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February 14, 1997

BGE

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Response to Request for Additional Information; Baltimore Gas and Electric Company's Integrated Plant Assessment Systems and Commodity Reports

REFERENCES:

(a) Letter from Mr. S. C. Flanders (NRC) to Mr. C. H. Cruse (BGE), dated August 30, 1996, Request for Additional Information Regarding the Baltimore Gas and Electric Company Integrated Plant Assessment Systems and Commodity Reports Submitted May 22, 1996

(b) Letter from Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated May 22, 1996, Request for Review and Approval of License Renewal IPA System and Commodity Reports

This letter forwards our responses to 248 questions contained in Reference (a). We are pleased with the results of our discussions that have taken place as part of your review of Reference (b). We believe real progress was achieved in developing and approving the template at the September 11, 1996 and January 9, 1997 NRC/BGE management meetings. Also as a result of the discussions, we have concluded that we understand the basis for the editorial comments (questions 249 through 283). As we have discussed with you, we will not respond to them in writing. In future correspondence, we will strive to address the issues the editorial comments raise. We look forward to discussing these responses with you in February 1997.

Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

CHC/JMO/dlm

Attachment As stated

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ATTACHMENT

BALTIMORE GAS AND ELECTRIC COMPANY
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION;
INTEGRATED PLANT ASSESSMENT SYSTEMS AND COMMODITY REPORTS

Calvert Cliffs Nuclear Power Plant
February 14, 1997

DIESEL FUEL OIL (Questions 1 - 25)

1. Section 5.3.2, of the Diesel Fuel Oil (DFO) System Integrated Plant Assessment (IPA) System and Commodity Report (Appendix A, Attachment 1 of letter from BGE to NRC, dated May 22, 1996) indicates the scope of the DFO System covers the fuel oil storage tanks (FOSTs) to the strainer at the diesel generator fuel oil transfer pumps. Clarify whether the scope of the report includes this strainer. Also, discuss where the remaining components required for delivering fuel oil to the diesel generators, such as fuel oil transfer pumps and day tanks, will be reviewed for aging management for renewal.

Response

The DFO System AMR report includes the piping up to but not including the suction strainer for the fuel oil transfer pumps. The fuel oil transfer pump suction strainer, the transfer pumps themselves, and the day tanks are evaluated as part of the emergency diesel generator system AMR report. The license renewal (LR) technical report will clearly describe this interface when it is revised per the guidance in the LRA template. Note that throughout this response, "LRA template" means the BGE template approved in a meeting summary by S. C. Flanders (NRC), dated September 23, 1996.

2. Section 5.3.2 of the IPA report indicates that the fuel oil unloading station is within the scope of LR (WSLR). Provide a description of the unloading station, its components, intended function(s), and any additional plausible aging effects.

Response

The fuel oil unloading station is included in the Fire Protection Commodity Evaluation Report because this portion of the system is only WSLR because of a fire protection function. The LR technical report will provide a discussion of any structures and components (SCs) within the conceptual boundaries that are covered by a separate Aging Management Review (AMR)/Commodity Evaluation Report, e.g., Fire Protection Commodity Evaluation Report. This is per the guidance in the Baltimore Gas and Electric Company (BGE) License Renewal Application (LRA) template.

3. Section 5.3.2 of the IPA report indicates that "certain DFO System equipment supports the fire protection function" and were addressed in commodity evaluations of fire protection equipment. Describe which portion of the DFO System is necessary to perform the fire protection intended function, and whether it is covered within the specified scope of the report for renewal. Also, describe the equipment within the scope of the DFO System report that was addressed in the Fire Protection Commodity Evaluation Report.

Response

The portions of the system used only to deliver fuel to the diesel-driven fire pump are the portions which are WSLR only for a fire protection intended function. The LR technical report will provide a discussion of any SCs within the conceptual boundaries that are covered by a separate AMR/commodity evaluation report, e.g., Fire Protection Commodity Evaluation Report. This is per the guidance in the BGE LRA template.

4. Section 5.3.2 of the IPA report describes the boundary of the mechanical portion of the system WSLR. However, there is no description of the boundary of the electrical and instrumentation and control portions of the system WSLR. Provide such a description.

Response

The electrical equipment in the DFO System is listed component by component in the component level scoping results for this system, and this information is maintained onsite. This electrical equipment includes fuses, hand switches, level switches, motors, relays, transformers and indicating lamps. Some of these devices (fuses, hand switches, motors, relays, transformers and indicating lamps) were determined to only contribute to active functions during the pre-evaluation process and, therefore, are not described in the LR technical report. Level switches were determined to also contribute to a passive function, but are addressed in the Instrument Lines Commodity Evaluation Report.

5. Section 5.3.2 of the IPA report indicates that there is no plausible aging effect for the tank bottom external surfaces based on "design features." However, the cited "design features" include coating, cathodic protection, and sealing, which the staff would consider as programs to manage aging effects. Identify the plausible aging effects which would be managed for renewal.

Response

The DFO tank bottoms are protected from potential aging mechanisms by several design features; a galvanic coating, weld seam strips, perimeter sealing, and an impressed current cathodic protection system. The tank bottoms are also protected by an oil soaked compacted sand external environment, being located above ground water level, and in the case of the No. 21 FOST, a concrete enclosure. Baltimore Gas and Electric Company does not consider these design features to be aging management programs. The design features perform three functions:

- Directly protect the bottom of the tank (coating, weld strips) — These passive design features are in a weather-protected, benign environment. They were specified to provide corrosion protection based on industry experience. They are necessarily a maintenance-free design feature, since it is not practical to inspect or maintain tank bottom exteriors. The degradation of the protective properties of these features would not result in significant corrosion of the tank bottoms given the other protective features (i.e., the oil soaked sand, perimeter seal, cathodic protection, being above ground water, and the protection from weather provided by the No. 21 FOST concrete enclosure). Therefore, these design features are not subject to AMR. The AMR report documents the fact that these features are relied upon as part of the AMR. Current site processes will be adjusted, as needed, to ensure that the role that these design features play in the non-plausibility determination are considered during future modification and maintenance activities.

- Prevent water from getting under the tank (perimeter seal) — The perimeter seal, which prevents water from getting under the edge of the tanks, can deteriorate due to weathering. This feature has now been evaluated as part of the DFO AMR (as a subcomponent of the tank).

- Provide cathodic protection — This design feature is active (i.e., it provides protection only when operating). The system is tested quarterly and adjusted to provide the optimal protection for the serviced components. The system is normally not permitted to be out-of-service for more than 60 days. However, the failure of the system to operate will not cause or allow significant corrosion of the tank bottom in the short term. Therefore, this design feature is not subject to AMR. The AMR report documents the fact that this system is relied upon as part of the AMR. Current site processes will be adjusted, as needed, to ensure that the role that these design features play in the non-plausibility determination are considered during future modification and maintenance activities.

6. Table 2-1 of the DFO AMR report (Appendix A, Attachment 1, Enclosure 1, to the May 22, 1996, letter) indicates that there are strainers, fuses, transformers, and indicating lamps in the DFO System that are WSLR. However, Table 3-2 of the AMR report indicates that these components do not support any passive functions and are not included in the AMR for renewal. Title 10 CFR 54.21(a)(1)(i) requires SCs that perform an intended function without moving parts or without a change in configuration or properties to be subject to an AMR for renewal. Discuss the technical bases for not including these components in the AMR.

