March 28, 2003

Mr. Stephen A. Byrne
Senior Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, South Carolina 29065

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE V.C. SUMMER NUCLEAR STATION (VCSNS), LICENSE RENEWAL APPLICATION - SECTIONS 3.2, 3.3, 3.4, 3.5, 4.0 AND APPENDIX B.

Dear Mr. Byrne:

By letter dated August 6, 2002, South Carolina Electric & Gas Company (SCE&G) submitted, for the Nuclear Regulatory Commission's (NRC's) review, an application pursuant to 10 CFR Part 54 to renew the operating license for VCSNS. The NRC staff is reviewing the information in the license renewal application and has identified areas where additional information is needed to complete the review.

The enclosed requests for additional information (RAIs) are numbered to coincide with the numbering of the license renewal application. These RAIs concern Sections 3.2, 3.3, 3.4, 3.5, and 4.0 and related Appendix B sections.

The staff is willing to meet with SCE&G and to clarify the RAIs before SCE&G submits its responses. If you have any further questions, please contact me at 301-415-1025 or rca@nrc.gov.

Sincerely,

/***RA***/

Rajender Auluck, Senior Project Manager
License Renewal Section
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-395

Enclosure: As stated

cc w/enclosure: See next page

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Request for Additional Information

3.2 ENGINEERED SAFETY FEATURES SYSTEMS

RAI 3.2-1 In LRA Table 3.2-1, Item 3, the applicant stated that loss of material of the underside of the refueling water storage tank (RWST) is not an aging effect requiring management, as this stainless steel tank is not buried. It is not clear to the staff how the applicant arrived at such conclusion. The applicant is requested to discuss the potential corrosive environments that may surround the tank bottom, and justify the determination that there are no aging effects requiring management.

RAI 3.2-2 In LRA, Table 3.2-1, Item 4, the applicant stated that MIC has been determined not to be a valid aging mechanism for the material/environment combination represented by the containment isolation valves and associated piping. The applicant stated that this aging mechanism is not applicable since the four systems (AC, DN, LR, NG), which provide containment isolation, are not subject to wetting from raw water. The applicant is requested to provide the details of the physical environments that are associated with the containment isolation valves and associated piping, for each of the four systems, and justify that these components are not susceptible to loss of material due to MIC.

RAI 3.2-3 For the stainless steel components, in LRA Table 3.2-2, Item 1, the applicant stated that sheltered environments do not contain contaminants of sufficient concentration to cause aging effects require aging management. Provide the basis, for all the variety of potential sheltered environments in the ESF, that stainless steel components are not susceptible to any aging effects requiring management.

RAI 3.2-4 In LRA Table 3.2-1, Item 5, the applicant stated that, for the high-pressure safety injection pump mini-flow orifice, loss of material due to erosion is considered a design problem, and, therefore, does not have an identified aging management program. The applicant is requested to provide more information on this design problem, and the procedure, in place, to resolve the design problem.

RAI 3.2-5 For components serviced by closed-cycle cooling system, in LRA Table 3.2-1, Item 9, the applicant stated that the Chemistry Program (Appendix B.1.4) has proven effective in maintaining the system's chemistry and detecting abnormal conditions. The applicant also stated that a review of operating experience confirms the effectiveness of the Chemistry Program to manage aging effects when continued into the period of extended operation. The applicant, therefore, concluded that a verification program, such as a one-time inspection, is not warranted for the components in this component group. The staff believes that, although operating experience is a valuable indicator for a plant's fitness to continue its operation in the extended period, industry experience may not support using it as a substitute for a verification program, without adequate justification. The applicant is requested to justify that, under all circumstances, including the situation of susceptible locations in a system with potential slow and stagnant flow conditions, the Chemistry Program will be sufficient to manage the aging effects associated with the components.

RAI 3.2-6 In LRA Table B-1, the applicant stated that the Bolting Integrity Program of GALL (XI.M18) is not credited for aging management. In LRA Tables 2.3-8 through 2.3-17, the applicant did not list closure bolting as a separate component type requiring AMR review, for the engineered safety features systems. Also, in Table 3.2-1, Item 12, the applicant states that loss of mechanical closure integrity is not considered an aging effect requiring evaluation for non-Class 1 component bolted closures within the scope of license renewal at VCSNS. The applicant further stated that the bolting/fasteners within the scope of license renewal were not itemized as a separate non-Class 1 component/component type. Rather, bolting was treated as a "piece-part" (or sub-component/sub-part) of non-Class 1 components/component types. The staff requests:

a. Provide the basis for not considering loss of mechanical closure integrity an aging effect,
b. Discuss what aging effects/mechanisms have been identified for the closure bolting, even if it is treated as a sub-component, and
c. Considering that closure bolting and its associated component may differ in their materials, environmental exposures, and potential modes of failure, the applicant is requested to discuss how the plant-specific aging management program of closure bolting, when treated as a "piece-part" (or sub-component/sub-part) of non-Class 1 components/component types, is measured against the intent of XI.M18, "Bolting Integrity", of GALL. The applicant is requested to ensure that all the attributes of the plant-specific program meet the intent of the corresponding GALL Chapter XI program attributes.

3.3 AUXILIARY SYSTEMS

General RAIs

The following RAIs are applicable to several components in auxiliary systems and are, therefore, considered general RAIs for auxiliary systems.

RAI 3.3-1 Numerous tables included in the application list the component material and environment to which the component is exposed. However, the applicant did not provide a description of these environments in the LRA. It should be noted that the aging effect depends on the component material as well as the plant specific environment characteristic. A description of the specific information (such as ranges of temperature, humidity, and/or compositions etc.) related to the plant specific environment characteristic considered in the VCSNS LRA will provide the necessary environment information for the staff to perform its AMR of the components of the auxiliary systems as well as other systems in the VCSNS. The applicant is requested to provide a description of the environments included in the LRA.

RAI 3.3-2 This common RAI concerns aging mechanisms related to the aging effect of loss of materials in sheltered environment for carbon steel components in the auxiliary systems described below.

Gaseous Waste Processing System

In the table entitled “Virgil C. Summer Nuclear Station Database AMR Query”, the applicant stated that for carbon steel in a sheltered environment, the aging effect of loss of material is

due only to general corrosion. However, in the AMR Query Note A-WG-C, the applicant stated that microbiologically induced corrosion (MIC) is also an applicable aging effect for carbon steel in a sheltered environment. The applicant is requested to clarify this discrepancy. In addition, it should be noted that the GALL report identifies the additional aging mechanisms of pitting and crevice corrosion in moist air and the additional aging mechanism of MIC in warm, moist air. Provide justification as to why these aging mechanisms have not been addressed.

Instrument Air Supply System

In the Database Query Table of VCSNS LRA, no aging effect is identified for the carbon steel components exposed to sheltered environment. For carbon steel components exposed to external environments of moist air such as sheltered environment, the GALL report identified loss of material due to general, pitting, crevice corrosion and MIC as an aging effect. The applicant is requested to justify why loss of material due to general, pitting, crevice corrosion or MIC is not an applicable aging effect for the carbon steel components exposed to sheltered environment.

RAI 3.3-3

This common RAI concerns the susceptibility to aging effects for stainless steel components in ambient environment in the auxiliary systems described below.

Liquid Waste Processing System

Stainless steel components in ambient environment may be subject to loss of material aging effects due to pitting, crevice corrosion, and MIC. In the VCSNS AMR Database AMR Query Table, the applicant identified no aging effects for stainless steel piping/fitting and valve (body only) in reactor building and sheltered environments because of the presence of insignificant concentration of contaminants in these environments. Provide your basis for determining significant concentration of contaminants and the verification/inspection activities on susceptible locations to justify this basis.

Nuclear & Non-nuclear Plant Drains

Stainless steel components in ambient environment may be subject to loss of material aging effects due to pitting, crevice corrosion and MIC. In the VCSNS Database AMR Query table, the applicant identified no aging effects for stainless steel piping/fittings and valves (body only) in the reactor building or sheltered environments because of the presence of insignificant concentration of contaminants in these environments. Provide your basis for determining significant concentration of contaminants and the verification/inspection activities on susceptible locations to justify this basis.

Roof Drains System

Stainless steel components in ambient environment may be subject to aging effects of loss of material due to pitting, crevice corrosion and MIC. In the VCSNS Database AMR Query table, the applicant identified no aging effects for stainless steel pipe/fittings in the reactor building environment because of the presence of insignificant concentration of contaminants in this

environment. Provide your basis for determining significant concentration of contaminants and the verification/inspection activities on susceptible locations to justify this basis.

Station Service Air System

Stainless steel components in ambient environment may be subject to aging effect of loss of material due to pitting, crevice corrosion and MIC. In the VCSNS Database AMR Query table, the applicant identified no aging effects for stainless steel pipe and fittings, tube and tube fittings, and valves (body only) in the reactor building and sheltered environments because of the presence of insignificant concentration of contaminants in these environments. Provide your basis for determining significant concentration of contaminants and the verification/inspection activities on susceptible locations to justify this basis.

System-specific RAIs

3.3.2.4.1 Air Handling and Local Ventilation and Cooling System

RAI 3.3.2.4.1-1 The table entitled "Virgil C. Summer Nuclear Station Database AMR Query" indicates that galvanized steel ductwork in a 'yard' environment has no identified aging effects and does not require an aging management program. The staff finds that this conclusion may not be justified because of factors associated with corrosive agents in the local environment and rainfall. Provide justification for your conclusion that galvanized steel ductwork in a 'yard' environment has no identified aging effects.

RAI 3.3.2.4.1-2 The table entitled "Virgil C. Summer Nuclear Station Database AMR Query" states that carbon steel cooling coil headers in a treated water environment are subject to stress corrosion cracking (SCC). However, no aging management program has been provided to address this aging effect. Explain why no aging management program has been provided to address this aging effect.

3.3.2.4.3 Building Services System

RAI 3.3.2.4.3-1 In the LRA Table 3.3-2, Item 11, the applicant stated that no aging effect was identified for the stainless steel piping and fittings in the air-gas environment. However, in the AMR Query Notes "A-BS-c" the applicant stated "Loss of material due to corrosive impacts of alternate wetting and drying are aging effects for stainless steel exposed to a ventilation environment, and subject to alternate wetting and drying that may concentrate contaminates. A review of the Air-Gas System Screening Report [TR00160-006], Attachment I and associated references determined that there are stainless steel components within the license renewal evaluation boundaries of the BS system which are exposed to alternative wetting and drying in the ventilation environment. Therefore, loss of materials and cracking due to corrosive impacts of alternative wetting and drying are not aging effects requiring management of stainless steel components/component types of the BS system exposed to the ventilation environment." Clarify, with justification, the above quoted statements in LRA Table 3.3-2, Item 11 and the AMR Query Notes "A-BS-c".

3.3.2.4.4 Chilled Water System

RAI 3.3.2.4.4-1 LRA Table 3.3-2, Item 19 credits the Above Ground Tank Inspection program (B.2.1), and the Chemistry Program (B.1.4), for managing loss of material and cracking of the internal surfaces of the chilled water expansion tanks (XTK0174A/B) during the period of extended operation. The staff finds that this conclusion does not appear adequate to detect significant tank degradation in inaccessible locations such as tank bottom surfaces. Provide assurance that significant tank degradation in the inaccessible locations of these tanks such as tank bottom surfaces is adequately managed.

