitoring Program to periodically inspect these elastomer seals and collars in ventilation systems in lieu of a one-time inspection.

   Reference: D-RAI 3.3-1 and supplemental response to RAI 3.3-6

4. LRA pages 3.3-111 and -112: For the component types "Fuel Oil Storage Tanks" and "EDG Day Tanks" in Table 3.3.2-14, the One-Time Inspection Program (in addition to the Fuel Oil Chemistry Program) should be listed in the Aging Management Programs column for the fuel oil environment only. The other table entries for the fuel oil environment remain unchanged.

   Reference: Consistent With GALL Audit Comment.

5. LRA page 3.3-151: The first sentence of Plant Specific Note 18 should be deleted.

   Reference: Consistent With GALL Audit Comment.

6. LRA page 3.5-21: In the "Discussion" column of Table 3.5.1, Item 3.5.1-11, Containment Tendon Prestress TLAA, "Section 4.3.3" should be "Section 4.3.4."

   Reference: D-RAI 3.5-3

7. LRA page 3.5-35: For the carbon steel component type "Internal Structure: Steel Liners" in an inside environment, the Structural Monitoring Program should be added to the Aging Management Programs column for managing loss of material (associated with NUREG-1801 Volume 2 Item III.A4.2-a). Plant-specific note 46 should be associated with NUREG-1801 Volume 2 Item III.B1.1.1-b in lieu of Item III.A4.2-a.

   Reference: Consistent With GALL Audit Comment.

8. LRA page 3.6-9: In Table 3.6.2-1, for the component type "Electrical Connectors not subject to 10 CFR 50.49 EQ requirements that are subject to borated water leakage," Note "I" should be listed in lieu of Note "A". The other table entries remain unchanged.

9. LRA page 4.1-3: In Table 4.1.2 for the "Low-temperature overpressure protection (LTOP) analyses" TLAA, the LRA section cross-reference "4.2.3" should be "4.5.3."

10. LRA page A-4 (Section A.2.6) and page B-23 (Section 3.6.1): The manipulator crane should be added to the scope statement for the Overhead and Refueling Crane Inspection Program. The manipulator crane is in the scope of the Overhead Heavy and Refueling Load Handling System as described on sheet 2.3-23 of the LRA and in the SNC response to RAI 2.3.3.4-1.

    Reference: SNC response to RAI 2.3.3.4-1 (SNC letter NL-04-0473 dated April 7, 2004).

ENCLOSURE 2

Joseph M. Farley Nuclear Plant Units 1 and 2

Application for License Renewal

Responses to April 21, 2004 and April 26, 2004 Telephone Conferences Requests for Revised or Supplemental Information

RAI 3.3-6

RAI 3.3-11

RAI 3.3.2.1.15-2

RAI 3.4-3

RAI 3.3-6 (Revised Response)

In several systems (including the control room area ventilation system, the auxiliary and radwaste area ventilation system, and the liquid waste and drains system), the applicant credited the One-Time Inspection Program for managing the aging effects of loss of materials, change in material property, and cracking for elastomers components. However, the One-Time Inspection Program is intended for use as a verification AMP to check the degree of aging of components when significant aging is not expected, while periodic inspections are more appropriate if aging effects can reasonably be expected to occur. The degradation of elastomers depends upon the service loads and environmental conditions, including temperature, radiation level, and presence of aggressive chemicals. The applicant is requested to provide additional information on the service loads and environment of the components to justify the use of One-Time Inspection Program for managing the aging effects of elastomers.

Response:

(This revised response is in reference to the telephone conference of April 26, 2004 between SNC and the NRC staff and supersedes SNC's response in letter NL-04-0473 dated April 7, 2004.)