Response

There are two separate responses for this question:

a. Strainer — This component is part of the DFO unloading station. The unloading station only contributes to the fire protection function of the system. Therefore, its passive pressure retaining function is covered in the Fire Protection Commodity Evaluation Report. It has no passive functions that need to be addressed by the DFO AMR report. Table 3-2 will be clarified to ensure these points are more understandable.

b. Other electrical components (fuses, transformers, indicating lamps) — The Statements of Consideration to the LR Rule (60FR22476 and 60FR22477) state that the Commission reviewed several industry concept of "passive" and determined that they do not accurately describe the SCs that should be subject to AMR for LR. Accordingly, the Commission developed a description of "passive characteristics" of SCs and incorporated these characteristics into the IPA process to avoid the creation of a new term "passive." The guidance provided in the Statements of Consideration is summarized below:

   1) Passive components do not exhibit moving parts;
   2) Passive components do not exhibit a change in configuration or properties;
   3) "Change in configuration or properties" should be interpreted to include "a change in state.";
   4) Passive components do not have performance and condition characteristics which are readily monitorable; and
   5) Detrimental effects of aging on passive components are not readily monitorable.

Based on this guidance, BGE has determined that the fuses, transformers and indicating lights are not passive for the following reasons:

- Fuses are active components, per Responses 6.b(2) and 6.b(3) above, since their intended function involves a change in configuration or a change in state of the fuse. The intended function of fuses is to interrupt power in the case of a fault in a load in order to protect the rest of the electrical circuit. This function involves a change in configuration since the fuse physically changes from a closed conducting circuit to an open non-conducting circuit. In accordance with Response 6.b(4) above, this change of state is readily detectable by its effect on the fused circuit.

- Transformers are considered to be active components per Response 6.b(2) above since they perform their intended function through a change in configuration. The function of transformers WSLR is to step down voltage from a higher to a lower value, or to provide isolation of a load. In either case, electrical energy is changed to magnetic energy and back to electric energy from the primary through the core to the secondary windings of the transformer. Per Response 6.b(5) above, any degradation of the transformer's ability to perform its intended function is readily detectable by a change in the performance of the transformer and the associated circuits.

- Indicating lights are active per Response 6.b(3) above because they perform their intended function by a change in state; i.e., when energized with sufficient voltage, they display readily detectable visible light, per Response 6.b(4) above.

All electrical equipment contributes to maintaining continuity of electrical circuits, in addition to performing its other intended function(s). Baltimore Gas and Electric Company does not believe that components should be considered passive because they contribute to maintaining electrical continuity of a circuit. Changes in a circuit's ability to maintain electrical continuity are readily detectable from existing monitoring equipment associated with the circuit (e.g., ground detection, voltmeters, active performance of the equipment in the circuit). This belief is supported by the fact that many electrical components, which do contribute to maintaining electrical continuity, in addition to performing other intended functions, were specifically excluded from AMR by the LR Rule, e.g., motors, switchgear, transistors, switches, circuit boards, power supplies and others.

Note that for electrical devices, the electrical continuity function is a prerequisite to the active electrical function. A loss in continuity will be apparent because of the readily detectable effect of the continuity loss on active performance. For example, loss of fuse electrical continuity will result in associated circuit shutdown. In contrast, the pressure retaining function of piping is the primary function of that piping. Degradation of this primary function may not result in readily detectable losses in associated system active functions until degradation becomes serious.

7. Tables 2-1 and 3-2 of the AMR report identify a "pump" as being WSLR, but is not included in the AMR because the "pump" does not support a passive function. However, pump casings do provide a passive intended function to maintain the pressure boundary, and 10 CFR 54.21(a)(1)(i)

specifically requires pump casings to be evaluated. Describe this "pump" and explain how pump casings are covered with respect to AMR.

Response

The pressure retaining portion of the unloading pump is covered in the Fire Protection Commodity Evaluation Report. Aging management review report, Table 3-2, will be revised to clarify that this component contributes to a passive function, which is evaluated in a commodity evaluation.

8. Table 3-1 of the AMR report states an intended function of the DFO System as, " . . . (includes isolation of nonessential auxiliary boiler and SBO diesel fuel oil)" and indicates that this is not a passive function. Although the valve closure to isolate these other components may be an active function, the associated piping and valve body for achieving that isolation serve a passive pressure boundary function. Describe which portion of the DFO System is necessary to perform this function, and whether it is covered within the specified scope of the report for renewal.

Response

Table 3-1 of the DFO AMR includes a system function titled, "To maintain the pressure boundary of the system liquid," which is passive. Components associated with isolation of the auxiliary boiler supply header and isolation valves for the station blackout (SBO) DFO components are evaluated in the DFO AMR, because these components also support this passive function.

9. Attachment 5 (pipe: 023-HB-02) of the DFO AMR report indicates that although the buried piping is subject to corrosion, it is not subject to stress corrosion cracking (SCC). However, buried piping has experienced SCC. Clarify whether the buried DFO piping is also subject to SCC.

Response

The reasons SCC is not plausible for the DFO buried piping are explained in Attachment 6, Code 8, as follows: The material is mild carbon steel with a minimum specified yield strength of approximately 35 ksi, which is normally not affected by SCC. Most of the pipe is protected by a coating. Stress corrosion cracking can only occur locally at holidays *[where coating degradation has occurred]*. Industry experience and testing show SCC is less likely to occur when yield strengths are low, and almost never occurs for materials with this low of a yield strength. Given the design pressure of 35 psig and the maximum system operating pressure of 25 psig, the piping hoop stresses are negligible (approximately 350 psi). Based on these conditions, the age-related degradation mechanism (ARDM) is considered not plausible for pipe externals.

10. Attachment 6 (pipe, valve, tank) of the DFO AMR report indicates that hydrogen damage is not a concern for bolting material because the minimum specified yield strength is low. Also, it indicates that the bolting material is resistant to SCC. However, NUREG-1339, which is the basis for resolving Generic Safety Issue (GSI)-29, "Bolting Degradation or Failure in Nuclear Power Plants," indicates that bolting material may have an actual strength far exceeding the minimum specified value, and recommends the use of actual measured yield strength for evaluating susceptibility to SCC. Discuss the susceptibility of the bolting material to hydrogen damage and SCC based on the actual measured yield strength.