RAI 3.3.2.4.4-2 LRA Table 3.3-1, Item 5 credits the Inspections of Mechanical Components program (B.2.11) for managing loss of material of the external surfaces of the carbon steel chilled water expansion tanks (XTK0174A/B) during the period of extended operation. The staff finds that this conclusion does not appear adequate to detect significant tank degradation in inaccessible locations such as under insulation or external tank bottom surfaces. Provide assurance that significant tank degradation in the inaccessible locations of these tanks such as segments under insulation or external tank bottom surfaces are adequately managed.

RAI 3.3.2.4.4-3 The table entitled “Virgil C. Summer Nuclear Station Database AMR Query” states that carbon steel components such as pump casings, evaporator tubesheets and water boxes, valve bodies, pipe and fittings, and tanks in a treated water environment are subject to stress corrosion cracking (SCC). The staff finds that the Chemistry Program may not be adequate to manage this aging effect because it does not contain a one-time inspection of these components at susceptible locations that verifies the absence of cracking and the effectiveness of the Chemistry Program. Justify the absence of an inspection/verification activity for the Chemistry Program.

3.3.2.4.6 Component Cooling Water System

RAI 3.3.2.4.6-1 Selective leaching is known to affect copper-nickel in aqueous environments with nickel being the element removed. Preventive measure involves proper selection of alloy/environment combination. For Copper-nickel components in treated water environment the applicant stated in the table entitled ”Virgil C. Summer Nuclear Station Database AMR Query” that loss of material due to selective leaching was determined to not be an aging effect for VCSNS. Provide the basis for this conclusion, including specific information on materials composition and environmental conditions that enable the applicant to draw this conclusion.

RAI 3.3.2.4.6-2 For stainless steel component in reactor building environment the applicant stated that for VCSNS no aging effects were determined to require aging management during the period of extended operation. Provide the basis of this conclusion. In particular, in view of the operational experience described in IN 85-30: Microbiologically Induced Corrosion of Containment Service Water System, explain why MIC is not an applicable aging mechanism leading to loss of material as applicable aging effect in VCSNS reactor building environment. In addition, for stainless steel component in sheltered environment the applicant stated that for VCSNS no aging effects of loss of material due to pitting and crevice corrosion were determined to require aging management. Provide the basis for this conclusion.

RAI 3.3.2.4.6-3 The applicant identified galvanic corrosion as an applicable aging effect for carbon steel component in treated water environment and the Chemistry program as the

applicable AMP. It should be noted that the likely material/locations determining galvanic corrosion rates depend on which specific metal/alloy is used, how far apart the two dissimilar metals are on the galvanic series chart, the electrolyte conductivity, geometric factors and immersion time. Given these factors provide the basis that the Chemistry program is the applicable AMP for galvanic corrosion.

RAI 3.3.2.4.6-4 The applicant credited its Chemistry Program (which explicitly exempts the one-time inspection) for managing loss of material and cracking aging effects for some sub-components in heat exchangers in several auxiliary systems (e.g., tubes in a heat exchanger in CCWS, Page 31 of 413 of Database AMR Query). The applicant is requested to explain how the credited Chemistry Program alone will ensure the heat transfer function of the sub-components in the heat exchanger.

3.3.2.4.7 Diesel Generator Services Systems

RAI 3.3.2.4.7-1 For the AMR results of the flexible hose and flexible coupling included in LRA Table 2.3-23, the applicant identified Table 3.3-1 Item 2 and Table 3.3-2 Item 26.

LRA Table 3.3-1, Item 2 states that loss of material due to wear is not considered an aging effect because mechanical components must perform their License Renewal intended functions without moving part. Wear that occurs on non-moving components is considered to be caused by improper design and should be corrected by normal maintenance activities. The staff disagrees with the applicant's explanation that wear is caused by improper design in the non-moving components. The staff believes that wear of elastomer may be attributed to many conditions such as relative movement due to thermal expansion. The applicant is requested to provide the technical basis to justify why the aging effect of loss of material due to wear is not applicable.

LRA Table 3.3-2, Item 26 states that, internal surfaces of rubber components are not considered to be susceptible to degradation in fluid environments due to lack of excessive temperatures and to the change in material properties of elastomers being closely tied to external conditions such as ultraviolet radiation. Therefore, no aging management is required. Clarify what type of rubber is used and provide technical justification and operational history to demonstrate that internal surfaces for flexible hoses and other elastomers used in diesel generator services systems do not have aging effects of hardening, cracking, loss of strength, and wear from exposure to the process fluid.

RAI 3.3.2.4.7-2 No aging management program has been identified for managing loss of material due to galvanic corrosion for any applicable components in the diesel generator service systems. Provide the basis for not including such an aging management program.

RAI 3.3.2.4.7-3 LRA Table 3.3-2, Item 10 indicates that exhaust piping and mufflers are thick-walled components and do not require aging management. The corrosion of carbon steel components exposed to condensation and alternate wetting and drying, such as the mufflers and piping used in the diesel exhaust, is affected by their orientation and the proper function of any installed drain traps. Does the exhaust contain any corrosive contaminants such as sulfur that may be corrosive to the material? Provide the basis for not inspecting the interiors of

silencers/mufflers and exhaust piping for localized corrosion from sulfuric acid and condensation.

3.3.2.4.12 Instrument Air Supply System

RAI 3.3.2.4.12-1 For the aging management review of several components within the license renewal evaluation boundary of the instrument air supply system, the applicant stated that they are exposed to an oil-free, filtered, and dried compressed air (referred to as an air-gas environment) and loss of material is not an aging effect requiring management during the period of extended operation. It should be noted that in the instrument air system, components that are located upstream of the air dryers are generally exposed to a wet air/gas environment and, therefore, may be subject to loss of material due to general and pitting corrosion. In addition, it is reasonable to assume that components downstream of the dryers are exposed to dry air/gas environment. However, this may not be supported by some operating experience. For example, NRC IN 87-28, “Air Systems Problems at U.S. Light Water Reactors,” provides the following: “A loss of decay heat removal and significant primary system heat up at Palisades in 1978 and 1981 were caused by water in the air system.” This experience implies that the air/gas system downstream of the dryer may not be dry. On the basis of this industry experience, the applicant is requested to discuss its plant-specific operating experience related to components that are exposed to an instrument air environment, and to provide a technical basis for not identifying loss of material as an aging effect for these components.

3.3.2.4.14 Liquid Waste Processing System

RAI 3.3.2.4.14-1 In the LRA Table 3.3-1, Item 14 and the table entitled "Virgil C. Summer Nuclear Station Database Query", the applicant identified the aging effects on carbon steel and stainless steel heat exchanger/condenser components in the liquid waste processing system that are exposed to treated water and the corresponding aging management program. The applicant further stated that the AMR results for this group are consistent with GALL (VII.C2.2-a, C2.2.1) in material, environment, and aging effects. The applicant also stated that the Chemistry Program is considered to provide adequate management in lieu of the Closed-Cycle Cooling Water System Program that is recommended for this group by GALL. It should be noted that the AMP, Closed-Cycle Cooling Water System Program, includes preventive measures as well as surveillance testing and inspection. The applicant is requested to explain how the Chemistry Program alone (without One-Time Inspection to verify the effectiveness of the Chemistry Program) is considered to provide adequate management of the identified aging effects for these components.

RAI 3.3.2.4.14-2 The GALL report identifies stress corrosion cracking aging effects for stainless steel components exposed to treated water and corresponding aging management programs and recommends further evaluations. In the table entitled ”Virgil C. Summer Nuclear Station Database Query”, the applicant states that the aging effects for the combination of those components/component types and environments are consistent with GALL. However, the applicant also stated that further evaluations was not recommend by GALL. Explain why the conclusion in the LRA is different from the GALL.

RAI 3.3.2.4.14-3 In the AMR query notes item A-WL-k, the applicant stated, “Some component surfaces such as the area around cooling coils are subject to alternate wetting and drying and are thus susceptible to pitting and crevice corrosion and stress corrosion cracking.

This mechanism is not expected to be significant in the ventilation air environment. The subject valve is not in a wetted location for the majority of the time and is considered to be dry during normal operation. As such, loss of material/cracking due to corrosive impacts of alternate wetting and drying are not aging effects requiring management." Provide results from inspections performed that support this conclusion. If not, provide justifications for your conclusion.

3.3.2.4.16 Nuclear Sampling System

RAI 3.3.2.4.16-1 For carbon steel components exposed to external environments of moist air such as reactor building or sheltered, the GALL report identified that loss of material is an aging effect that is caused by general, pitting, crevice corrosion and MIC. The VCSNS LRA identifies loss of material as an aging effect due to general corrosion only. Justify why pitting, crevice corrosion or MIC does not occur for the carbon steel components exposed to external environments of moist air such as reactor building or sheltered. If insignificant concentration of contaminants is part of the technical basis, provide the acceptance criterion and the verification/inspection activities performed to justify your conclusion.

RAI 3.3.2.4.16-2 The nuclear sampling system contains borated water. However, the VCSNS B.1.2 Boric Acid Corrosion Surveillance AMP is not mentioned in the database AMR Query table of nuclear sampling system. Address how the loss of materials from boric acid corrosion due to borated water leakage is managed for the components of nuclear sampling system or provide the basis for why this is not an applicable aging effect.

3.3.2.4.17 Radiation Monitoring System

RAI 3.3.2.4.17-1 The table entitled "Virgil C. Summer Nuclear Station Database AMR Query" states that for stainless steel pipe and fittings in a sheltered environment, the loss of material due to MIC can be managed for the period of extended operation by the applicant's Maintenance Rule Structures Program (B.1.18). The applicant also stated that exposure of other stainless steel components such as pressure retaining instrumentation, tanks, tube and tube fittings and valve bodies, to the same sheltered environment has no aging effect. Address and clarify this inconsistency.

3.3.2.4.18 Reactor Makeup Water Supply System

RAI 3.3.2.4.18-1 In the table entitled "Virgil C. Summer Nuclear Station Database AMR Query", the applicant stated that for stainless steel pipe and fittings in a sheltered environment, the loss of material due to MIC can be managed for the period of extended operation by the applicant's Maintenance Rule Structures Program (B.1.18). The applicant also stated that exposure of other stainless steel components such as orifices, pump casings, tube and tube fittings and valve bodies, to the same sheltered environment has no aging effect. The applicant is requested to clarify this inconsistency.

3.3.2.4.20 Station Service Air System

RAI 3.3.2.4.20-1 Normally station service air system may contain elastomer materials in hose connection seals, duct seals, flexible collars between ducts and fans, rubber boots, etc. For

some plant designs, elastomer components are used as vibration isolators to prevent transmission of vibration and dynamic loading to the rest of the system. The aging effects on those elastomer components are hardening and loss of material. However, no elastomer component associated with the station service air system was listed in the LRA. Clarify whether there are elastomer components present in the Station Service Air System and if so, address the management of the aging effects of hardening and loss of material on the elastomer components.

RAI 3.3.2.4.20-2 Loss of material due to boric acid corrosion for components adjacent to a source of borated water is an aging effect for carbon steel components. In the VCSNS Database AMR Query table, the applicant identified some carbon steel components in the reactor building and sheltered environments are subject to such an aging effect and some are not. Explain why different conclusions are attained for components with the same material/environment combination.