Background on Environmental Considerations for Elastomers

EPRI Technical Report TR-1002950, "Aging Effects for Structures and Structural Components (Structural Tools), Revision 1", indicates that elastomers are potentially subject to thermal degradation. Thermal degradation results in changes in the elastomer properties and potentially cracking. The EPRI Structural Tools reports continuous temperature ratings for the evaluated elastomers ranging from 130 °F for natural rubber to 275 °F for silicone rubber. The EPRI Structural Tools state that in general, if the ambient temperature is less than 95 °F, then thermal aging is not significant for the period of extended operation. This is a conservative threshold temperature intended to encompass all elastomer materials. When the specific elastomer material type is considered, installation in thermal environments marginally above 95 °F may also not be susceptible to significant thermal degradation.

The EPRI Structural Tools indicate that degradation of natural rubbers can occur through simultaneous exposure to ultraviolet radiation and oxygen, which supports an ozone – rubber reaction that embrittles the rubber and can result in cracking or checking. Sources of ultraviolet radiation include both sunlight and ultraviolet or fluorescent lamps. Areas exposed to direct sunlight are expected to have the highest potential for degradation due to ultraviolet radiation / ozone exposure since this environment best supports both the formation of ozone and the reaction between ozone and natural rubbers. The EPRI Structural Tools indicate that nitrile rubber, butyl rubber, silicone rubber, and neoprene either have good resistance to ultraviolet / ozone degradation or are essentially unaffected by ultraviolet radiation / ozone.

The EPRI Structural Tools indicate that ionizing radiation can significantly alter the molecular structure and material properties of elastomers. Radiation levels exceeding 10^6 Rads is the lowest reported threshold for irradiation effects in an elastomer of the types in scope for license renewal. Conservatively, radiation embrittlement is postulated for elastomers in locations above this threshold. A cumulative dose of 1×10^6 Rads over sixty (60) years would require a continuous hourly dose rate of 1.9 Rads/hour, or 1900 mRad/hour.

Attack by chemical species is also a potential degradation mechanism. Experience has shown that rubbers can be embrittled by exposure to certain chemicals present in nuclear power plants. Table 28-27 of Perry's Chemical Engineer's Handbook notes that most all natural and synthetic rubbers offer poor resistance to oils and fuel products. Resistance to water and acids is noted to be fair to good for some rubbers and excellent for others, with resistance to acid attack generally the limiting factor.

<u>Discussion of FNP Environments for Elastomers in Scope of One-Time Inspection Program</u>:

Control Room Area Ventilation System: Elastomer components in the Control Room Area Ventilation System are located inside the Non-Rad portion of the Auxiliary Building. These components are protected from environmental effects, have no radiation loading, are not subject to attack by aggressive chemicals, and operate at temperatures below which thermal degradation is a significant concern.

Auxiliary & Radwaste Area Ventilation System: The in-scope elastomer components in the Auxiliary & Radwaste Area Ventilation System are divided between two locations (Rad-portion and non-Rad portion of the Auxiliary Building). Flexible connectors for the battery room exhaust fans are located inside the Non-Rad portion of the Auxiliary Building. These components are protected from environmental effects, have no radiation loading, are not subject to attack by aggressive chemicals, and operate at temperatures below which thermal degradation is a significant concern. Flexible connectors for the penetration room filtration fans are located inside the Rad portion of the Auxiliary Building. These components are protected from environmental effects, are not subject to attack by aggressive chemicals, and operate at temperatures below which thermal degradation is a significant concern. These components are located in rooms designated as Radiation Zone III. The projected dose rate in a Radiation Zone III area is ≤ 15 mRem/hour.

Primary Containment Ventilation System: The in-scope elastomer components in the Primary Containment Ventilation System are divided between two locations. Flexible connectors for the containment purge fans are located inside the Rad portion of the Auxiliary Building. These components are protected from environmental effects, are not subject to attack by aggressive chemicals, and operate at temperatures below which thermal degradation is a significant concern. These components are located in rooms designated as Radiation Zones III and V. The projected dose rate in a Radiation Zone III area is ≤ 15 mRem/hour. The projected dose rate in a Radiation Zone V area is > 100 mRem/hour. Recent survey data in the Zone V rooms shows maximum general area dose rates in the area of the in-scope components of 15 mRem/hr (Unit 1) and 14 mRem/hr (Unit 2), with both Units operating at 100% power. Flexible connectors for the containment coolers are located inside the Containment Building. These components are replaced periodically as a preventive maintenance task. These components are therefore short-lived and not subject to an aging management review.