Response

The concern of bolting being manufactured with yield strengths well above the specified minimum strength is an industry issue which was raised and closed by the NRC. Generic Safety Issue-29 raised several bolting issues in the early 80s. The industry response to GSI-29 is contained in Electric Power Research Institute (EPRI) NP-5769 Volumes 1 and 2, and the Good Bolting Practices reference manuals. NP-5769 shows that most of the industry bolt failures were due to SCC. A few of these cases implicated improper heat treatment or high hardness/tensile strengths in the failure. The report statistically analyzes field hardness measurements of low alloy quenched and tempered (LAQT) bolting materials. The report shows that the common A193 B7 bolting material is rarely provided with sufficiently high tensile strength to be a SCC concern, that materials with specified minimum tensile strengths <150 ksi may be screened from SCC evaluations, and that a generic concern for all LAQT materials does not seem warranted. The NRC review of the industry response (NUREG-1339) indicates that experimentally measured tensile strength (or hardness) should be used as the basis for SCC screening rather than specified minimum tensile strengths (or hardness). Generic Letter 91-17 closes GSI-29 based on existing NRC bulletins and generic letters related to bolting issues (some of which require formal responses), and actions taken in response to the industry initiatives. No written response was required by Generic Letter 91-17. Given that Calvert Cliffs Nuclear Power Plant (CCNPP) has responded satisfactorily to NRC bulletins and generic letters relating to bolting issues, without committing to hardness testing of LAQT materials, this issue is considered closed.

However, if the DFO LAQT bolts were supplied overly hard, the bolts are still not susceptible to age-related degradation due to hydrogen damage or SCC based on environment. The painted bolting materials are normally exposed to atmospheric air (not to corrosive fluids), and are at low temperatures. These conditions are not conducive to SCC. Hydrogen damage requires a source of mono-atomic hydrogen, which is not available in sufficient concentration or pressure at the surfaces of the DFO bolts. Additionally, even if an environment conducive to SCC or hydrogen damage were present and the DFO LAQT bolts were supplied overly hard, industry experience with this mechanism shows that it would have manifested itself relatively soon after installation, rather than after many years, and the resultant cracking would have been discovered by system engineer walkdowns. Therefore, based on all of the factors discussed above, these mechanisms are considered not plausible for DFO bolting.

11. Attachment 6 (pipe, valve) of the DFO AMR report indicates that general corrosion (wastage) and SCC are not plausible for bolting. However, alloy steel bolting is subject to general corrosion and may also be subject to SCC. In addition, a bolted joint could develop leakage exposing the bolts to a wet environment. Discuss the susceptibility of the bolting to wastage and SCC.

Response

Based on the discussion in the response to Question 10 above, SCC is not plausible for alloy steel bolting.

With respect to the bolting being exposed to a wet environment from leakage, the AMR does not consider leakage from the system to be the normal environment for this system; therefore, this environment is not the one evaluated for the aging of the these bolts. Any leakage would not be allowed to continue for extended periods of time and, therefore, affect the aging of the bolts.

Additionally, the leaking fluid would be treated fuel oil, which is not corrosive to alloy steel bolting.

With respect to general corrosion of the alloy steel bolting, the AMR will be modified to show that this ARDM is plausible due to a potentially moist environment external to the system. Aging management of the bolting will consist of the activities already discussed under corrosion of external surfaces.

12. Attachment 6 (pipe, valve, tank) of the DFO AMR report indicates that stress relaxation of bolting is not plausible because of low temperature. However, the loss of preload in bolting may be caused by other factors, such as mechanical vibration. Discuss the susceptibility of bolting to loss of preload.

Response

Stress relaxation is defined on the Potential ARDM List as a high temperature ARDM. This ARDM is not plausible for the DFO System. Loss of bolt preload due to vibrations is different from stress relaxation. Such a loss of preload could reflect an installation deficiency, improperly designed joint or improperly designed piping system, not an aging mechanism.

13. Attachment 6 (tank) of the DFO AMR report indicates that the anchor bolts evaluation discussed in the "Storage Tank #21 Enclosure" report is judged to be applicable to that of Tank #11. However, Tank #21 is located inside a building structure, while Tank #11 is located outside. Discuss the basis for the indicated applicability determination.

Response

No credit is taken for the protection of the enclosure during the No. 21 FOST aging evaluation. Corrosion of the embedded portion of the anchor bolts is considered non-plausible based on concrete quality (i.e., pH and water impermeability). Therefore, the anchor bolt evaluation applies to both tanks.

14. Attachment 6 (pipe, valve) of the DFO AMR report indicates that general, crevice, and pitting corrosion are not plausible for the internal surfaces of DFO System piping and valves. However, existing literature indicates a corrosion rate of between 0.002 and 0.020 inch per year for carbon steel exposed to diesel fuel (Reference: P. A. Schweitzer, "Corrosion Resistance Tables," Marcel Decker, Inc., New York, 1986). Provide additional assessment of the applicability of corrosion to the internal surfaces of these components.

Response

Schweitzer addresses "diesel fuel" as a generic environment compared to carbon steel. It does not discuss the specific condition of the DFO (i.e., water content, corrosion inhibitor content, etc.). Matrix code A on Attachment 6 for pipes presents the fuel oil conditions specific to CCNPP, which includes dry fuel oil with FOA-15 (which includes a corrosion inhibitor) added. Fuel oil is not a corrosive environment for carbon steel per Petroleum Processing Handbook, Bland and Davidson, McGraw Hill Book Co. This reference indicates that such petroleum products result in excellent corrosion resistance of all forms of steel, alloy steel and stainless steel. This conclusion

is also supported by experience with the system at CCNPP which shows that filter clogging due to corrosion products does not occur.

15. Attachment 6 (tank) of the DFO AMR report states, "The embedded portion of the anchor bolts has been evaluated to be adequately protected from corrosion by the quality of the concrete . . ." However, concrete cracks and would expose the anchor bolts to corrosion. Provide additional discussion on corrosion of anchor bolts.

Response

Any concrete cracking that is sufficient to allow corrosion of embedded anchor bolts would be discovered by programs described under the component supports commodity evaluation and corrected before it could impact the ability of the bolting to perform its intended function.

16. Attachment 7 (pipe, valve, tank) of the DFO AMR report states, under rubber degradation, "Rubber can be used in specific applications of this device type" (DT). However, Attachment 6 of the AMR report does not indicate the presence of rubber material. Clarify whether rubber is used in the system WSLR.

Response

The intent of Attachment 7 is to ensure that a common set of aging mechanisms is considered for similar DTs across multiple systems. This "Potential ARDM List" statement says that some piping, valves and tanks have rubber liners. Attachment 6 makes a specific statement about the DFO System. No rubber components or subcomponents were evaluated in the AMR for DFO.

17. Section 8.4.1 of the plant Updated Final Safety Analysis Report (UFSAR) states, "In the event of a failure of No. 21 FOST, fuel can be supplied to the emergency diesel generators from the concrete structure by way of a non-safety-related line." Discuss whether this particular line is subject to AMR for LR.

Response

All CCNPP systems, structures, and components (SSCs) which satisfy §54.4(a)(2) scoping criterion are classified as SR at Calvert Cliffs. As noted in the CCNPP IPA Methodology, Revision 1, Section 3.3.1 (page 19) "the scoping is performed consistent with the CCNPP Q-List *[Quality List]* Design Standard which was developed with the intent of identifying a similar scope of SSC to that defined by the first two criteria of §54.4." Therefore, the NSR building drain line which serves as an emergency fuel oil suction for the diesel generators in the event of a No. 21 FOST rupture is not in the scope of LR.

18. Section 8.4.1 of the plant UFSAR describes standpipes inside the FOSTs to provide exclusive fuel reserves for the emergency diesels. Discuss whether the standpipes are subject to AMR for LR.

Response

The AMR and LR technical report have been revised to include the standpipe since this subcomponent does contribute to the tank's passive function.