3.3.2.4.21 Service Water System

RAI 3.3.2.4.21-1 The applicant stated in the VCSNS Database AMR Query Table that galvanic corrosion is one of the applicable aging mechanism that give rise to the aging effect of loss of materials. The component group affected in this category for the Service Water System includes carbon steel couplings, and pipe and fittings in an underground environment. The Buried Piping and Tanks Inspection is stated as the applicable AMP. The applicant further stated that this AMP will be consistent with XI.M34, Buried Piping and Tanks Inspection, as identified in NUREG -1801 prior to the period of extended operation. It should be noted that the likelihood and extent of galvanic corrosion depends on the relative position of the contacting metal/alloys on the galvanic potential chart, the electrolyte, immersion time and geometrical factors and many of these factors are location-dependent. The applicant is requested to clarify whether the buried piping and tanks inspections are to be performed in areas with the highest likelihood on galvanic corrosion or are to be performed on an opportunistic basis. Provide justifications for either case.

RAI 3.3.2.4.21-2 For carbon steel component in the sheltered and reactor building environments of VCSNS is loss of materials from aging mechanisms other than boric acid corrosion (such as general corrosion, galvanic corrosion) an applicable aging effect? If so, identify the applicable aging effects and the associated AMPs, or provide the technical basis to justify no other applicable aging effects for these components.

RAI 3.3.2.4.21-3 The Query Notes (A-SW-f) states that "Loss of material due to MIC is an aging effect for stainless steel components, and is a potential problem in sheltered environments where contamination from untreated water or soil may have introduced bacteria. VCSNS operating experience has identified the accumulation of microbiological organisms on the external surfaces of some piping components at building wall penetrations as a result of groundwater intrusion effects. The VCSNS AMR has conservatively considered all piping, process tubing and ductwork component types to be susceptible to external MIC if they either enter a building from the outside or pass between buildings included in the sheltered environment below the 425’ elevation. Loss of material due to MIC is only an aging effect requiring management for the stainless steel process tubing which passes between buildings below the 425’ elevation."

In the VCSNS Database AMR Query table, the applicant identified no aging effect for stainless steel expansion joints, mechanical -bellows, orifices, valves (body only) and pipe and fittings (thermowells) in a sheltered environment. The staff also noted that the applicant identified loss of materials from MIC as an applicable aging effect for stainless steel tube and tube fittings in a sheltered environment. Clarify the applicability of the discussion in VCSNS Database AMR Query Notes (A-SW-f) quoted above, to justify the different conclusion for the identified components. In particular, clarify which components mentioned above are above or below the 425' elevation and provide the basis for not including MIC as an applicable aging mechanism for the aging effect of loss of materials.

The applicant also does not identify any aging effect for stainless steel tube and tube fittings, valves (body only) in the reactor building environment. Provide justification for this omission. If insignificant concentration of contaminants is part of the justification, provide the acceptance criterion and the verification/inspection activities on susceptible locations to justify your judgement.

RAI 3.3.2.4.21-4 The applicant identifies no applicable aging effect for carbon steel components in an embedded environment. Provide the specification for the embedded environment. If this environment involves concrete, corrosion of carbon steel components embedded in concrete through carbonation etc., is commonly known degradation process. Provide the basis for the concluding that no applicable aging effect exists for carbon steel components in this particular embedded environment.

3.3.2.4.22 Spent Fuel Cooling System

RAI 3.3.2.4.22 -1 In page 211 of the VCSNS Database AMR Query Notes, the applicant states that loss of material due to MIC is identified as an aging effect for vulnerable stainless steel components including pipe and tubing exposed to sheltered environment. However, loss of material due to MIC is not identified by the applicant as an aging effect for stainless steel components other than pipe and tubing. Provide justification as to why loss of material due to MIC is identified as an aging effect only for stainless steel pipe and tubing components and not for other stainless steel components such as heat exchangers, orifices, pumps, and valves.

3.3.2.4.23 Thermal Regeneration System

RAI 3.3.2.4.23-1 In the VCSNS Database AMR Query table, the applicant identified only the stainless steel pipe and fittings in the sheltered environment are subject to aging effect of loss of material due to MIC. The rest of the stainless steel components in the same environment in this system are identified as not subject to loss of material due to MIC. Explain why the conclusions are different for the same combination of material and environment.

SECTION 3.4: STEAM AND POWER CONVERSION SYSTEMS

RAI 3.4-1 In Section 2.3.4.10, the LRA lists turbine cycle sampling system components subject to aging management review but Section 3.4.1, which lists VCSNS steam and power conversion systems does not include the turbine cycle sampling system. Provide an explanation for this omission.

RAI 3.4-2 In Tables 2.3-38 thru 2.3-47, the LRA does not identify any steam and power conversion systems components that are managed for cumulative fatigue. NUREG-1801 recommends aging management of cumulative fatigue for piping and fittings in the main steam, feedwater, and auxiliary feedwater systems. Explain why Tables 2.3-38 thru 2.3-47 do not identify any steam and power conversion systems components that are managed for cumulative fatigue.

RAI 3.4-3 LRA Table 3.4-1, item 1, identifies the applicant's aging management for cumulative fatigue damage for piping and fitting in the main feedwater line, the steam line, and for AFW piping. In the discussion column for this item, the LRA states, "see Section 4.3.2 [of the LRA] for the TLAA discussion of Class 2 and 3 piping." The discussion column does not state if the applicant's TLAA is consistent with the NUREG-1801 TLAA program. For the steam and power conversion systems piping, NUREG 1801 recommends an evaluation of allowable stress levels based on the number of anticipated thermal cycles as described in NUREG-1800, Section 4.3.1.1.2. Does the applicant perform the thermal cycle evaluation of steam and power conversion systems piping as described in NUREG-1800, Section 4.3.1.1.2 for the main feedwater line, the steam line, and for AFW piping? If so, is the applicant's TLAA program consistent with NUREG-1801. If not, explain any differences.

RAI 3.4-4 In Table 3.4-1, item 2, the LRA states that various components will be managed for the aging effect of loss of material due to general (carbon steel only), pitting, and crevice corrosion using the applicant's Chemistry program but a One-Time Inspection is not warranted to verify corrosion is not occurring for components in this group, except for the condensate storage tank. The LRA further states that a review of operating experience confirms the effectiveness of the Chemistry program for treated water to manage aging effects when continued into the period of extended operation. The NRC staff position is that a one-time inspection is needed to address concerns for the potential long incubation period for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly. For these cases, there needs to be confirmation that either the aging effect is indeed not occurring, or the aging effect is occurring very slowly as not to affect the component or structure intended function. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. The one-time inspection should be performed late in the current operating period to ensure aging effects will not affect the component intended function during the period of extended operation. The applicant is requested explain how operating experience will confirm that these aging effects will not occur during the period of extended operation or perform a one-time inspection of components based on severity of conditions, time of service, and lowest design margin as recommended by NUREG-1801, XI.M32, "One-Time Inspection." Also, this RAI applies to the valves in Table 3.4-2, item 5.

Note: NUREG-1801 does not recommend a One-Time Inspection for main steam system piping. Therefore, a one-time inspection is not necessary to verify the Water Chemistry program for main steam system components in LRA Table 2.3-44.

RAI 3.4-5 In Table 2.3-47, the LRA does not include blowdown system heat exchangers identified as within the scope of license renewal on Drawing D-302-771. Explain why these

heat exchangers are not included in Table 2.3-47 and describe the aging management for these heat exchangers.

RAI 3.4-6 Loss of material due to general corrosion, pitting and crevice corrosion, microbiologically influenced corrosion (MIC), and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the auxiliary feedwater system. In Table 3.4-1, item 3, the LRA does not identify aging management of raw water exposure to AFW piping. In the discussion column, the LRA states that the "AFW piping at VCSNS is not exposed to untreated water. The service water system provides emergency backup to the emergency feedwater system through automatic isolation valves that normally provide boundary isolation between the treated water of the emergency feedwater system and the untreated water of the service water system." Explain what is meant by the statement that, "automatic isolation valves that normally provide boundary isolation," and how the applicant has verified that the AFW piping has not been exposed to raw water. If any portions of the AFW system require aging management due to exposure to raw water, list the components and describe how aging will be managed.

RAI 3.4-7 In Table 3.4-1, item 4, the LRA states that aging management review for auxiliary feedwater system pump lubricating oil coolers determined that water and contaminates will not intrude into the oil environments for these components. The staff's position is that an environment of lubricating oil contaminated with water may cause loss of material of carbon or stainless steel heat exchanger components due to general corrosion (carbon steel only), pitting, crevice corrosion and microbiological influenced corrosion. On this basis, the auxiliary feedwater system pump lubricating oil coolers have the potential of being contaminated with water. Explain why water and contaminates will not intrude into the oil environments for these heat exchangers and why oil samples are not credited to ensure water does not contaminate the lube oil. Also, this RAI applies to the heat exchangers in Table 3.4-2, item 3.

RAI 3.4-8 In Table 2.3-46, the LRA identifies that the turbine cycle sampling system pipe and valves are managed for aging by the AMP B.2.1, "Inspection for Mechanical Components." The scoping section of AMP B.2.1 identifies the mechanical systems managed by the AMP but does not include the turbine cycle sampling system. Explain why the turbine cycle sampling system is not included in the scope section of AMP B.2.1.

RAI 3.4-9 In Tables 2.3.38 thru 2.3.47, the LRA identifies "valve body" in the component column. NRC position is that the aging effects identified in these tables, except for wall thinning due to flow-accelerated corrosion, are applicable to both the valve body and bonnet. Explain why the valve bonnets are not affected by these aging effects or provide aging management for the bonnets.

RAI 3.4-10 In Table 3.4-1, item 6, the LRA states in the discussion column of the Flow Accelerated Corrosion program that "the component/component type AMR results for VCSNS are consistent with NUREG-1801 in material, environment, aging effects, and program. In NUREG-1801, aging management for Flow Accelerated Corrosion is specified for all steam and power conversion systems piping, fitting, pump casings, and valve bodies. In Tables 2.3-38 and 2.3-40, the LRA does not identify aging management for Flow Accelerated Corrosion for piping, fitting, pump casings, and valve bodies in the auxiliary boiler and feedwater system and the emergency feedwater system. Also, in Table 2.3-44, the LRA does not identify aging management for Flow Accelerated Corrosion for the main steam system pump turbine (casing

only). Explain why the LRA states it is consistent with NUREG-1801 but does not include the above components in the FAC program.

RAI 3.4-11 The objective of the Water Chemistry program is to mitigate damage caused by corrosion and stress corrosion cracking. NUREG-1801 recommends implementation of the Water Chemistry program to manage loss of material due to general (carbon steel only), pitting, crevice, and stress corrosion cracking (stainless steel only) for piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell. The LRA does not credit the Chemistry program for the following components: 1) heat exchanger tube and shell in Table 2.3-40, 2) tank (reservoir) in Table 2.3-40, and 3) pump turbine (case only) in Table 2.3-44. Explain why the Chemistry program is not credited to manage loss of material due to general (carbon steel only), pitting, crevice, and stress corrosion cracking (stainless steel only) for these components. A one-time inspection should be used to verify the effectiveness of the Water Chemistry program if the component is not in the main steam system.

RAI 3.4-12 NUREG-1801 recommends that heat exchanger internal exposed to raw or treated water be managed for loss of material by the Open Cycle and Closed Cycle Cooling Water System AMPs. In Table 3.4-1, items 9 & 10 of the LRA, the LRA states that the Open Cycle and Closed Cycle Cooling Water System AMPs as described in NUREG-1801 are not used in any steam and power conversion systems at VCSNS. Are there any steam and power conversion systems heat exchangers at VCSNS exposed to raw or treated water that require aging management review? If yes, identify the heat exchangers, the aging effects, and how the aging effects are managed?