Liquid Waste & Drains System: The Elastomer components in the Liquid Waste & Drains System are expandable plugs used to plug the penetration room floor drains. Plugging of the floor drains is necessary to provide a pressure boundary for the Penetration Room Filtration System. These floor drain plugs are located inside the Rad portion of the Auxiliary Building. These components are protected from environmental effects and operate at temperatures below which thermal degradation is a significant concern. These components are located in rooms designated as Radiation Zone V or less. The projected dose rate in a Radiation Zone V area is > 100 mRem/hour. Actual dose rates are typically significantly less than 100 mRem/hr as shown in the previous example. In addition, the concrete of the floor shields the drain plugs from many sources. The floor drain plugs are installed in drains which would collect leakage, spills, etc. Exposure to aggressive chemicals is considered unlikely because the systems in these areas do not contain such chemicals. Piping containing a mild boric acid solution is the only significant source of chemical contamination, and leakage from these systems is aggressively controlled. Although unlikely, exposure to aggressive chemicals was considered as having the potential to accelerate aging of these plugs.

Conclusion:

While significant aging of elastomer components is not expected due to their installation in locations which provide minimal exposure to potential aging mechanisms, SNC will include the flexible connectors and floor drain plug elastomer components in the scope of the External Surfaces Monitoring Program (in lieu of the One-Time Inspection Program). Inclusion in the External Surfaces Monitoring Program will provide for periodic inspection of the elastomer components and will ensure their continued ability to perform their intended functions.

RAI 3.3-11 – Supplemental Response

The staff reviewed the response of the applicant to RAI 3.3-11 (provided in SNC letter NL-04-0473 dated April 7, 2004). In order to complete their review, the staff requested the following clarifications:

- For the Control Room Air Conditioning Cooling Coil Units the applicant stated that the raw water environment for these units is moisture/condensation that may form on the units. Clarify whether the raw water from moisture/condensation would provide a periodic/intermittent drying/wetting environment. If so justify the use of One-Time Inspection as an aging management program.

- For the Drain Piping and Valves In The Liquid Waste and Drains System, the applicant stated that the drain piping and valves in the liquid waste and drains system (and exposed to raw water) operate at low pressure and temperature and are used on an intermittent basis. Clarify whether the "unmonitored and uncontrolled water" source on an intermittent basis as stated by the applicant would provide a periodic/intermittent drying/wetting environment. If so justify the use of One-Time Inspection as an aging management program.

Response:

Control Room Air Conditioning (A/C) Cooling Coil Units (including the drain and loop seal piping):

The control room air conditioning cooling coil units operate year round with moisture/ condensation on the cooling coils expected throughout most of the year due to the normally warm and humid outdoor environment. "Drying" of the cooling coils occurs when the supply air's dew point is below the coil temperature (typically during colder weather), and also occurs when swapping over to a different cooling unit. As a result, normal operation results in infrequent wet/dry cycling of the cooling coils and associated drain and loop seal piping. The loop seal feature further limits the wet/dry cycling frequency for the in-scope piping.

The exposed surfaces of the cooling coil frames are galvanized carbon steel, while the drain and loop seal piping is plain carbon steel. Since wet/dry cycling is infrequent, loss of material degradation is expected to progress slowly. Cooling coils of similar design (copper alloy tubes with aluminum fins and galvanized steel framing) have proven reliable in air conditioning applications. The drain and loop seal piping is a 1-1/2", Schedule 40 design. Since the gravity drain lines operate at atmospheric pressure, significant corrosion allowance is available. A review of the FNP operating experience did not identify any history of corrosion related failure (i.e., loss of material) for the control room A/C cooling coils or other similar units, or the drain and loop seal piping.