19. Provide a simplified diagram of the DFO System in the IPA System and Commodity Report indicating the portion of system WSLR. Also indicate the portion of the system that is buried or inside a building.

Response

The revised LR technical report will ensure that the portion of the DFO System WSLR is clearly described, as well as those portions that are buried or inside a building. If a diagram is needed for clarity, it will be included.

20. Discuss relevant operating experience with the DFO System related to aging.

Response

As agreed to in the BGE template discussions, the revised LR technical report will discuss relevant operating experience of DFO System aging.

21. Discuss the Code classification of the components addressed in the report, that is, American Society of Mechanical Engineers (ASME) Code Class 1, 2, 3, or non-Code class which is described in the plant inservice inspection (ISI) program. In addition, although Section 8.4.1 of the plant UFSAR indicates that the FOSTs are Seismic Category I structures, there is no information on the piping. Discuss if the DFO System piping is designed to withstand severe loading, such as seismic or missiles.

Response

Diesel fuel oil piping in the AMR is ASME non Class, with respect to ISI. Its design code is B31.1. The portions of the DFO System which are SR will be described in the revised LR technical report. These portions have had a seismic analysis performed on them. Piping in the No. 21 FOST Enclosure is protected against tornado produced missiles, tornado winds, and the impact of a falling transmission tower. Piping from No. 21 FOST to Nos. 1B, 2A, and 2B Emergency Diesel Generators is underground or in underground valve pits.

22. Discuss whether providing fuel oil to the SBO diesel is an intended function of the DFO System because SBO is WSLR in 10 CFR 54.4. If this is an intended function, describe which portion of the DFO System is necessary to perform this function and whether it is covered within the specified scope of the report for renewal.

Response

Isolating the fuel line to the SBO diesel is an intended function of the DFO System. The portion of the system which is in scope for this function will be shown clearly on the diagram in the revised LR technical report. The SBO diesel day tank is sized to allow operation of the SBO diesel for the entire coping duration. Therefore, providing fuel to the SBO diesel is not an intended function.

23. Because part of the piping is buried, assess the potential effects of ground settlement over time on buried piping.

Response

Settlement of the ground over the DFO buried pipe is not a LR aging issue since any settlement would occur shortly after construction, not in the 40- to 60-year period.

24. Small fabrication flaws may exist in fabricated components, such as at weld joints. These small flaws may grow in size during plant service from mechanisms such as fatigue, corrosion, and SCC. The resulting cracking or loss of material should be managed for renewal. Discuss the applicability of cracking and loss of material in fabricated components for renewal.

Response

Small fabrication defects that are below the detection limits of pre-service examination procedures are present in any steel structure, including those fabricated to ASME Code Section III requirements. These defects should not be referred to as flaws, since that terminology is limited to defects of a size that exceed acceptance criteria [see definition IWA 2110(d), ASME Section XI, 1983 Edition]. Therefore, there are no fabrication flaws in weld joints, by definition, unless they are undetected by pre-service and in-service examination. Fatigue and SCC were determined to be not plausible in the DFO AMR. General corrosion does not result in cracking. The aging management programs credited ensure the loss of material resulting from general corrosion does not impact intended function.

25. Socket welds have experienced failure due to vibrations. Also, socket welds may be susceptible to corrosion or SCC because of the crevice geometry. If socket welds are used in this system, discuss the applicable aging effects on socket welds for renewal.

Response

Socket welds are used in vents and drains and in small branch lines to the emergency diesel generators' transfer pumps. Discussions with operations and test personnel indicate no history of vibratory issues with the DFO System.

The fluid in this system is DFO treated with a corrosion inhibitor, and maintained to contain less than 0.05% water. This is not a fluid conducive to crevice corrosion or SCC.

RADIATION MONITORING (Questions 26-78)

26. Section 5.7.1 of the Area and Process Radiation Monitoring IPA System and Commodity Report (Appendix A, Attachment 2, to the May 22, 1996 letter) includes a boundary description of the Radiation Monitoring System (RMS) that does not provide sufficient detail for the staff to determine the full extent of components WSLR. Simply stating the components that comprise the system is insufficient. A more detailed discussion of system interfaces and of the system itself is needed in the application. Provide this information for both the mechanical and electrical components.

Response

A more complete discussion, consistent with the BGE LR technical report template, will be provided in the revised LR technical report.

27. Section 5.7.1 of the IPA report, second paragraph, states that "some" components associated with the Control Room Ventilation, Service Water, and Component Cooling Systems will be addressed during review for that particular system. Identify which components associated with the above systems were reviewed with the RMS, and which components are evaluated with the other systems.

Response

Consistent with the BGE LR technical report template, the revised LR technical report will provide this discussion.

28. Section 5.7.1 of the IPA report lists specific radiation monitors of the RMS that are WSLR. However, the RMS is an extensive system, as described in Section 11.2.3 of the UFSAR. Discuss the specific intended function(s) of the RMS and why only the specific radiation monitors are required to perform the intended function(s). Specifically, identify the radiation monitors and associated SCs, such as piping and valves, etc., that are SR [10 CFR 54.4(a)(1)], those that are NSR that affect SR [10 CFR 54.4(a)(2)], and those that are relied on in regulated events [10 CFR 54.4(a)(3)].

Response

Consistent with the BGE LR technical report template, the revised LR technical report will provide more discussion in this area. As discussed during template interactions, CCNPP documentation does not distinguish between SR components and components that could fail and prevent SR components from performing their intended functions. Both are treated as SR at CCNPP. Therefore, this particular differentiation cannot be provided.

29. Section 5.7.1 of the IPA report lists specific radiation monitors within the scope of the report. For each monitor in the RMS, provide information on (1) the process fluid, such as containment air or service water; (2) flow conditions, such as stagnant conditions; (3) materials of construction; (4) temperature; and (5) operating experience, to assist the staff in assessing applicable aging effects.

Response

Consistent with the BGE LR technical report template, the revised LR technical report will provide information with respect to process fluid, flow conditions (such as stagnant flow), materials of construction, general temperature range and operating experience.

30. Section 5.7-1, Table 5.7.1, lists the component types determined to require an AMR. When referencing Table 5.7-1, additional description of the specific criteria for grouping component types is necessary. For example, listing "Flow Indicators" does not provide enough detail to determine which of the different types of indicators fall into this component type. Understanding

that some specifics are provided in the results of the AMR section of the application, additional descriptive information is necessary when first introducing the component type categories.

Response

Consistent with the BGE LR technical report template, more discussion on the component types subject to AMR will be provided in the revised LR technical reports.

31. Section 5.7.1 of the IPA report states that process instrument tubing is not included in this review, but is addressed in a commodity group. The CCNPP IPA methodology report, Section 5.3.2, infers two instances of a boundary between instrument tubing and the system piping, at a root isolation valve and at a hand valve. Clarify all the interfaces or review boundaries between process instrument tubing and the piping included in the RMS AMR report. Marked-up piping and instrumentation drawings may be a method of showing these interfaces.