RAI 3.4-13 In Table 3.4-1, item 12, the LRA states that the AMP Inspection of Mechanical Components is used to monitor the external surfaces of the above ground condensate storage tank for loss of material. For tanks supported on earthen or concrete foundations, corrosion may occur at inaccessible locations, such as the tank bottom. Is the bottom of the condensate storage tank located on an earthen or concrete foundation? If so, explain how loss of material at the tank bottom is managed. Are periodic thickness measurements taken at the tank bottom to ensure the integrity of the tank bottom is maintained?

RAI 3.4-14 In Table 3.4-1, item 12, the LRA states that there is underground piping in the AFW system (emergency feedwater system at VCSNS) and that the Buried Pipe and Tanks Inspection program will manage the aging effects. Table 2.3-40 of the LRA, for the emergency feedwater system, only identifies orifices as subject to aging management by the Buried Pipe and Tanks Inspection program. Explain why the AFW piping in Table 2.3-40 does not refer to the Buried Pipe and Tanks Inspection program and how the underground piping in the AFW is managed for aging.

RAI 3.4-15 NUREG-1801 recommends a one-time inspection to verify the effectiveness of the Water Chemistry program for all components except those in the main steam system. Explain why a one-time inspection is not performed to verify the effectiveness of the Chemistry program for auxiliary boiler steam and feedwater system components in Table 2.3-38, gland sealing steam system components in Table 2.3-43, main steam dump system components in Table 2.3-45, and turbine cycle sampling system components in Table 2.3-46.

3.5 CONTAINMENTS, STRUCTURES, AND COMPONENT SUPPORTS

RAI 3.5-1 In Report TR00170-003, Revision 0, Attachment II: Aging Management Review Results for Structures and Structural Components, cable trays, conduit, electrical and instrument panels and enclosures are identified as component types within most of the buildings and structures. These components are identified as steel in an internal environment, except for the Electrical Substation and Transformer Area, where the environment is external. In all cases, no aging effect requiring aging management is identified. The staff believes that these components located in the reactor, auxiliary, intermediate, and fuel handling buildings are susceptible to boric acid corrosion and that these components located in an external environment are susceptible to environmental corrosion. Therefore, in both cases loss of material is an applicable aging effect requiring aging management. The applicant is requested to identify and describe the aging management programs which will manage loss of material for these components located in the reactor, auxiliary, intermediate, and fuel handling buildings, and in an external environment.

RAI 3.5-2 Many concrete component types in internal, external, and below-grade environments are identified in Report TR00170-003, Revision 0, Attachment II as having no aging effects requiring aging management. The specific component types are duct banks; equipment pads; flood curbs; foundations; hatches; missile shields; reinforced concrete-beams, columns, floor slabs, walls; roof slabs; sumps; caissons; piers; trenches; jet barriers; and manholes. The staff position is that all accessible concrete components that perform an intended function require aging management for loss of material, cracking, and change in material properties; and that inaccessible concrete components (i.e., below grade) also require aging management unless specific criteria defined in NUREG-1801 GALL Volume 2 are satisfied, to demonstrate a non-aggressive below-grade environment.

Report TR00170-003, Revision 0, Attachment II also lists three (3) steel components in a concrete environment. These are anchorage, anchorage/embedments (exposed surfaces) and embedments. All are identified as having no aging effects requiring aging management. The condition of the concrete surrounding anchorage and embedments may affect their load capacity. GALL Volume 2, III.B, Item Numbers III.B1.1.4, III.B1.2.3, III.B2.2, III.B3.2, III.B4.3, and III.B5.2 specifically identify the need for aging management of the concrete surrounding expansion and grouted anchors, and grout pads for support base plates. The staff position is that all accessible concrete requires aging management; this includes monitoring the condition of concrete surrounding anchorages and embedments.

AMR items 7 and 15 of LRA Table 3.5-1 indicate that for the concrete containment structure only certain aging effects require aging management. As an example, for accessible exterior concrete, only change in material properties due to leaching is identified as requiring aging management. It is the staff position that ASME Section XI, Subsection IWL should be credited for managing loss of material, cracking, and change in material properties for the concrete containment structure; and that inaccessible concrete (i.e., below grade) also requires aging management unless specific criteria defined in NUREG-1801 GALL Volume 2 are satisfied, to demonstrate a non-aggressive below-grade environment.

Therefore, the applicant is requested to

(a) verify that cracking, loss of material, and change in material properties will be managed in accordance with NUREG-1801, XI.S2, ASME XI, Subsection IWL for all accessible containment concrete components;
(b) identify the aging management programs that will manage loss of material, cracking, and change in material properties for all other concrete components in accessible areas;
(c) submit a quantitative assessment of the below-grade environment, comparing it to the specific criteria defined in GALL Volume 2;
(d) if it is non-aggressive, based on satisfaction of the specific criteria defined in GALL Volume 2, describe the groundwater monitoring program that will be implemented to verify that the below-grade environment remains non-aggressive, including monitoring frequency and consideration of seasonal fluctuations;
(e) if the below-grade environment does not satisfy the specific criteria defined in GALL Volume 2, describe in detail the plant-specific aging management programs for inaccessible concrete components.

RAI 3.5-3 Report TR00170-003, Revision 0, Attachment II does not list O-rings for the containment airlocks and hatch or seals for fire/flood doors as separate components. Therefore, there is no documented aging management review. Since these components are passive and are typically replaced only upon identification of a degraded condition, they require an aging management review. Therefore, the applicant is requested to submit its aging management review for these components, including a description of the aging management programs that will be relied upon to ensure there is no loss of intended function during the period of extended operation.

RAI 3.5-4 Report TR00170-003, Revision 0, Attachment II identifies loss of material as the only aging effect requiring aging management, for pipe supports located in the auxiliary building; control building; intermediate building; diesel generator building; fuel handling building; reactor building; and service water structures. The ASME Section XI ISI Program - IWF is identified as one of the credited aging management programs, presumably for ASME Class piping supports. Attachment II indicates that this is a match with GALL. The staff notes that this is not a match with GALL, because GALL Volume 2, III.B, Item Numbers III.B1.1.3 and III.B1.2.2 also identify loss of mechanical function as an aging effect to be managed by IWF. Therefore, the applicant is requested to verify (1) that loss of mechanical function is an applicable aging effect for ASME Class piping supports, and (2) that IWF is the applicable aging management program. Alternatively, submit a detailed technical basis for excluding this aging effect and clearly identify this as a deviation from GALL.

RAI 3.5-5 In the "Aging Management Programs" column of the Report TR00170-003, Revision 0, Attachment II Table, Technical Specification 3/4.9.10 is listed for the following component types in the fuel handling building: fuel transfer canal liner plate, spent fuel pool liner, and spent fuel storage rack; and Technical Specification 3/4.6.1 is listed for the following component types in the reactor building: personnel airlock, escape hatch, and equipment hatch. The staff requests the applicant to describe the objective, scope, and implementation procedures for each technical specification, as it relates to aging management for license renewal.

RAI 3.5-6 In LRA Section 3.5.1.2, the applicant has identified that the foundation for the auxiliary building extends below the groundwater level and is supported on fill concrete down to competent bedrock. However, the applicant did not identify whether underdrain (de-watering)

systems are utilized at V. C. Summer for the auxiliary building and/or any of the other buildings in the license renewal scope. In addition, no intended function(s) have been identified for the fill concrete used under several of the buildings included in the license renewal scope. Therefore, the staff requests the applicant to submit the following information related to underdrain systems and fill concrete:

(a) Identify whether underdrain (de-watering) systems are utilized at V. C. Summer.
(b) If utilized, describe the specific applications; describe current monitoring and/or maintenance activities that ensure proper functioning; discuss whether they perform an intended function; and, as appropriate, submit an aging management review, including identification of credited aging management program(s).
(c) Describe the fill concrete, including its strength, thickness, underground profile, and construction procedures. Also define the ground water level with respect to the fill concrete profile.
(d) Describe plant-specific operating experience concerning settlement of buildings resting on fill concrete.
(e) Discuss whether fill concrete performs an intended function; and, as appropriate, submit an aging management review, including identification of credited aging management program(s).

RAI 3.5-7 In LRA Table 3.5-1, AMR item 19, the applicant credits the Chemistry Program (LRA Appendix B.1.4) for aging management of the stainless steel, spent fuel pool liner. The staff considers verification of the effectiveness of a chemistry control program to be an integral element of aging management. For the spent fuel pool, this is readily achieved by monitoring an existing plant-specific, spent fuel pool leak detection system or by monitoring the spent fuel pool water level for indications of leakage. Therefore, the staff requests the applicant to describe its plant-specific operating experience concerning leaks in the spent fuel pool, including a description of each occurrence, how it was detected, the determination of root cause, and how it was remedied.

RAI 3.5-8 LRA Table 3.5-2 is titled "Summary of Aging Management Programs for Station Containment, Other Structures and Component Supports That are Different From or Not Addressed in NUREG-1801 but are Relied on for License Renewal." Ten (10) AMR items are listed in the table. For each AMR item, the following information is provided in the table: component type, material, environment, aging effect / mechanism, program activity, and discussion. The staff's review of LRA table 3.5-2 identified the need for clarification and additional information relating to a number of the AMR items. For all except one (1) of these items, additional pertinent information has either been requested in other RAIs or was located in Attachment II to Report TR001700-003. The exception is LRA Table 3.5-2, AMR item 4: "Lubrite Plates (Class 1 Pipe Hanger Supports)." It is identified as a lubricant material in an internal environment. No aging effect / mechanism is identified, and consequently no aging management program is identified. In the "Discussion" column, the applicant provided a brief summary of its aging management review, which concluded that lubrite plates "are not susceptible to aging effects requiring management." Aging management of lubrite plates for Class 1 piping supports is addressed in NUREG-1801, GALL Volume 2, III.B, Item No. III.B1.1.3. ASME Section XI, subsection IWF is identified as the applicable aging management program. Therefore, the applicant is requested to submit a detailed technical basis to support its conclusion that lubrite plates do not require aging management, or to credit its IWF aging management program for aging management of lubrite plates, consistent with GALL.

RAI 3.5-9 LRA Table 3.5-1 is titled "Summary of Aging Management Programs for Station Containment, Other Structures and Component Supports Evaluated in NUREG-1801 That are Relied on for License Renewal." Twenty-nine (29) AMR items are listed in the table. For each AMR item, the following information is provided in the table: component group, aging effect / mechanism, aging management program, further evaluation required, and discussion. This table is a reproduction of NUREG-1800 Table 3.5-1, with an added "Discussion" column. LRA Table 3.5-1 does not indicate that the applicant's aging management reviews are consistent with GALL. In the "Discussion" column, the applicant refers to aging management programs that are "consistent with those reviewed and approved in NUREG-1801." For most of the AMR items, the aging management review is not consistent with GALL. The staff's review of LRA table 3.5-1 identified the need for clarification and additional information relating to many of the AMR items. For many of these items, additional pertinent information has either been requested in other RAIs or was located in Attachment II to Report TR001700-003. The applicant is requested to submit the following additional information or clarifications related to LRA Table 3.5-1:

(a) For AMR items 1 and 2, describe how the design basis for the flat plate containment penetration closures considered cyclic loading due to temperature/pressure transients. If a CLB fatigue analysis exists for the flat plate penetration closures, has it been updated for a 60-year operating life? How will cracking due to cyclic loading be managed for the period of extended operation?

(b) For AMR item 8, clarify the reference to three (3) aging management programs in the "Discussion" column, considering that the containment foundation is not subject to settlement.

(c) For AMR item 15, clarify the reference to three (3) aging management programs in the "Discussion" column, considering that freeze-thaw and reaction with aggregates are dispositioned as not requiring aging management for both accessible and inaccessible areas.