The control room A/C cooling coil units at FNP were replaced (circa 1997) as part of an overall upgrade/modification of the Control Room Air Conditioning system. The upgrade/modification replaced the original water-cooled control room A/C units with air-cooled A/C units, and included independent refrigeration systems including cooling coils.

Based on the FNP and industry operating experience to-date, the recent replacement of the cooling coils, and the low frequency of wet/dry cycling, the One-Time Inspection

Program is justified as the aging management program for the control room A/C cooling coils. The one-time inspection will be performed to confirm loss of material degradation of the control room A/C cooling coil units is progressing slowly and will not threaten its integrity during the extended period of operation. The One-Time Inspection Program will be used to predict the potential for through-wall leakage occurring in the drain and loop seal piping during the period of extended operation. The inspections will determine if corrective actions such as future inspections or repair/replacement will be required.

Fouling was also identified as an aging effect requiring management. Fouling is not applicable to the license renewal component intended function of "Pressure Boundary," and therefore should not have been listed.

Drain Piping and Valves In The Liquid Waste and Drains System:

As stated in our original response to RAI 3.3-11, the liquid waste and drains system operates at low pressures and temperatures (classified as a low energy system in the current licensing basis). The gravity drain lines operate at atmospheric pressure, and therefore a large corrosion allowance is available. Other in-scope portions are only above atmospheric pressure during sump or transfer pump operation.

Drain piping components in the liquid waste and drains system are typically "dry" with a low frequency of wet/dry cycling. These normally "dry" drains are infrequently exposed to "raw water" (characterized as "unmonitored and uncontrolled water") from draining equipment to support maintenance, and from other sources such as abnormal leakage (prior to corrective maintenance) that is being routed to the floor drain. A few drains receive "continuous" low volume drainage, such as condensate from air handling units, and therefore are typically "partially wetted" with a low frequency of wet/dry cycling. Small portions of the system are normally filled, such as pump discharge piping and the drain traps/loop seals.

For the stainless steel piping components exposed to "raw water," the One-Time Inspection Program will confirm loss of material is not occurring or is progressing very slowly so as not to affect the component intended function. The use of a one-time inspection as the aging management program (and not a periodic inspection program) is justified based on the inherent corrosion resistance of stainless steels and the supporting operating experience. Stainless steels have provided reliable service in the liquid waste and drains system and similar applications. The operating experience review (plant-specific and industry-wide) performed in support of the LRA did not identify age-related failures of stainless steels in similar service.

The FNP carbon steel piping components exposed to "raw water" are in-scope under the 10 CFR 54.4(a)(2) criterion of the License Renewal Rule. For the carbon steel piping components exposed to "raw water," pressure boundary loss of material is managed by a combination of the One-Time Inspection Program, the External Surfaces Monitoring Program and the Borated Water Leakage Assessment and Evaluation Program (where potentially exposed to borated water leakage). The One-Time Inspection Program will be used in areas where a potential spatial interaction exists between a leaking drain line and a safety-related SSC, such as where a drain line runs over sensitive components, to predict the potential for through-wall leakage occurring during the period of extended operation. The inspections will determine if corrective actions such as future inspections or repair/replacement will be required.

The use of a one-time inspection as the aging management program (and not a periodic inspection program) for the carbon steel piping components is justified based on targeting the locations where the potential interaction is with sensitive components, and having other programs in place that will detect leakage (and initiate corrective action) prior to a failure of the safety-related SSC. The aging management programs that monitor the exterior of the liquid waste and drain system carbon steel piping components, and the aging management programs designated in the LRA to monitor the exterior of the safety-related SSCs (e.g., the External Surfaces Monitoring Program, the Borated Water Leakage Assessment and Evaluation Program, and the Structural Monitoring Program), are reasonably assured to detect leakage prior to a failure of the safety-related SSC. The FNP operating experience confirms that leakage is readily identified and remedial action taken.