Response

The boundary between the instrument line commodity evaluation and the system AMR is described in IPA Methodology Section 5. A listing of which parts of the system are addressed in which evaluation is provided in the pre-evaluation results maintained onsite. Consistent with the BGE LR technical report template, the revised LR technical report description will provide a discussion of any SCs within the conceptual boundaries of the RMS that are covered by a separate AMR/Commodity report.

32. Identify the reports that evaluate the electrical cabling for the RMS, component supports for the RMS, and the instrument tubing and process instrument components of the RMS that support the pressure boundary function.

Response

Section 7 of the IPA Methodology, (Revision 1) describes the fact that component supports for all components WSLR, cables providing power for any intended function of components WSLR, and instruments and associated tubing and components connected to components WSLR are evaluated in the Component Supports, Cables and Instrument Lines Commodity Evaluations, respectively. Consistent with the BGE LR technical report template, the revised LR technical report description will provide a discussion of any SCs within the conceptual boundaries that are covered by a separate AMR/Commodity report.

33. Page 5.7-2 function d. states, "Component supports provide structural support to RMS components." However, Table 3-1 of the RMS AMR report states that the fourth passive system function is to "provide seismic integrity and/or protection of SR (safety related) components." Please clarify and discuss if these two function descriptions are intended to be the same. If so, how do component supports support the " . . .protection of SR components?" In addition, consistent description and terminology should be applied between the IPA and the RMS AMR report.

Response

The function to "Provide seismic integrity and/or protection to SR components" is generic wording used in AMR reports to describe a number of structural support-related functions in many systems. The wording of the revised LR technical report will ensure that the intended function associated with the component supports is clearly stated.

34. Section 5.7.1, Table 5.7-2, does not provide the information necessary for the staff to make a finding of the BGE conclusions concerning aging effects. Additional discussion of the bases should be included to support these conclusions concerning aging effects.

Response

The correct level of detail to support a finding has been established and agreed upon in the BGE template. Using this template to revise the RMS LR technical submittal should resolve this question.

35. If the component types are subdivided in the AMR and result in different aging assessments, identify the components in each subgroups and the rationale for developing the subgroup.

Example: Attachment 4 (pipe) of the RMS AMR report (Appendix A, Attachment 2, Enclosure 2 to the May 22, 1996 letter) indicates that piping is separated into two groups: one for carbon steel and the other for stainless steel. Attachment 5 (pipe) of the RMS AMR report indicates that these two groups are subject to different aging effects. However, Section 5.7.1 does not appear to make that distinction.

Example: Attachment 4 (valve) of the RMS AMR report indicates that the hand valves are separated by "Group ID." Attachment 5 (valve) of the RMS AMR report indicates that these valves by "Group ID" are subject to different aging effects. However, Section 5.7.1 does not appear to make that distinction.

Response

The LR technical report stated the aging mechanisms referred to are plausible for the carbon steel piping and valves. There is only carbon steel piping in the RMS. Consequently, there is only one group of RMS piping (077-HB-01). Attachment 4 breaks this pipe into subcomponents, all of which are carbon steel. The Attachment 5 results for these different subcomponents are all the same. On the other hand, there are both carbon steel and stainless steel hand valves in this system. The stainless steel hand valves in a plant vent gas environment were determined to be subject to no plausible aging mechanisms. Therefore, the LR technical report did not discuss the aging of these valves since non-plausible ARDMs are only discussed if they are "highly visible ARDMs." The LR technical report does address the carbon steel valves.

Using the BGE template to prepare the revised LR technical report should clarify these types of issues.

36. Section 1.1.1 of the RMS AMR report describes the RMS subsystems included in the RMS review. Are these items the same as those listed in Section 5.7.1 of the Technical Information. It appears that different terminology is used to describe similar monitors. Use similar terminology and clarify what monitors are included in the RMS.

Response

Section 1.1.1 of the AMR report is a general description of the entire Area and Process Radiation Monitoring System. The 5.7.1 discussion addresses only the specific portion of the RMS WSLR. Later in the AMR report (Section 2.2) where the portion of the system WSLR is described, the terminology is comparable to Section 5.7.1. Exactly consistent terminology will be used in the revised LR technical reports.

37. The description of the radiation monitoring system boundary in Section 1.1.2 of the RMS AMR report needs to provide sufficient detail to allow the staff to determine the full extent of components WSLR. It appears that the information contained in Section 1.1.2 is a general description of RMS component functions, not a system boundary. Marked-up piping and instrumentation drawings or system schematics could illustrate the RMS boundaries. Again, systems that interface with the RMS are given but locations of interfaces are not described. Provide these descriptions (This is similar to Question 1 for the RMS)

Response

The section referred to in the AMR report again addresses the entire RMS, not the portion WSLR. In section 2.2, the portion of the system WSLR is described and the list of components WSLR, maintained onsite, is referred to. A marked-up drawing will be used to clarify this scope in the revised LR technical report.

38. Discuss whether the radiation monitors are subject to 10 CFR 50.49 and whether they will be evaluated separately as a "time-limited aging analysis" (TLAA)

Response

The Containment high range radiation monitors are subject to 10 CFR 50.49. None of these perform a passive intended function and, therefore, were not subject to AMR. The TLAA associated with these active monitors will be addressed in a separate LR technical report covering all environmentally qualified (EQ) components and in the TLAA LR technical report. The other radiation monitors are not subject to 10 CFR 50.49. The revised RMS LR technical report will be modified to clarify this point.

39. Section 2.1 of the RMS AMR report states, "The purpose of component level scoping is to identify all system components that support the intended system functions . . ." Is it the intent to identify all 'components' or all 'component types,' as described elsewhere in the RMS AMR report? Provide a discussion.

Response

As described in Section 4 of the IPA Methodology, the component level scoping process for systems identifies all system components which contribute to each of the intended functions.

Section 6 of the Methodology describes how the passive long-lived components WSLR are grouped for the AMR process. These groups are the subject of the discussions presented in the AMR.

40. Section 2.2 of the RMS AMR report, first sentence of the second paragraph, lists portions of the RMS WSLR and specifically notes "components" as WSLR. Please clarify what are considered "components" in this case.

Response

The IPA Methodology describes the fact that the site technical database contains a listing of components of each of the systems onsite. Each component belongs to one and only one system. The components in the conceptual boundaries of either the Process or Area Radiation Monitoring Systems were scoped using the component level scoping process to determine which are WSLR.

41. Section 2.2 of the RMS AMR report, last paragraph, states, "Refer to the results of the Area and Process Radiation Monitoring System Component level Scoping for the list of intended functions, the list of components within the scope of LR, and other scoping-related details." Where specifically are the "results" referred to by this sentence? A pointer to the applicable RMS AMR report section(s) would be helpful. Is the list of system intended functions described in Section 1.0, "Introduction," the intended functions to be applied to the component level scoping? The sentence infers that a list of components WSLR is provided, yet Table 2-1 provides only a list of component types. Please clarify where "other scoping related details" are contained.

Response

The component level scoping results for each system contains a listing of all of the components in the system and the association between the components and the intended functions of the system. These results are maintained onsite in a separate controlled document and are not included in the AMR report, except in the summary form in Table 2-1. The intended functions described in Section 1.1.3 of the AMR report are the intended functions determined during the scoping process.