(d) For AMR item 16, explain the reference to two (2) aging management programs that are only applicable to the containment structure.

(e) For AMR item 24, explain the following statement in the "Discussion" column: "Note that the combinations of components, materials, and environments identified in NUREG-1801 for Group 8 (Steel Tanks) are not applicable to VCSNS; therefore, aging management is not required." Do any steel tanks have stainless steel liners? If so, how are SCC and crevice corrosion managed?

(f) For AMR item 25, clarify which listed subcomponents are managed by each of the two (2) referenced aging management programs. Also identify which, if any, of the subcomponents do not require aging management, based on the plant-specific aging management review.

(g) For AMR item 28, explain why ASME Section XI, subsection IWF is not credited for aging management of the ASME Class supports, consistent with GALL. How are the two (2) referenced aging management programs implemented as a substitute for IWF?

RAI 3.5-10 LRA Section 3.5.1.1 indicates that the reactor building foundation mat bears on fill concrete that extends to competent rock, and that a retaining wall, extending approximately one-quarter of the way around the reactor building, protects the below grade portions of the reactor building wall from the subgrade. LRA Section 2.4.1 further indicates that the retaining wall protects the below-grade portions of the reactor building wall from the subgrade and groundwater. The groundwater at VCSNS has been identified as being mildly acidic but

considered non-aggressive in LRA Table 3.5-1. It is not clear to the staff whether the retaining wall serves an intended function and is subject to an aging management review. Therefore, the applicant is requested to submit the following information related to the retaining wall:

(a) Describe in detail the primary function(s) for the retaining wall.
(b) Discuss the consequences of its failure on structures and components that serve intended functions.
(c) If the retaining wall serves an intended function, submit the aging management review for the retaining wall, including the aging management programs credited to manage aging.
(d) Otherwise, submit the technical basis for concluding that the retaining wall serves no intended function.

RAI 3.5-11 In Report TR00170-003, Rev. 0, Attachment II, many structural components are identified as not having any applicable aging effects and thereby no aging management programs are specified in the "Aging Management Programs" column. Most of these structural components are concrete, which the staff has addressed in RAI 3.5-2. For several stainless steel components in the reactor building (refueling canal liner plate, sump screens, and sumps), a statement in the "Notes" column indicates that although no aging effects have been identified, the Maintenance Rule Structures Program inspects these components. Please explain the intent of this statement. Is the Maintenance Rule Structures Program being credited to manage aging of these components for license renewal?

RAI 3.5-12 AMR item 10 in LRA Table 3.5-1 addresses the aging effect of reduction in strength and modulus due to elevated temperature for concrete elements of containment. The discussion column of this item states that "The VCSNS containment concrete elements are not exposed to temperatures which exceed the thresholds for degradation; therefore, reduction of strength and modulus due to elevated temperatures are not aging effects requiring management". This statement does not seem to be consistent with the information presented in Report TR00170-003, Rev. 0, Table 6.1-1 and the discussion on page 59 of the report. The table indicates that there is one region (above the reactor head but below the operating floor elevation 463') that has a maximum temperature of 157 F. Page 59 of the report also indicates that the control rod drive mechanism (CRDM) is maintained at a temperature of less than or equal to 170 F. The report concludes that these temperatures are localized and do not exceed 200 F. The report follows with some additional discussion about elevated temperature concerns for three areas inside the reactor building. Some design modifications were made to rearrange air flow in the reactor building and tests were made in which the inspector identified no further problems. From the information presented, it is not clear to the staff which regions currently experience temperatures above 150 F; whether these are area temperatures or localized temperatures around hot piping penetrations; and how aging effects due to elevated temperatures will be managed. Therefore, the applicant is requested to provide the following information:

(a) Explain the apparent inconsistency between LRA Table 3.5-1, AMR item 10 and the information in Report TR00170-003, Rev. 0 (see above discussion).
(b) For all structures in the scope of license renewal, identify all regions that currently experience temperatures in excess of 150 F.
(c) If there are regions that currently experience temperatures in excess of 150 F, indicate whether these are area temperatures or localized temperatures around hot penetrations.

(d) If any area temperatures exceed 150o F and/or any localized temperatures exceed 200o F, how will change in material properties of concrete due to elevated temperatures be managed during the period of extended operation?

RAI 3.5-13 AMR item 12 in LRA Table 3.5-1 discusses loss of material due to corrosion in accessible and inaccessible areas of the containment liner. For inaccessible areas, the LRA concluded that corrosion in the embedded containment liner is not significant because the four conditions described in NUREG-1801 are applicable to VCSNS. The staff notes that the plant-specific operating experience does not necessarily support this conclusion. LRA Appendix B.1.12.1, states that rust was identified on the reactor building liner plate adjacent to the moisture barrier and the moisture barrier had degraded. Therefore, it is not evident that loss of material due to corrosion in inaccessible areas of the containment liner is not significant at VCSNS.

It is also unclear to the staff why the non-conformance (NCN) discussed in LRA Appendix B.1.12.1 was identified by the Appendix J Leak Rate Testing program (B.1.12) and not by the Appendix J General Visual Inspection program (B.1.11) and/or the Containment ISI Program - IWE/IWL (B.1.16).

Therefore, the staff requests the applicant to provide the following information:

(a) What inspections have been conducted to assess the condition of the liner embedded in the concrete base?
(b) Confirm that the nonconformance discussed in LRA Appendix B.1.12.1 was detected prior to the implementation of the B.1.16 aging management program. If not, explain why this nonconformance was not detected under the B.1.16 aging management program.
(c) Explain why this nonconformance was not detected under the B.1.11 aging management program.
(d) Clarify the scope of and interaction between all three aging management programs (B.1.11, B.1.12 and B.1.16).
(e) The rust on the liner plate and the degraded moisture barrier could indicate the presence of or result in degradation in the inaccessible areas of the containment liner. Discuss how the acceptability of the inaccessible areas of the containment liner was evaluated as a result of this nonconformance.
(f) Since this type of degradation has already occurred, what is the technical basis for concluding that it could not occur again?
(g) Clarify whether the supplemental requirements of 10 CFR 50.55a for inaccessible areas are credited for LR aging management of the inaccessible liner plate.

RAI 3.5-14 LRA Table 2.4-2 indicates that the aging management review results for numerous component types in the reactor building (such as containment liner plate, cable tray, conduit, electrical and instrument panels and enclosures, fire doors, flood curbs, and HVAC duct supports) are presented in LRA Table 3.5-1, AMR item 13. LRA Table 3.5-1, AMR item 13 covers the component group "Steel elements; protected by coating," AMR item 13 lists four aging management programs in the "Discussion" column. These are 10 CFR 50 Appendix J General Visual Inspection; Containment Coating Monitoring and Maintenance Program; Containment ISI Program - IWE/IWL; and Maintenance Rule Structures Program. Report TR00170-003, Rev. 0, Attachment II only credits the coating monitoring and maintenance

program for aging management of the containment liner plate. It is not apparent to the staff which aging management programs are being credited for which components. Therefore, the applicant is requested to clarify the following items:

(a) Table 3.5-1, AMR item 13 covers the component group "Steel elements; protected by coating." Are all components that reference AMR item 13 protected by coatings, and are the coatings managed by a coating monitoring and maintenance program?
(b) For each of the component types covered under AMR item 13, identify which of the four (4) aging management programs are credited for license renewal.

RAI 3.5-15 For the containment post-tensioning system, Report TR00170-003, Rev. 0, Attachment II, identifies loss of material and loss of prestress as the aging effects requiring management, and the Tendon Surveillance Program as the applicable aging management program. The match with GALL is specified as "partial". LRA Table 3.5-1, AMR items 14 and 11 respectively address the same aging effects for the post-tensioning system, and identify the Containment ISI Program - IWE/IWL and the Tendon Surveillance Program as the applicable aging management programs. Both aging management programs are identified as consistent with GALL. To clarify this apparent contradiction, explain what is meant by a partial match in Report TR00170-003, Rev. 0, Attachment II. Also submit the technical basis for any deviations from the GALL programs that manage aging of the post-tensioning system (i.e., GALL XI.S2 and X.S1) .

RAI 3.5-16 LRA Table 3.5-1 AMR items 1, 2, and 3 discuss bellows used in containment penetrations and conclude that stress corrosion cracking (SCC) is not an applicable aging effect requiring management. The discussion under these AMR items indicates that the penetration bellows are not part of the containment pressure boundary because they are located on the exterior side of containment and hot penetrations are sealed on the inside of containment by a flat plate welded to both the penetration sleeve and process pipe. LRA Table 3.5-1, AMR item 2 states that the hot penetrations bellows "provide structural and/or functional support for process piping on the outboard side of containment; therefore, in the unlikely event of SCC in the bellows, the intended functions are not affected." While the intended function for containment pressure boundary may not be affected, failure of the bellows would appear to affect other intended functions. In addition, AMR items 2 and 3 credit the Appendix J General Visual Inspection, Appendix J Leak Rate Testing, and Containment ISI Program - IWE-IWL as aging management programs. These programs appear to applicable only to the welded flat plate closures, if the penetration bellows are not part of the containment pressure boundary. Therefore, the applicant is requested to provide the following information:

(a) Explain why cracking of the stainless steel penetration bellows (and the associated dissimilar metal welds) does not affect the bellows' intended function to "provide structural and/or functional support for process piping on the outboard side of containment."
(b) Identify the aging effects that are applicable to the penetration bellows (and the associated dissimilar metal welds), and the aging management programs that are credited to manage aging.

RAI 3.5-17 For the personnel airlock, escape airlock, and equipment hatch, the staff considers that loss of leak tightness in a closed position due to mechanical wear of locks, hinges, and closure mechanisms is an applicable aging effect that needs to be managed. This is

NUREG-1801, Vol. 2, GALL Item Number II.A3.2-b. From the information provided on page 43 of Report TR00170-003, Rev. 0, Attachment II, it is not clear whether this aging effect will be managed for license renewal. LRA Table 3.5-1, AMR item 5 indicates an apparent commitment to manage this aging effect. However, the following statement is included in the "Discussion" column: "Operation of hatches is governed by VCSNS Technical Specifications. Plant operational experience has not identified any fretting or seal degradation. Locks, hinges, and closure mechanisms are active components; therefore, mechanical wear is not considered an aging effect." The applicant is requested to clarify its aging management review for this aging effect as follows:

(a) Verify that loss of leak tightness in a closed position, resulting from mechanical wear of locks, hinges, and closure mechanisms, is an applicable aging effect requiring management for the containment personnel airlock, escape airlock, and equipment hatch.
(b) Identify the aging management programs that are credited to manage this aging effect.
(c) Indicate whether Technical Specification 3/4.6.1, which is referenced as an aging management program for the personnel airlock, escape airlock, and equipment hatch in Report TR00170-003, Rev. 0, Attachment II, allows any deviations from the requirements specified in GALL XI.S1, ASME Section XI, Subsection IWE. If so, describe the deviations and provide the technical basis for concluding that the aging management commitment is at least equal to the ASME Section XI, Subsection IWE aging management program.