3.3.2.1.15 Emergency Diesel Generator System

RAI 3.3.2.1.15-2 (Revised Response):

In LRA Table 3.3.2-15 for emergency diesel generator system, for most copper alloy or stainless steel components exposed to an air/gas (wetted) environment, the LRA identifies loss of material as the applicable aging effect and credits the One-Time Inspection Program for aging management. However, for ducts and fittings in the intake/exhaust system, and the pipes and valve bodies in the air start system, the LRA also identifies cracking as an applicable aging effect, and credits the One-Time Inspection Program for aging management. The applicant is requested to explain the difference in aging effects for apparently similar material/environment combinations. If the cracking is due to cyclic loading of specific components, justify the use of the One-Time Inspection Program in lieu of periodic inspections, since such cracking may have a long incubation period.

Response:

(This revised response is in reference to the phone conference of April 26, 2004 between SNC and the NRC staff and supersedes SNC's response in letter NL-04-0473 dated April 7, 2004.)

The aging effect of cracking identified for the subject components is associated with the aging mechanism of stress corrosion cracking (SCC) and not due to cyclic loading. Fatigue of ASME non-Class 1 components is addressed separately as a TLAA in Section 4.3.3 of the LRA.

SNC utilizes a screening threshold temperature of 140 °F for assigning susceptibility to stress corrosion cracking (SCC) as an aging mechanism (and cracking as the resultant aging effect) for stainless steel. Stainless steels are susceptible to SCC in the presence of detrimental species (e.g., halogens). If oxygen is removed from the environment, cracking only occurs when concentrations of detrimental species are very high. In general, industry experience and laboratory test indicate that SCC rarely occurs in stainless steels below 140 °F unless the environment is harsh (e.g., significant contamination with halogens).

There is no threshold temperature associated with the susceptibility of copper alloys to SCC. Copper alloys (brasses) are susceptible to SCC from exposure to ammonia and ammonium compounds. Both oxygen and moisture are necessary for ammonia to be corrosive to copper alloys. Bronzes, with the exception of aluminum bronze, are considered immune to SCC. There is no threshold temperature associated with the susceptibility of copper alloys to SCC. However, lower contaminant levels are required to initiate SCC in environments with elevated temperatures.

Emergency Diesel Generator (EDG) Exhaust System

SCC was determined to be a potential aging mechanism/effect for stainless steels in the EDG exhaust system's air/gas (wetted) environment. The air/gas (wetted) environment includes elevated temperatures (above the 140 °F threshold temperature) during EDG operation produced by the high temperature exhaust gases. These exhaust gases include water vapor and various corrosive combustion products. SNC does not expect SCC to actually occur given the successful operating history of stainless steels in exhaust piping applications and the limited operating time for each standby diesel generator. SNC did not identify any industry or plant-specific operating experience indicative of SCC of stainless steels in a diesel exhaust environment. The EDGs operate in standby, with actual operating time comprised mainly from surveillance and post-maintenance tests. A conservative estimate of the actual operating time for each diesel generator is less than 5 to 10 percent of the time over the course of 60 years, or 3 to 6 years of actual run time.

Since operating experience and actual operating time for the EDGs indicate SCC in the stainless steel exhaust components is unlikely, the use of the One-Time Inspection Program is adequate to assure that cracking is not occurring.

EDG Intake System

SCC is not an applicable aging effect for the stainless steels in the EDG intake system's air/gas (wetted) environment. The EDG intake system operates at ambient temperatures and is not subject to elevated temperatures. Cracking should not have been indicated in LRA Table 3.3.2-15 for the stainless steel ducts and fittings in the EDG intake system.