42. Section 3.1 of the RMS AMR report describes a pre-evaluation of which components are subject to an AMR. The discussion infers that components supporting an active system function are not subject to an AMR. While the discussion states that components supporting passive functions and are long-lived are subject to an AMR, for the RMS, it should also address all those SCs that are considered WSLR and also perform a passive intended function.

Response

As described in Section 5 of the IPA Methodology, the pre-evaluation process excludes components that only contribute to active intended functions. If a component contributes to more than one intended function, it will not be excluded from the AMR unless all associated intended functions are active. In this manner, the process ensures that all long-lived components WSLR, which perform any passive intended functions, are included in the AMR.

43. Section 3.1 of the RMS AMR report states that, during the pre-evaluation, a determination is made as to where the component will be addressed if it is subject to an AMR, i.e., in a commodity group evaluation, in another system AMR, or in the RMS AMR report. Reference should be provided to

the BGE methodology report section that describes how this determination is made. Without this reference, there is no basis for how this pre-evaluation is performed. In addition, components that are within the RMS boundaries, but are addressed elsewhere, should be explicitly identified or described, and the report where they are addressed should also be identified (piping and instrumentation drawings may be useful in performing this activity).

Response

The IPA Methodology Section 5.3 and Section 7 describes how certain components are identified in each system IPA process to be addressed in a commodity evaluation. The portions of the RMS which are addressed in a commodity evaluation include: 1) the cabling to electrical components in the system which perform an intended electrical function; 2) component supports for all system components WSLR which have supports; and 3) certain instrument lines which will be specified in the revised LR technical report. Additionally, certain components in the RMS conceptual boundary were evaluated with the Control Room Heating, Ventilation and Air Conditioning, Service Water, and Component Cooling Water Systems' AMRs for administrative reasons. Consistent with the BGE LR technical report template, the revised LR technical report description will provide a discussion of any SCs within the conceptual boundaries that are covered by a separate AMR/Commodity report.

44. Section 3.2 of the RMS AMR report states, "Table 3-1 summarizes the disposition of intended system functions for the Area and Process Radiation System Monitoring System (RMS) as either active or passive." This discussion may be misleading. It is not the intent of the screening criteria contained in 10 CFR 54.21(a)(1) to perform the active passive determination at the system level for the purpose of determining which SCs are subject to an AMR. Please clarify the intent of dispositioning system level functions as either active or passive.

Response

As described in the BGE IPA Methodology, Section 5, the pre-evaluation process determines whether an intended function requires moving parts, or a change in configuration or properties (including a change of state) of the components which perform the intended function. If so, the function is determined to be active. If not, the function is determined to be passive. As stated in the response to Question 42 above, only components which contribute exclusively to active intended functions are excluded from the AMR at this step of the process. If a component contributes to both an active and a passive function, it will be included in the AMR, and the effects of aging on its ability to perform that passive function will be evaluated in the AMR.

45. Section 3.2 of the RMS AMR report, last paragraph, states, "Refer to the results of the Area and Process Radiation Monitoring System Component Pre-evaluation for the list of components subject to an AMR and other details." The sentence infers that a list of components subject to an AMR is provided, yet Table 3-2 provides only a list of component types. In addition, this paragraph appears redundant in that it refers to the same section in which the paragraph is contained. If it is the intent to refer to Tables 3-1 and 3-2, this would be duplicative to information already described in the section. Please clarify the meaning of this paragraph.

Response

The sentence which is the subject of this question refers to the pre-evaluation results for the system which are maintained in a separate controlled document onsite. These pre-evaluation results include a listing of the components in the system that are subject to AMR.

46. It is not clear in the RMS AMR report if the passive function, "provide seismic integrity and/or protection of SR (safety related) components" will be addressed in the RMS AMR report. There does not appear to be any component types listed in Table 3-2 or the Table 4's that support this passive system intended function. Clarify if component types supporting this intended function will be addressed in the RMS report or, if not, in which report will they be addressed. This comment is also applicable to the function, "maintain electrical continuity and or provide protection of the electrical system."

Response

The components which provide the structural support function exclusively (i.e., component supports) are addressed in the component supports commodity evaluation. This will be clarified in the revised LR technical report. Components which contribute to the electrical function referred to in the second part of this question were either determined to contribute to this function by moving parts or a change in configuration or properties, or were determined to be excluded as active in the LR Rule §54.21(a)(1)(i) listing, or were included in the Cables Commodity Evaluation Report.

47. Table 3-2 of the RMS AMR report indicates that pumps are replaced and are "in other system AMR reports." Discuss the disposition of the pump casing, such as were they eliminated because they are replaced, or were they addressed in another report. If the latter, identify the other report. Also, the IPA report should also reflect that pump casings are within the scope of renewal.

Response

The pumps in this system include some that are replaced on a defined frequency and were excluded from the AMR because they are short lived. They also include pumps associated with the Service Water and Control Room Heating, Ventilation and Air Conditioning Systems that will be addressed in the LR technical reports for these systems. This will be clarified in the revised LR technical report.

48. Additional discussion on the details of configuration describing flow elements and radiation elements is necessary in order to evaluate the conclusions regarding ARDMs for these components.

Response

The level of detail needed for the LR has been documented and agreed upon in the BGE LR template. This template will be followed in order to add more information to the LR technical report concerning radiation elements and flow elements, as necessary, to provide sufficient information for the reviewer to evaluate the conclusions. However, BGE does not believe that the details of the configuration of these radiation elements are needed in order to conclude that the

stainless steel pressure boundary components subject to an air environment have no plausible aging mechanisms.

49. Section 4.2.1 of the RMS AMR report lists five equipment types (ETs). It is not clear if these components are the only component types subject to an AMR, or if the evaluation is for the same ETs listed as the RMS boundary in Section 1.1.2.

Response

As discussed in the BGE IPA Methodology, Section 2.1, ET is "a general categorization of components according to their function and design. Examples of specific ETs are valve, piping, instrument, etc. For those ETs subject to AMR, the list of age-related ARDMs which needs to be addressed is developed for each ET." The discussion in Section 4.2.1 of the AMR describes the ETs for which potential ARDM lists were developed for RMS. Section 1.1.2 of the AMR describes the types of equipment found within the RMS boundary in general terms. See Question 99.

50. Table 4-1 of the RMS AMR report lists Saline Water Attack as a potential ARDM for piping only. Explain why pump casings and valve bodies that could be manufactured from the same material as piping are not listed as being potentially susceptible to saline water attack. Attachment 7 (pipe) describes other fluid components embedded in concrete. Provide additional information on the materials used in construction for these items, and describe what other fluid components are subject to saline water attack.

Response

Saline water attack is not considered a potential ARDM for pump casings, valves, and other components because these RMS component types are not embedded in concrete at CCNPP.

51. Loss of bolting preload should be considered in the ARDMs for the valves and for components where bolting performs an intended function WSLR. Provide an evaluation of the applicability of this ARDM to the components subject to an AMR for the RMS.

Response

Loss of preload could reflect an installation deficiency, improperly designed joint, or improperly designed piping system, not an aging mechanism. System temperatures are not conducive to loss of preload due to creep-related stress relaxation. See response to Questions 12 and 94.