AGING MANAGEMENT PROGRAMS

RAI 3.5-18 The Introduction to Appendix B - Aging Management Programs and Activities of the LRA states that "clarification is provided for instances where the VCSNS program does not match specific details of a NUREG-1801 program element but is still determined to be consistent." For the following aging management programs, a clarification is provided; however, it is not clear how the VCSNS program does not match the referenced GALL aging management program. Please explain what is intended by the clarification provided for each program and confirm that each program is completely consistent with GALL:

(a) ASME Section XI ISI Program - IWF (B.1.13)

(b) Containment ISI Program - IWE/IWL (B.1.16)

RAI 3.5-19 The staff noted several inconsistencies between the FSAR Supplement summary descriptions of the aging management programs in LRA Appendix A and the scope of the aging management programs identified in LRA Appendix B as "consistent with GALL." Some examples of these inconsistencies are:

(a) Section 18.2.5 of LRA Appendix A states that the ASME Section XI ISI Program – IWF manages "loss of material," while the parameters monitored under GALL XI.S3 are much broader and include: corrosion; deformation; misalignment; improper clearances; improper spring settings; damage to close tolerance machined or sliding surfaces; and missing, detached, or loosened support items.

(b) Section 18.2.5 of LRA Appendix A states that the ASME Section XI ISI Program – IWF manages cracking of high strength anchorage of ASME Class 1 component supports. Under GALL XI.S3 the visual inspection would be expected to identify relatively large cracks. If cracking of high strength anchorage needs to be managed, the staff would expect that the applicant would credit a program consistent with GALL XI.M18, Bolting Integrity.

For the following aging management programs identified as consistent with GALL, please verify that the complete scope of the aging management program, as described in NUREG-1801, GALL Volume 2, is being credited for license renewal aging management. If this is not the case, please identify and document the justification for each exception:

10 CFR 50 Appendix J Leak Rate Testing (B.1.12)

ASME Section XI ISI Program - IWF (B.1.13)

Containment ISI Program - IWE/IWL (B.1.16)

Maintenance Rule Structures Program (B.1.18)

Service Water Pond Inspection Program (B.1.21)

Tendon Surveillance Program (B.3.3)

The aging management program descriptions in LRA Appendix A should accurately reflect the scope of each program that is being credited for license renewal aging management. The descriptions should make direct reference to applicable 10 CFR sections, codes, standards, regulatory guides, and any other formal documents that define the commitment. Issues related to the FSAR supplement are being addressed by the staff on a generic basis.

RAI 3.5-20 The applicant states that 10 CFR 50 Appendix J General Visual Inspection (B.1.11) is consistent with XI.S4, 10 CFR 50 Appendix J, as identified in NUREG-1801. However, the scope of GALL XI.S4 is for containment leak rate testing and not general visual inspection of containments. Inspection of containments is covered by GALL XI.S1 and XI.S2, which involve ASME Section XI, Subsections IWE and IWL, respectively. The applicant states in LRA Section B.1.16 that the Containment ISI Program - IWE/IWL is consistent with GALL XI.S1 and XI.S2. The 10 CFR 50 Appendix J General Visual Inspection (B.1.11) is included in the discussion column of LRA Table 3.5-1, but is not identified as a credited aging management program in Report TR00170-003, Rev 0, Attachment II: Aging Management Review for Structures and Structural Components.

The applicant is requested to clarify whether the 10 CFR 50 Appendix J General Visual Inspection (B.1.11) program is credited as an aging management program for license renewal and provide the following information:

(a) If it is credited, the applicant needs to verify that it supplements the Containment ISI Program - IWE/IWL for visual inspection of containment, and is not used as a substitute.

(b) If any element of the containment visual inspection relies solely on the 10 CFR 50 Appendix J General Visual Inspection (B.1.11) program, then this aging management program needs to be evaluated against the 10 program elements of an aging management program, using the guidance in Branch Technical Position RLSB-1 in Appendix A of NUREG-1800.

(c) Identify which component types listed in Report TR00170-003, Rev 0, Attachment II credit this aging management program.

RAI 3.5-21 In LRA Section B.1.13.1, the applicant acknowledges that improperly heat-treated anchor bolts are susceptible to stress corrosion cracking, based on industry operating experience, but states that ASTM A490 anchor bolt material used at VCSNS is properly heat-treated by conforming to ASTM Specification A490 through a Certified Material Test Report, in accordance with station specifications. In Report TR00170-003, Rev 0, Section 6.8.6, the applicant indicates that SCC is unlikely at VCSNS for the reasons identified therein, but further states "Regardless, the examination requirements of ASME Section XI ISI Program - IWF manage loss of function and cracking due to SCC for the Class 1 component supports that are exposed to the Reactor Building environment." However, IWF visual inspection would be expected to identify only relatively large cracks, as noted in GALL XI.S3. If cracking of high strength anchorage needs to be managed, the staff would expect that the applicant would credit a program consistent with GALL XI.M18, Bolting Integrity. Therefore, the staff requests the applicant to (1) identify all plant-specific applications of high strength bolting in Class I piping and component supports; (2) specifically describe the plant-specific operating experience related to stress corrosion cracking of high-strength bolting materials used in Class I piping and component supports; (3) describe the plant-specific resolution of the generic safety issue related to bolting integrity, including a description of any inspections/tests conducted as part of the resolution; and (4) if cracking due to SCC is an applicable aging effect, describe the inspections, in addition to IWF visual inspection, that will be credited to manage this aging effect.

RAI 3.5-22 The Flood Barrier Inspection Program described in LRA Section B.1.17 is included in the discussion column of LRA Table 3.5-2, but is not credited for license renewal in Report TR00170-003, Rev 0, Attachment II: Aging Management Review Results for Structures and Structural Components. The staff requests that the applicant provide the following information regarding this program:

(a) Clearly state the component types and associated structures that credit this program for license renewal.
(b) Explain the added value of this program since LRA Section B.1.17 states that either the Fire Protection Program or the Maintenance Rule Structures Program manages all flood barrier components.
(c) Clarify why the scope section of this program indicates that there are flood seals in the intermediate building. The staff notes that flood barriers are not identified as a component type for the intermediate building in Report TR00170-003, Rev 0, Attachment II.
(d) The section on "monitoring and trending" states the frequency of inspection for flood barrier seals that are also fire barrier penetration seals. Provide the frequency of inspection for flood barrier seals that are not fire barrier penetration seals, as well as all

the other components within the scope of this program, such as flood barriers (walls, curbs, equipment pedestals) and flood doors.

RAI 3.5-23 LRA Section B.1.18 states that the Maintenance Rule Structures Program is consistent with GALL XI.S6 with several listed enhancements that will be incorporated into the program prior to the period of extended operation. The staff requests that the applicant provide the following information regarding this program:

Verify that the scope of this program includes visual inspection of concrete for aging effects of loss of material, cracking and change in material properties and explain what this program requires for VCSNS concrete structures.

(a) Since the North Berm, an earthen embankment, will be incorporated into the scope of this program, clarify that this program is also completely consistent with all the attributes of GALL XI.S7, RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants.

(b) Since this program is credited for managing aging effects of masonry walls, clarify that this program is also completely consistent with all the attributes of GALL XI.S5, Masonry Wall Program.

(c) Clarify the apparent editorial mistake in the last sentence of the second paragraph of LRA Section B.1.18.1 that states: "…including the protection and support of 0 systems and components."

(d) The commitment to incorporate the enhancements to this program discussed in LRA Section B.1.18 should also be included in the FSAR Supplement, Appendix A, Section 18.2.22. This section does not currently include such a commitment. Issues related to the FSAR supplement are being addressed by the staff on a generic basis.

RAI 3.5-24 The Pressure Door Inspection Program described in LRA Section B.1.20 is included in the discussion column of LRA Table 3.5-2, but is not credited for license renewal in Report TR00170-003, Rev 0, Attachment II: Aging Management Review Results for Structures and Structural Components. The staff requests that the applicant provide the following information regarding this program:

(a) Clearly state the component types and associated structures that credit this program for license renewal.

(b) Attachment II to TR00170-003 credits the Maintenance Rule Structures Program as the aging management program for pressure doors. However, the descriptions of the Pressure Door Inspection Program in LRA Section B.1.20 and Section 7.14 of TR00170-003 do not mention the Maintenance Rule Structures Program. Please clarify the relationship between these two programs and clarify which program is credited for LR aging management of pressure doors.

(c) Under "parameters monitored or inspected" it is stated that "Excessive wear for door appurtenances such as latches, gaskets, hinges, sills, and closing devices are additional attributes in the technical requirements package, but are not credited for license

renewal." However, LRA Appendix A, Section 18.2.24 states that "Pressure door inspection attributes include freedom of movement, function (closed during normal plant operation), structural deterioration, and loss of door/door hardware material." These inconsistencies should be clarified.

(d) Under "monitoring and trending," provide the frequency of inspection for all pressure doors within the scope of this program.

RAI 3.5-25 LRA Section B.1.21 states that the Service Water Pond Dam Inspection Program is consistent with GALL XI.S7 with several listed enhancements that will be incorporated into the program prior to the period of extended operation. The staff requests that the applicant provide the following information regarding this program:

(a) The commitment to incorporate the enhancements to this program discussed in LRA Section B.1.21 should also be included in the FSAR Supplement, Appendix A, Section 18.2.31. This section does not currently include such a commitment. Issues related to the FSAR supplement are being addressed by the staff on a generic basis.

(b) The discussion in LRA Section B.1.21.1 on operating experience does not include the East Dam. Please provide a discussion on the operating experience for the East Dam.

RAI 3.5-26 LRA Section B.1.23 Underwater Inspection Program (SWIS and SWPH), states that the scope of the program includes underwater inspections of both the service water intake structure (SWIS) and the service water pump house (SWPH). Report TR00170-003, Rev 0, Attachment II, states that the Underwater Inspection Program is credited for managing the aging effects for both SWIS and SWPH components for (1) loss of material and cracking in a raw water environment for concrete materials, and (2) loss of material in a raw water environment for steel materials. The concrete components identified in Attachment II include intake bays or canals and reinforced concrete - beams, columns, floor slabs, walls. The steel components identified in Attachment II include intake screens. The staff notes that the discussion column of LRA Table 3.5-2 states that VCSNS uses the Service Water Pond Dam Inspection Program (which is stated to be consistent with GALL XI.S7) inspections only for supplementary review for both the SWIS and SWPH. In order to complete the evaluation of this program, the staff requests that the applicant provides the following information:

(a) It is the staff's position that an effective aging management program for water control structures should incorporate the attributes described in GALL XI.S7. Since the applicant uses the Service Water Pond Inspection Program for supplementary review, the staff requests that the applicant explain which attributes from this program are not used for the inspections performed under the Underwater Inspection Program and provide a technical bases for their omission.

(b) Several aging management program attributes discussed in LRA Section B.1.23 focus mainly on the SWIS. The applicant is requested to discuss the following AMP attributes as they apply to the SWPH components identified in Report TR00170-003, Rev 0, Attachment II:

i. parameters monitored or inspected
ii. monitoring and trending

iii. acceptance criteria
iv. operating experience

(c) With regard to the section on "Detection of Aging Effects," explain what is meant by the expression "attributes associated with aging" for both the SWIS and SWPH.

(d) It is the staff's understanding that the complete scope of the Underwater Inspection Program is performed every five years for the SWIS. Please confirm that the staff's understanding is correct and that the inspection frequency also applies to the SWPH.

(e) The description of the Underwater Inspection Program for the FSAR Supplement in LRA Appendix A, Section 18.2.38 implies that underwater inspections of the SWPH only serve to monitor corrosion and fouling within the Service Water System. If this is not correct, describe how the FSAR Supplement will be modified to reflect the complete scope of this program as it applies to the SWPH. If the scope of the program is limited as the statement implies, explain how the program can be credited for managing the SWPH aging effects discussed in the first paragraph of this request.