EDG Air Start System

SCC was conservatively determined to be a potential aging mechanism/effect for stainless steels and copper alloys exposed to the air/gas (wetted) environment in portions of the EDG air start system. Only EDG 1-2A has a configuration where the air start system gas is potentially wetted. The air start subsystem for the 1-2A EDG does not include an after cooler/air dryer assembly. The air exiting the compressors is non-dried air at elevated temperatures (as a result of the compression) and will heat the downstream components. After the system pressure is achieved, the compressor stops, the components cool down, and moisture can condense within the components. Condensation/moisture is periodically drained from the system low points as part of normal operating practice.

In support of the LRA, SNC measured the frequency of operation and temperature rise in the 1-2A EDG air start system receiver charging piping. The air start system is operated intermittently during normal operation to maintain the pressure in the air receivers. The intermittent operation of the compressor occurs approximately six times a day, lasts only a few minutes, and raises the temperature just downstream of the compressor to as high as 215 °F, with the downstream temperature at the safety related receiver inlet isolation valve raised to as high as 128 °F. In both locations the temperature decreases quickly (the piping downstream of the compressor falls below 140 °F in a few minutes) and returns to the ambient room temperature in about one hour.

On occasions such as during maintenance outages, (estimated to be once each refueling outage, equivalent to 40 times over a 60 year life), a full recharge of the air receivers may be required. This process takes approximately one hour. The manufacturer of the compressor has stated that the discharge temperature of the air from the compressor could be as high as 615 °F during a full recharge of the air receivers. Again, the temperature decreases fairly quickly to room ambient temperatures once the charge is complete.

Since the temperature exceeded the screening threshold temperature of 140 °F, SCC was conservatively determined to be a potential aging mechanism/effect for the stainless steel components. However, from the operating experience, the air start system is above 140 °F for a very small fraction of the time. Coupled with the absence of any source of contaminants, SNC concludes that SCC of stainless steel in the EDG air start system is very unlikely based on the actual operating conditions for the EDG air start system.

The aging management review also conservatively determined SCC of the copper alloys in the EDG air start system downstream of the air receivers was a potential aging mechanism/effect. However, SNC concludes that SCC of copper alloys (brass) in the EDG air start system is very unlikely since there is no known source of ammonia or ammonium compound contaminants.

Since the operating conditions (based on operating experience) indicate SCC in the stainless steel and copper alloys in the EDG air start system is very unlikely, the use of the One-Time Inspection Program is adequate to assure that cracking is not occurring.

RAI 3.4-3 - Supplemental Response

RAI 3.4-3 requested SNC perform a one-time inspection to verify the effectiveness of the Water Chemistry Control Program at managing loss of material in the alloy steel steam/fluid traps in the steam and treated water environment, or provide justification for not performing a one-time inspection. In our response to RAI 3.4-3 in letter NL-04-0318 dated March 5, 2004, SNC provided justification to the staff for not performing a one-time inspection.

The staff reviewed SNC's response and in a subsequent telephone conference call on April 21, 2004, stated it was their position that a one-time inspection is necessary. Therefore, SNC will include the alloy steel steam/fluid traps in the steam and treated water environment in the scope of the One-Time Inspection Program.

ENCLOSURE 3

Joseph M. Farley Nuclear Plant Units 1 and 2

Application for License Renewal

Revised Response to RAI 3.3-16

RAI 3.3-16 (Revised Response):

The LRA does not identify cracking as an applicable AERM for bolting in auxiliary systems. LRA Table 3.3-1, item number 24, states that cracking is not applicable to bolting due to material selection and sound maintenance practices (control of torque, proper lubricants, and sealing compounds); however, the susceptibility to cracking is determined primarily by the bolting material and the operating temperature. In order to justify that cracking is not an applicable AERM, the applicant is requested to provide the reasons by identifying the bolting materials and the yield strength of the bolting procured for the auxiliary systems within the scope of license renewal, and the operating temperatures of the bolting. For high strength bolting (yield strength greater than 150 ksi), provide additional justification for the conclusion that cracking is not an applicable AERM, or provide an appropriate AMP to manage cracking.