52. The RMS AMR report contains an extensive aging effects evaluation of subcomponents of instruments. However, the CCNPP IPA Methodology (Section 7.1.2) and the associated staff safety evaluation report (Section 3.7.2) indicate that the evaluation of instruments may not be necessary. In addition, the LR Rule does not focus on a piece part review. Clarify the BGE intent on evaluating the instruments.

Response

The BGE IPA Methodology currently requires an AMR for instruments which contribute to the pressure boundary function, unless they function in a manner similar to those listed in the LR

Rule, as being specifically excluded (i.e., pressure transmitters, pressure indicators, water level indicators). Radiation monitors are not similar to these instruments and, therefore, they received a detailed AMR. If the Staff's position is that radiation monitors and all other instruments "for which functional degradation resulting from the effects of aging is more readily determinable and existing programs and requirements are expected to directly detect the effects of aging" [NRC Final Safety Evaluation on BGE IPA Methodology, page 23] should be excluded as active, BGE will alter the pre-evaluation process and applicable results accordingly.

53. Baltimore Gas and Electric Company indicates that carbon and low alloy steel components are not susceptible to SCC. However, the susceptibility of these materials to SCC depends on the materials, stresses, and environment. For example, high sulfur steel, welding residual stresses, dissolved oxygen, chlorides, and localized pitting, could increase SCC susceptibility. Further, some substances when present in low concentrations, as impurities, or in the atmosphere could contribute to SCC (Reference: B. E. Wilde, "Stress Corrosion Cracking," Metals Handbook, Ninth Ed., Vol. 11, Failure Analysis and Prevention, American Society for Metals, Metals Park, Ohio, 1986, pp. 207-208). Temperature is also a factor. Thus, the susceptibility of carbon and low alloy steel components to SCC would depend on their specific application in the plant. Provide additional discussion on the susceptibility of carbon and low alloy steel components to SCC.

Response

The Potential ARDM List (Attachment 7) for the piping and valve groups states that, "SCC of low alloy steel and carbon steel is not considered a credible aging mechanism for typical conditions encountered in a nuclear power plant. Transgranular SCC may be a concern in low alloy steel and stainless steel if aggressive chemical species (caustics, halogens, sulfates, especially if coupled in the presence of oxygen) are present." Based on this discussion, SCC is dispositioned as not plausible for carbon steel materials based on the carbon steel material alone. For low alloy steel, the matrix code discussion in Attachment 6 for valves discusses the relevant environment, materials, and stresses, and concludes that SCC is not plausible.

The reference presented in this question was reviewed. This reference discusses carbon steel SCC in nitrate solutions, ammonia, boilers (caustic cracking), and other chemical environments which are not present in RMS. This is consistent with the statement made in the potential ARDM List indicating that SCC of carbon steel is not a credible aging mechanism for typical conditions encountered at a nuclear power plant.

54. Small fabrication flaws may exist in fabricated components, such as at weld joints. These small flaws may grow in size during plant service from mechanisms, such as fatigue, corrosion, and SCC. The resulting cracking or loss of material should be managed for renewal. Discuss the applicability of cracking and loss of material in fabricated components for renewal.

Response

Small fabrication defects that are below the detection limits of pre-service examination procedures are present in any steel structure, including those fabricated to ASME Code Section III requirements. These defects should not be referred to as flaws, since that terminology is limited to defects of a size that exceed acceptance criteria [see definition IWA 2110(d), ASME Section XI, 1983 Edition]. Therefore, there are no fabrication flaws in weld joints, by definition, unless they

are undetected by pre-service and in-service examination. Fatigue and SCC were determined to be not plausible in the RMS AMR. General corrosion does not result in cracking. The aging management programs credited ensure the loss of material resulting from general corrosion does not impact intended function.

55. Socket welds have experienced failure due to vibrations. Also, socket welds may be susceptible to corrosion or SCC because of the crevice geometry. If socket welds are used in this system, discuss the applicable aging effects on socket welds for renewal.

Response

Socket welds are used in the RMS for carbon steel components in the AMR which contain air. There are no stainless steel components with socket welds exposed to the internal air environment in the RMS AMR.

See the response to Question 53 with regards to SCC of carbon steel. Crevice corrosion was determined to be plausible for all of the carbon steel components in the RMS AMR in both the air internal environment. Its effects and management of the aging are discussed in the AMR and LR technical report.

A review of CCNPP, industry and NRC databases for RMS failures did not reveal vibration as an issue. In the RMS AMR, vibration was considered along with the Fatigue ARDM.

56. Attachment 7 (element) of the RMS AMR report, provides the following description/justification for Thermal Damage, "Non-metallic are particularly susceptible with material dependent temperature limits." All materials of use have temperature limits; non-metallic, e.g., ceramics or plastics, could have either higher or lower temperature limits than a metallic due to the differences in melting temperatures. It is the non-metallic with the lower temperature limits that tend to be more susceptible to thermal damage. Clarify the impact of temperature limits on the susceptibility of a material to thermal damage in this discussion.

Response

The purpose of the Attachment 7 is to provide a general description of the ARDM and to provide justification if the ARDM is considered not to be a potential ARDM for an equipment type. The description of thermal damage was enhanced in the AMR, Revision 2, to provide more information in this area. However, the detailed discussion related to temperature limits is provided on the Attachment 6, matrix code explanations for individual component groups where the ARDM is a potential concern.

57. Attachment 7 (element) of the RMS AMR report, the description/justification for Thermal Embrittlement mentions that this ARDM requires high temperature, 500 to 700^{0}F (260 to 371^{0}C), for metallic components. Are there any components in the RMS that are operated in this temperature regime? Identify those components.

Response

The potential ARDM provides a description of an aging mechanism that is used for multiple systems. The applicability of this ARDM to the RMS is judged in the ARDM matrix and matrix code explanations for each group. These pages state that the system operating temperature is not high enough for this ARDM to be plausible.

58. Attachment 6 (flow element) Code 15 of the RMS AMR report, fouling and microbiologically influenced corrosion (MIC) may be significant to passive functions such as providing seismic integrity and protection of SR equipment. Since plant experience has shown fouling has occurred, fouling and MIC should be considered as plausible ARDMs. Provide an evaluation of these ARDMs or their aging effects.

Response

Experience has shown that even if fouling does occur, it has no impact on the pressure boundary intended function of the component. Obstruction of the component due to fouling is a failure of the component's active function. Therefore, fouling is not a plausible ARDM.

Microbiologically influenced corrosion, like other forms of corrosion, require a moist or wet environment to occur. Microbiologically influenced corrosion is not plausible for these flow elements because there is minimal condensation on the flow elements and, therefore, the environment is not conductive to MIC.

59. Attachment 3 (radiation element) of the RMS AMR report states that experience indicates the physical properties of these fiberglass materials may degrade from long-term exposure to elevated temperature and high relative humidity. Additional description of the generic term "fiberglass" is needed to assess potential and plausible long-term, age-related degradation. Without a description of the specific material properties, a claim that this material is not susceptible to age-related degradation cannot be substantiated. Provide an authoritative material designation, a sketch or figure of the installed component, and sufficient quantitative proof that this material will continue to perform the intended function in the RMS environment for the duration of service.