(f) The conclusion provided in LRA Section B.1.23.2 states that "the Underwater Inspection Program (SWIS and SWPH) has been demonstrated to be capable of detecting and managing the effects of aging for concrete components in fluid environments." Please clarify why this conclusion omits reference to the aging effects for steel materials such as the intake screens.

RAI 3.5-27 In LRA Section B.3.3, the applicant states that a review of the non-conformances (NCNs) written to address programmatic and problematic deficiencies with the Tendon Surveillance Program indicates that there have been no adverse trends associated with aging that are not inherent to this type of post tensioning system.

The applicant states that a non-conformance (NCN) was identified to address the collection of water due to in-leakage into the auxiliary building tendon sump area to a depth that submerged a tendon end cap. The water level in the pit was reduced to a level below the tendon end cap. During RF-12 the tendon end cap was removed for inspection and no free water was found. Grease samples (analyzed for entrained moisture) and the tendon components (inspected for corrosion) were found to be acceptable. As a corrective action, Operations added the auxiliary building tendon sump area to their trend logs and will request facilities to drain the area if the water level in the area approaches the level of the tendon end cover.

The staff has concerns about the long-term condition of the tendon anchorages if subjected to additional episodes of water infiltration. Such environments could potentially degrade the tendon anchorage system, including anchor components inside the end cap, the baseplate and reinforced concrete region around the anchors. The staff requests the applicant to (1) explain the relationship between the auxiliary building tendon sump area and the tendon access gallery beneath the containment; (2) identify the type of tendon end caps (horizontal, vertical) in the auxiliary building tendon sump area; (3) describe the plant-specific operating experience related to leakage and/or flooding in the tendon access gallery, and identify whether the tendon access gallery is also included in the Operations "trend logs" to prevent excessive water level; (4) indicate whether draining of the auxiliary building tendon sump area is credited for management

of aging of the tendon prestressing system; and (5) discuss why water is allowed to remain in the auxiliary building tendon sump area and only drained if the water level in the area approaches the level of the tendon end cover.

4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

RAI 4.1-1 Table 4.1-1 of the LRA identifies time-limited aging analysis (TLAAs) applicable to Summer. Tables 4.1-2 and 4.1-3 in NUREG-1800 identify potential TLAAs determined from the review of other license renewal applications. The LRA indicates that NUREG-1800 was used as a source to identify potential TLAAs. For those TLAAs listed in Tables 4.1-2 and 4.1-3 of NUREG-1800, that are applicable to PWR facilities and not included in Table 4.1-1 of the LRA, discuss whether there are any calculations or analyses that address these topics at Summer. If calculations or analyses exist that address these topics, discuss how these calculations or analyses were evaluated against the TLAA definition provided in 10 CFR 50.3.

4.3 METAL FATIGUE

RAI 4.3-1 Section 4.3.1 of the LRA indicates that the transients listed in Table 5.2-2 of the FSAR were used in the design of reactor coolant system components at Summer. Section B3.2.1 of the LRA indicates that thermal fatigue transients have been tracked since operation began at VCSNS. Provide the following information for each of the transients monitored at VCSNS:

a. The current number of operating cycles and a description of the method used to determine the number of the design transients from the plant operating history.

b. The number of operating cycles estimated for 60 years of plant operation and a description of the method used to estimate the number of cycles for 60 years.

c. A comparison of the thermal fatigue transients monitored to the transients listed in Table 5.2-2 of the FSAR. Identify any transients listed in the FSAR that are not monitored by the VCSNS Thermal Fatigue Monitoring Program (TFMP) and explain why it is not necessary to monitor these transients.

RAI 4.3.1-2 The Westinghouse Owners Group issued Topical Report WCAP-14577, Revision 1-A, “Aging Management for Reactor Internals,” to address the aging management of the RVI. The staff’s review of WCAP-14577, Revision 1-A identified a number of issues that should be addressed on a plant specific basis. Renewal Applicant Action Item 11 specified in WCAP - 14577, Revision 1-A indicates that the fatigue TLAA of the reactor vessel internals should be addressed on a plant specific basis. In the LRA, SCE&G indicates that the VCSNS ISI program involves monitoring of thermal transients. List the transients that contribute to the fatigue usage for each component listed in Table 3-3 of WCAP-14577, Revision 1-A and discuss how the ISI program monitors these transients.

RAI 4.3.1-3 The Westinghouse Owners Group issued Topical Report WCAP-14575-A, “Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components,” to address aging management of the RCS piping. Tables 3-2 through 3-16 of WCAP-14575-A list RCS components where fatigue is considered significant. The staff’s review of WCAP-14575-A identified a number of issues that should be addressed on a plant specific basis.

Renewal Applicant Action Item 8 requests the applicant to address components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575-A. In the LRA, SCE&G indicates that the VCSNS ISI program involves monitoring of thermal transients. Discuss how the ISI program addresses the components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575-A.

RAI 4.3.1-4 The Westinghouse Owners Group has issued the generic Topical Report WCAP-14574-A to address aging management of pressurizers. The staff's review of WCAP-14574-A identified a number of issues that should be addressed on a plant specific basis. Renewal Applicant Action Item 1 requests the applicant to demonstrate that the pressurizer sub-component CUFs remain below 1.0 for the period of extended operation. Table 2-10 of WCAP-14574-A indicates that the ASME Section III Class 1 fatigue CUF criterion could be exceed at several pressurizer sub-component locations during the period of extended operation. WCAP-14574-A also identified recent unanticipated transients that were not considered in the original ASME Section III Class 1 fatigue analyses, including inflow/outflow thermal transients. Provide the following information:

a. Confirm that the additional transients discussed in WCAP-14574-A, not considered in the original design, have been addressed at Summer.

b. Show the ASME Section III Class 1 CLB CUFs for the applicable sub-components of the Summer pressurizers specified in Table 2-10 of WCAP-14574-A and the corresponding CUFs for the extended period of operation.

c. Discuss the impact of the environmental fatigue correlations provided in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," on the above results.

RAI 4.3.1-5 Section 4.3.1 of the LRA discusses SCE&G's TFMP. The discussion indicates that the program is equivalent to the program described in Section X.M1 of NUREG-1801. The discussion also indicates that the program will be enhanced to incorporate new guidance in EPRI Report, "Materials Reliability Program Guidelines for Addressing Fatigue Environmental Effects in a License Renewal Application (MRP-47)." EPRI Report MRP-47 was submitted to the staff for review by NEI letter dated July 31, 2001. By letter dated November 15, 2002, NEI requested that the staff place the review of EPRI Report MRP-47 on hold. As a consequence, the staff has not endorsed the guidelines in EPRI MRP-47. In order to meet the program described in NUREG-1801, the evaluation of the reactor water environmental effects should address the fatigue sensitive component locations identified in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components." Provide the following additional information regarding the evaluation of reactor water environmental effects:

a. Confirm that the environmental fatigue correlations contained in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," will be used in the evaluation.

b. Describe any enhancements to the TFMP resulting from the guidance provided in EPRI Report MRP-47 and provide the technical justification for these enhancements.

c. Provide the design basis usage factors for each of the six component locations listed in NUREG/CR-6260. Identify the transients that are significant contributors to the CUF at these locations.

RAI 4.3.2-1 Section 4.3.2 of the LRA addresses ASME Section III, Class 2 and 3 piping fatigue. The LRA indicates that the post-accident and nuclear sampling systems at Summer could approach the 7,000 cycle limit during the period of extended operation. Provide the material, the maximum calculated stress range, and the allowable stress limit at the bounding location for each of these systems.

4.5 CONCRETE CONTAINMENT (REACTOR BUILDING) TENDON PRESTRESS ANALYSIS

RAI 4.5-1 Section 4.5 of the LRA indicates that the reactor building tendons are a TLAA, and VCSNS will utilize 10 CFR 54.21(c)(1) - Option (iii) to demonstrate that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. Appendix B.3.3 of the LRA indicates that the Tendon Surveillance Program is consistent with X.S1, Concrete Containment Tendon Prestress, as identified in NUREG-1801. In order for the staff to determine the adequacy of the tendon prestressing force and the TLAA for the period of extended operation, an understanding of the past operating experience for the tendons is needed.

Test results from the first three surveillances indicated that the wire relaxation force losses in the tendon system were greater than the force losses predicted during design (resulting in lower measured prestressing forces). Therefore, in June 1988, the predicted wire relaxation force losses were increased from 8.5% to 12.5%. Then in the fourth period (10th year) tendon surveillance, the vertical tendons were retensioned because the previous surveillance data indicated that the vertical tendon forces would be below the Technical Specifications minimum prior to the fifth period surveillance. Although the fifth period (15th year) and sixth period (20th year) tendon surveillances have been completed, no information was provided regarding the comparison of the measured tendon forces to the predicted lower limit at the 15th and 20th year tendon surveillances. LRA Section 4.5 indicates that, based on trending data and results from previous surveillances, “VCSNS does not currently expect the tendons to provide adequate prestress for 60 years without future retensioning of various members.”

In order to make a reasonable assessment regarding the effectiveness of the TLAA, the staff requests that the applicant provide the following information:

a. Based on the measurements collected to date, provide the plots of the measured lift-off forces and trend lines along with the predicted lower limits and minimum required values for the three sets of tendons (vertical, horizontal, and dome). These curves should reflect the past retensioning of the tendons. Identify whether the guidance in Information Notice 99-10 is implemented.

b. Provide a brief discussion regarding the reason why the tendon wire relaxation values were greater than those used in the design of the tendon system. Are there any unique characteristics of the Summer tendons or containment design that would cause this to occur. If known, describe operating experience at other plants where similar tendon

behavior has occurred.

4.6 CONTAINMENT (REACTOR BUILDING) LINER PLATE, METAL CONTAINMENTS, AND PENETRATION FATIGUE ANALYSIS

RAI 4.6.1 The description of penetrations in Subsection 4.6.3.1 of the LRA indicates that the hot penetrations are sealed on the inside of the containment by a flat plate, welded to both the sleeve and the process pipe at each end of the penetration sleeve. The penetration sleeve is presumably welded to the liner. Provide justification for not evaluating the effects of hot process pipe thermal operating transients and other cyclic loads on potential fatigue of the liner, the hot penetrations, and the process piping at these locations.

AGING MANAGEMENT PROGRAM

B.1.19 Material Handling System Inspection Program

RAI B.1.19-1 The staff's position, as described in GALL Vol. 2 item VII.B.2-a, is that loss of material due to wear on crane rails falls within the scope of license renewal, even though it is caused by active components. The crane rails are passive, long-lived components, and loss of material due to wear is an applicable aging effect. Provide justification for concluding that loss of material due to wear does not require aging management for VCSNS cranes..

RAI B.1.19-2 The LRA is not clear which cranes are covered by this AMP. The only reference to this AMP is from AMR Table 3.3-1, Item 15; however, there are no LRA Section 2 tables that refer to this AMR item. Please clarify the AMR of the cranes, and clarify which cranes use the Material Handling System Inspection Program.

B.1.25 Preventive Maintenance Activities-Terry Turbine

RAI B.1.25-1 The Preventive Maintenance Activities-Terry Turbine description states in LRA Section B.1.25, under element 5 ("Monitoring and Trending"), that "routine periodic visual inspections are conducted…in order to detect age-related degradation and to initiate corrective actions as necessary." Please specify the frequency of these periodic inspections or how the inspection frequency is determined.

B.1.26 Preventative Maintenance Activities - Ventilation Systems Inspections

RAI B.1.26-1 Under *Monitoring and Trending*, the LRA states that "routine periodic visual inspections are conducted…in order to detect age-related degradation and to initiate corrective actions as necessary." Please specify the frequency of these periodic inspections and how the inspection frequency is determined.