Response:

(This response addresses additional bolting materials utilized in the auxiliary systems and supersedes SNC's response in letter NL-04-0473 dated April 7, 2004.)

Stainless steel, carbon steel, alloy steel and brass bolting materials used in FNP auxiliary systems within the scope of license renewal typically have low operating temperatures; however, some applications (e.g., portions of CVCS and Sampling System) can operate at temperatures as high as RCS temperatures.

The bolting materials used in the FNP auxiliary systems bolted connections are:

1. ASME SA-193 and ASTM A193 Grade B8 (Type 304) stainless steel bolts with a minimum specified yield strength of 30 ksi,
2. ASME SA-193 and ASTM A193 Grade B6 stainless steel bolts with a minimum specified yield strength of 85 ksi,
3. ASME SA-453 Grade 660 stainless steel bolts with a minimum specified yield strength of 85 ksi,
4. ASME SA-307 and ASTM A307 Grade B carbon steel bolts with a maximum specified tensile strength of 100 ksi and,
5. ASME SA-193 and ASTM A193 Grade B7 alloy steel bolts with specified minimum yield strengths up to 105 ksi;
6. ASTM B-16 brass studs.

ASME SA-193 and ASTM A193 Grade B8 stainless steel bolts are used in applications in the Open-Cycle Cooling Water System, Closed-Cycle Cooling Water System, Control Room Area Ventilation System, Primary Containment Ventilation System, Potable and Sanitary Water System, and Reactor Makeup Water Storage System. Due to the low operating temperatures in these systems, these bolts are exposed to operating temperatures well below the 140°F threshold above which stress corrosion cracking is a concern for stainless steels. These bolts are not high strength bolts.

ASME SA-193 and ASTM A193 Grade B6 stainless steel bolts are used in applications in the Reactor Makeup Water Storage System. Due to the low operating temperatures in this system, these bolts are exposed to operating temperatures well below the 140°F threshold above which stress corrosion cracking is a concern for stainless steels. These bolts are not high strength bolts.

ASME SA-453 Grade 660 stainless steel bolts are used in applications in the Reactor Makeup Water Storage System and Liquid Waste and Drains. Due to the low operating temperatures in these systems, these bolts are exposed to operating temperatures well below the 140°F threshold above which stress corrosion cracking is a concern for stainless steels. These bolts are not high strength bolts.

ASME SA-453 Grade 660 stainless steel bolts are also used in applications in the Chemical and Volume Control System. These bolts are not high strength bolts. Depending on the location of specific components, closure bolting in this system could be routinely exposed to temperatures greater than the 140°F threshold above which SCC is a concern for stainless steels. Austenitic stainless steels are susceptible to SCC when exposed to a corrosive environment containing aggressive chemical species and moisture, and the material temperature is greater than 140°F. At FNP, the concentration of contaminants in the inside and containment atmosphere environments is not significant due to the lack of sources of contaminants. The atmosphere is therefore extremely mild in terms of corrosion effects for stainless steels, even in areas of high humidity. Standard plant maintenance practices serve to minimize the introduction of contaminants (e.g., chemical product controls), cleanliness controls, and wetting of components (e.g., corrective maintenance to eliminate leaks). These factors serve to effectively control corrosive environments, eliminating SCC as an aging effect requiring management for stainless steel bolts in the Chemical and Volume Control System. Plant operating experience confirms that SCC of bolting is not occurring at FNP.

ASME SA-307 / ASTM A307 Grade B carbon steel bolts are not considered high strength bolting since the upper limit on tensile strength of 100 ksi assures that the maximum bolt yield strength will be less than 100 ksi. Based on this yield strength, these bolts are not susceptible to SCC in normal PWR environments. This conclusion is supported by both FNP and industry-wide operating experience.

ASME SA-193 / ASTM A193 Grade B7 bolts have a minimum specified yield strength of 105 ksi, which is well below the threshold value of 150 ksi. Bolting fabricated in accordance with SA-193 could reasonably be expected to have an actual yield strength less than 150 ksi. However, since no maximum yield strength is specified for this material, it cannot be assured that the actual yield strength will not exceed the 150 ksi limitation for SCC susceptibility set forth by the Staff. SNC considers several mitigating factors to exist which, when considered together indicate that SCC of ASME SA-193 / ASTM A193 Grade B7 bolts need not be considered an aging effect requiring management at FNP.

Although there have been isolated instances of SCC of bolting in the industry, these failures have been attributed primarily to high yield stress materials (including abnormally high yield stresses resulting from improper heat treatment), excessive bolt preload, and contaminants, such as the use of thread lubricants containing molybdenum sulfide (MoS_2). A review of industry failure databases and NRC generic communications supports the fact that a combination of material selection, control of contaminants, and proper maintenance and torquing procedures is effective in eliminating the potential for SCC of bolting materials. These practices are in place at FNP as discussed below.

1. Material Selection – EPRI NP-5769, "Degradation of Bolting in Nuclear Power Plants," April 1988 indicates that susceptibility to SCC is minimized

through selection of materials having specified minimum yield strengths less than 150 ksi. The auxiliary systems bolting materials meet this criteria. ASME SA-193 / ASTM A193 Grade B7 bolts have a minimum specified yield strength of 105 ksi, which is below the recommended value of 150 ksi.

2. Control of Contaminants – In general, environmental conditions that could lead to SCC of bolting are not expected to occur in non-Class 1 components. Most bolting at FNP is normally in a dry environment and coated with a lubricant. For bolting located outdoors, the atmosphere is mild in terms of corrosive contaminants (rural environment and remote from coastal regions). Rain tends to wash off contaminants instead of concentrating them. Within the industry, SCC failures of quenched and tempered alloy steel bolting, such as SA-193 Grade B7 bolts, have many times been associated with the use of lubricants that may decompose into SCC-inducing contaminants, most notably MoS_2. FNP has not used lubricants containing MoS_2 and procedural controls are in place at FNP to prevent the use of lubricants containing potentially detrimental species such as chlorides and sulfates.

3. Control of Bolt Preload – Excessive bolt stresses have resulted in SCC failures in the industry. Proper control of bolt preload through sound bolt torquing practices has been shown to prevent excessive preload and thereby minimize the potential for SCC failures. At FNP, procedural controls are in place to assure that proper bolt torquing practices are used.

ASME B-16 brass studs are used in the Control Room Area Ventilation System pressurization / filtration and recirculation / filtration units to attach the filter media to the mounting frames. These components are internal to the filtration units, so they are exposed to an "Inside" environment which is the same as the control room air. For these specific components, the atmosphere is air conditioned and filtered. ASME B-16 brass is >15% zinc. SCC of copper alloys is associated with exposure to ammonia and ammonium compounds. At the relatively low operating temperatures in the FNP Control Room Area Ventilation System, a high concentration of contaminants would be required to drive SCC as an aging mechanism. The "Inside" environment at FNP does not have levels of ammonia or ammonium compounds present sufficient to drive SCC.

The potential for SCC of bolting materials has been addressed at FNP in response to several industry communications including NRC IE Bulletin 82-02, INPO SOER 84-5, and EPRI guidance documents. For FNP, the bolting materials used, lubricant/ contaminant controls employed, and sound bolt torquing practices have been effective at eliminating this aging effect. A review of recent FNP operating history performed for development of the FNP LRA did not identify any instances of SCC in auxiliary systems bolting (which includes ASTM SA-193 / ASTM A193 Grade B7 fasteners). In addition, a review of recent NRC generic communications did not identify any recent bolting failures attributable to SCC.

Therefore, cracking due to SCC is not an aging effect requiring management for the stainless steel, carbon steel, alloy steel, and brass bolting materials used in FNP auxiliary systems.