RAI B.1.26-2 Under *Monitoring and Trending*, the LRA states that temperatures are trended for the reactor building cooling units (RBCUs). However, *Parameters Monitored or Inspected* and *Detection of Aging Effects* discuss visual inspections and do not mention temperature monitoring. Please clarify how the temperature measurements are used in this program.

B.2.2 Diesel Generator Systems Inspection

RAI B.2.2-1 Under *Operating Experience*, the LRA states that this is a new one-time inspection program for which there is no operating experience; however, plant operating experience should provide information on degradation due to loss of material caused by general corrosion and alternate wetting and drying. Please clarify the operating experience. Identify any degraded conditions of systems within scope of the program that have been experienced (if no degraded conditions have been experienced, so indicate).

B.2.3 Liquid Waste System Inspection

RAI B.2.3-1 The Liquid Waste System Inspection is a one-time inspection program with commitments to follow-up actions based on engineering evaluation of inspection results. This a reasonable approach. However, the applicant has stated that the liquid waste processing system components are exposed to unmonitored and uncontrolled borated water, and that the system is used frequently. In addition, this is a new program for which there is no operating experience. There is a potential for high concentrations of impurities in the water, and the condition of the system is unknown. For these reasons, the staff is concerned with the adequacy of the AMP for managing the aging effects of the components with this combination of material and environment and the lack of operating experience. In light of the above, justify the use of a one-time inspection for the liquid waste system components.

RAI B.2.3-2 Under *Operating Experience*, the LRA states that this is a new one-time inspection program for which there is no operating experience; however, plant operating experience with this system should provide information on any age-related degradation. Please clarify the operating experience with this system. In particular, Provide operating history on the occurrence of crevice, pitting, and stress corrosion cracking in the nuclear plant drains (ND) system and the liquid waste processing system (WL) to justify the use of a one-time inspection for the liquid waste system components.

B.2.5 Reactor Building Cooling Unit Inspection

RAI B.2.5-1 The Reactor Building Cooling Unit Inspection program description in LRA Section B.2.5, Element 3, *Parameters Monitored or Inspected*, states that the parameters inspected include visual evidence of loss of material, cracking, or other age-related degradation. Explain how visual inspection can provide information about cracking at the inside surface of piping.

RAI B.2.5-2 LRA Section B.2.5, Element 5, *Monitoring and Trending*, states that no actions are taken as a part of the reactor building cooling unit inspection to trend inspection results. The NRC staff notes that the evaluation of appropriateness of the techniques and timing of the one-time inspection improve with the accumulation of plant-specific and industry-wide experience. As a result of the insights gained from the recent discovery of boric acid-induced corrosion of the Davis-Besse vessel, address the changes that may be made in monitoring and trending (considering that certain components, although stainless steel, are exposed to unmonitored borated water environment) in response to the Davis-Besse event. Clarify that when inspection results reveal degraded conditions (even from a different system), additional inspections addressed in element 7 ("Corrective Actions") form the basis for future monitoring and trending actions. Also identify to what extent, if any, the boric acid corrosion AMP is

integrated with the reactor building cooling unit inspection.

RAI B.2.5-3 LRA Section B.2.5, *Operating Experience*, states that the inspection is a new one-time inspection for which no operating experience exists. Provide operating experience relative to leaks or degradation in the reactor building cooling unit drain piping and drain pan. If no leaks or degradation have been experienced, so indicate.

B.2.6 Service Air System Inspection

RAI B.2.6-1 The Service Air System Inspection program description in LRA Section B.2.6, under Element 2, *Preventive and Mitigative Actions*, states that there are no preventive or mitigative actions taken as part of this program. The staff notes that accepted industry guidance and the GALL recommend preventive monitoring of system air quality to ensure that oil, water, rust, dirt, and other contaminants are kept within specified limits. The air quality needs to be maintained because instruments and components may not function properly if the air is contaminated, and the presence of oil or contaminants in the air can impact the rate and types of aging degradation. Describe the monitoring of air quality as it relates to corrosion and degradation of the steel components within the scope of this program.

RAI B.2.6-2 LRA Section B.2.6, *Operating Experience*, states that this program consists of is a new one-time inspection for which no operating experience exists. Discuss the operating experience with the service air system, service air and building services systems, building services system, or instrument air system as it relates of aging degradation of these systems. For example, provide operating experience related to leaks or degradation in the service air system (re: GL 88-14). If no leaks or degradation have been experienced, so indicate.

B.2.8 Waste Gas System Inspection

RAI B.2.8-1 LRA Section B.2.8, under *Operating Experience*, states that the inspection is a new one-time inspection for which no operating experience exists. Discuss the operating experience with the gaseous waste processing system as it relates of aging degradation of these systems (such as leaks or degraded conditions related to aging).

B.2.11 Inspections for Mechanical Components

RAI B.2.11-1 The Inspections for Mechanical Components description in LRA Section B.2.11, under *Program Scope*, states that the relevant aging effect of loss of material is due to galvanic, general, and pitting corrosion. However, the inspections for mechanical components program does not mention MIC, even though the program is credited with the management of loss of material due to MIC in Table 3.3-1, Item 5. Clarify if the inspections for mechanical components applies to evaluating MIC or if some other aging management program addresses loss of material due to MIC.

RAI B.2.11-2 LRA Section B.2.11, Element 3, *Parameters Monitored or Inspected*, states that the external surfaces of components fabricated of carbon steel, low-alloy steel, and other susceptible materials are inspected for loss of material or cracking. Expand the description of the program to provide the technical basis for the selection of the component external surfaces to be inspected.

For example, are these visual examinations conducted on an opportunistic basis? Are these external surfaces already exposed and accessible to visual examination during normal operation, or do they include external surfaces at susceptible locations that are exposed to visual examination due to targeted planned actions such as equipment disassembly, insulation removal, etc., that may or may not involve suspension of normal operation? If the second group of surfaces is excluded from the AMP, provide the basis. In addition, provide the technical basis for determining how many and what additional component external surfaces are to be inspected if unacceptable degradation is observed in the representative components.

RAI B.2.11-3 Inspections for mechanical components is a new plant specific program with no mention of the qualifications of personnel performing the mechanical inspections. NUREG-1800 section A.1.2.3.6 indicates that qualitative inspections should be performed to same predetermined criteria as quantitative inspections by personnel in accordance with ASME Code and through site specific programs. For example, NUREG-1801 section XI.M.32 for one time inspection indicates that combinations of NDE are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR50 Appendix B. Define the qualifications of inspection personnel.

RAI B.2.11-4 LRA Section B.2.11, Element 5, *Monitoring and Trending*, states that the inspections will be performed and documented in accordance with station procedures and, following baseline inspection, the frequency of inspections will be determined based on inspection results and industry experience. Provide the schedule for the baseline inspection.

Editorial Comment: LRA Section B.2.11, Element 7, *Corrective Actions*, states, "If the results of the inspections for mechanical components are not acceptable, as determined by the engineering evaluation, then corrective actions are taken to repair or replace the “effective components." Should this read "affected" components?

RAI B.2.11-5 LRA Section B.2.11, under *Operating Experience*, states that the inspection is a new inspection. The applicant states that there is VCSNS relevant operating experience with the identification of pitting below the insulation in the chilled water system, which was detected and repaired under existing inspection activities, and that several instances of leakage in the chilled water system have been identified by surveillance procedures. Discuss any additional related operating experience relevant to the systems within scope or confirm that this is the only system in the scope of this program with observed degraded conditions.

RAI B.2-11-6 LRA Table 3.3-1, Item 5 credits the Inspections for Mechanical Components program for managing loss of material of the chilled water expansion tanks. GALL Program XI.M29 addresses aboveground carbon steel tanks including inaccessible areas, but the LRA does not include this program. Describe how the Inspections for Mechanical Components program addresses aboveground carbon steel tanks, including inaccessible locations, and other elements addressed in XI.M29.

RAI B.2-11-7 The AMP 2.11, Inspection for Mechanical Components, a new plant specific program, with no NUREG-1801 parallel, is credited for managing loss of material due to general corrosion and crack initiation and growth due to cyclic loading and SCC of the carbon and alloy steel component/component types and inherently addresses their closure bolting in the auxiliary (AS) and the steam and power conversion (SPC) systems. In Table 3.2-1, AMR Item12 (ESF);

Table 3.3-1, AMR Item 23 (AS); and in Table 3.4-1, AMR Item 8 (SPC); the applicant states that the specific bolting/fasteners materials within the scope of license renewal were not itemized as a separate Non-Class 1 component/component types. Rather, bolting was treated as "piece-part" (or sub-component/sub-part) of Non-Class 1 components/component types.

The staff notes that NUREG-1801 credits AMP XI.M 18 Bolting Integrity for monitoring loss of material, cracking, and loss of preload. In addition, accepted bolting integrity programs (such as EPRI 104213) recommend monitoring for loss of preload as one of the parameters monitored/inspected. Monitoring for cracking of high strength bolts (actual yield strength equal or greater than 150 ksi) is also recommended.

As such, the applicant is requested to provide the following information:

a. Identify the AMP that will manage the aging effects for ESF closure bolting (Table 3.2-1, AMR Item 12).
b. Justify how the AMPs credited in the VCSNS LRA for bolting are consistent with the Bolting Integrity AMP.
c. Provide justification for concluding that loss of preload is not an applicable aging effect.
d. Are there any high strength bolts included within the boundary of these three systems (Engineered Safety Features, Auxiliary, and Steam & Power Conversion Systems)?

B.2.12 Heat Exchanger Inspections

RAI B.2.12-1 The Heat Exchanger Inspections (HEI) program is credited in LRA Section B.2.12 with detecting and characterizing loss of material due to selective leaching and erosion-corrosion, as well as heat exchanger fouling due to particulates, for heat exchanger components in a treated water environment. Provide information regarding management of galvanic corrosion of heat exchanger tubes.

RAI B.2.12-2 LRA Section B.2.12 states that the HEI program is a one-time inspection. For all heat exchanger components in the component cooling water system subject to aging effects for which the Chemistry Program (CP) and the HEI are applicable AMPs, discuss whether both AMPs are used together to manage all applicable aging effects. The LRA is unclear on this point because the CP explicitly exempts one-time inspection, but the LRA states that HEI is consistent with GALL Programs XI.M32 and XI.M33. Discuss whether the HEI is used to verify the effectiveness of the CP for the applicable aging effects.

RAI B.2.12-3 LRA Section B.2.12, Element 4, *Detection of Aging Effects*, states that a combination of proven volumetric and visual examination techniques will be used at sample locations in the various heat exchangers determined by engineering evaluation to be most susceptible to the applicable aging effects. The LRA states that if no parameters are known that would distinguish the susceptible locations, sample locations will be selected based on accessibility and radiological concerns, and the results will be applied to the associated components. Discuss how the results of sampling would be taken into account for any future inspections (monitoring).

RAI B.2.12-4 LRA Section B.2.12, Element 6, *Acceptance Criteria*, states that the acceptance criteria are no unacceptable loss of material or heat exchanger fouling that could result in a loss of the component intended function(s) as determined by engineering evaluation. Elaborate on

the acceptance criteria applied in the engineering evaluation and explain how a determination of no unacceptable loss of material or cracking of subject components can be made on the basis of a one-time inspection with consideration to the rate of damage.

RAI B.2.12-5 LRA Section B.2.12, *Operating Experience*, states that this is a new one-time inspection for which no operating experience exists. Comment on any relevant operating experience for the systems that will be managed by this program.