Response

The AMR sections for radiation elements (077-RE-03) were reviewed, and the quoted statement related to long-term exposure to elevated temperature and high relative humidity were not found. However, the material for these fiberglass spacers is MIL- P- 18177C, Plastic Sheet, Laminated, Thermosetting, Glass Fiber Base, Epoxy Resin; Type GEE. Type GEE material is intended for use in electronics applications requiring moisture resistance and high mechanical strength [paragraph 6.1.1 of MIL-P-18177C]. The matrix code descriptions on Attachment 6 for this group explains that the design operating temperature for these instruments is 130°F. Type GEE material does not deteriorate from thermal damage at these temperatures. The moisture resistance of Type GEE material, along with the low potential for moisture in this system, support the conclusion that aging due to moisture effects are insignificant.

60. Attachment 4 (filter) of the RMS AMR report states that the filters are designed to minimize the condensation of moisture in the system. The report has used filtration as an argument to rule out many moisture-related ARDMs, such as general corrosion, pitting, crevice corrosion, fouling, and

MIC. Therefore, one would expect that the filter internals would require periodic inspection and/or replacement. The RMS AMR report, however, indicates that the internals of the filter are not subject to the AMR report because they have no passive intended functions. Specifically because it is not a pressure boundary component, and because the filter is not subject to replacement program (Table 3-3, page 3-2). Nonetheless, the internals perform the filtering function "without moving parts or without a change in configuration or properties." Provide additional discussion on why the filter internals are excluded from AMR. Provide a discussion that addresses the effects of aging for the filter internals since they appear to be WSLR.

Response

The filters are a design feature that provide an internal environment which is not conducive to aging. The reliance on this feature for the non-plausibility determination is documented in the AMR results so that future plant activities (e.g., modifications and maintenance practices) will consider the role that this filter plays in the AMR non-plausibility determinations. This feature; however, does not meet any of the §54.4 scoping criteria and, therefore, the filtration function is not considered an intended function.

61. Attachment 4 (pipe; 077-RP-01B) of the RMS AMR report described supporting members as having no LR function. Support members perform a function "without moving parts or without a change in configuration or properties." Provide additional discussion on why the support members are excluded from AMR.

Response

The Attachments 4 and 5 for this group have been modified to show that these supports are WSLR, and they have been evaluated for the potential ARDMs.

62. Attachment 7 (pipe) of the RMS AMR report provides a basis that general corrosion is a potential ARDM for pipe which includes a discussion on external attack from borated water falling on to piping components, resulting in boric acid attack if the pipe is manufactured from carbon steel. The evaluation of plausible ARDMs does not address this description. General corrosion is considered a plausible aging effect, but for internal surfaces only. Provide a corresponding evaluation of external wastage from the ARDM described in the potential ARDM Table. This comment may be applicable to other components in the RMS that are subject to general corrosion.

Response

Boric acid corrosion is addressed for piping systems which contain a boric acid solution. For these systems, a program is in place to manage leakage of boric acid such that this leakage will not affect the passive intended functions of the system containing the boric acid or other adjacent systems. This program will be credited for LR, and the demonstration for this program will be presented in the LR technical reports for the systems which contain borated water. The RMS does not contain borated water and, therefore, no demonstration is provided for controlling boric acid wastage as an aging mechanism.

63. Attachment 5 (pipe) of the RMS AMR report states that particulate-wear erosion is not significant. Nonetheless, airborne particulates may be present, although in limited numbers, which may result in erosion. Codes 17 and 15 conclude, "airborne particles will not lead to significant erosion."

Discuss what is considered significant and could this ARDM, in conjunction with other ARDMs, lead to conditions where the pressure boundary function may be jeopardized. The report justifies excluding erosion as a plausible ARDM in part because of erosion resistant materials. Data from J. S. Hansen, "Relative Erosion Resistance of Several Materials," Erosion: Prevention and Useful Applications, ASTM STP 664, W. F. Adler, Ed., American Society for Testing Materials, 1979, pp. 148-162, shows that the only truly erosion resistant materials are cubic boron nitride and diamond. Provide further justification for the claim that the subject materials are erosion resistant, and that the environmental conditions will not cause significant erosion over the period of service.

Response

The only sources of particles for this system are a limited number of carbon steel corrosion products. The lack of significant particles and the relatively low velocities in the system support the conclusion that this ARDM is not plausible. Additionally, searches of industry event data revealed no instances of particulate wear erosion leading to degradation or failures in radiation monitoring systems. Industry literature (such as the ASME Wear Control Handbook) supports the assertion that particulate wear erosion will not impact the pressure retaining boundary of the piping.

64. Attachment 7 of the RMS AMR report does not consider deterioration of carbon steel piping as a source of fouling. The internal coatings on the carbon steel piping can deteriorate and separate from the walls with age. The separated coatings can foul piping and valves. Provide a discussion of fouling as plausible ARDM for carbon steel piping.

Response

No internally-coated piping is used in the RMS. Again, the potential ARDM list description of ARDMs are common to many systems.

65. Relative to Attachment 5 (pipe 077-HB-01) of the RMS AMR report; if sliding type supports are used with these pipes, then wear should be considered a plausible ARDM. Clarification of sliding type supports are used and provide an assessment of any aging effects. If an assessment is provided in other AMR documentation, provide reference to that location.

Response

Sliding supports, used for the pipe segments subject to AMR in the RMS (077-HB-01), are designed such that there is no motion between the piping and the support. The sliding portions are all within the supports themselves.

66. In Attachment 5 (pipe 077-RP-01) of the RMS AMR report Matrix Code List indicates that the system using the stainless steel pipes samples the plant vent gases. The report should be more explicit as to the nature of these gases, or include other plausible ARDMs, such as pitting.

Response

The environment of the plant vent gases is primarily discharge from building ventilation systems (i.e., air with some humidity). There are occasional discharges of waste gas (non-corrosive gases

and water vapor), and blowdown tank relief valve venting into the plant vent. See response to Question 72 for discussion of moisture in plant vents.

Attachments 5 and 6 for 077-RP-01 discussed pitting, and concluded the ARDM is not plausible for these stainless steel components in an air environment with a limited amount of moisture.

67. Attachment 4 (pipe, valve) of the RMS AMR report indicates that there are carbon steel and stainless steel piping and valves. If piping and valves consist of dissimilar materials, discuss the potential for galvanic corrosion. In addition, Attachment 6 (valve) of the AMR report indicates that there are stainless steel valve bodies with alloy steel or carbon steel bolting. Discuss the assessment for galvanic corrosion between these dissimilar materials.

Response

The information contained in the AMR addressed the potential for galvanic corrosion:

The containment atmosphere RMS lines have carbon steel pipe, stainless steel air operated valves and carbon steel hand valves at the containment penetration. The fluid is air. Condensation is not expected due to temperatures in the containment and penetration rooms. Condensation has not been observed. Air is not an electrolyte.

The closed cooling loop systems have radiation monitoring trains with carbon steel valves. Valve internal materials include alloy steel, stainless steel and stellite. Galvanic corrosion was determined to be not plausible because of chemistry control at ppb levels for dissolved oxygen and chlorides, ratio of carbon steel wetted area to cathodic materials wetted area, and lack of plant or industry history of galvanic corrosion as an issue to tightly controlled, closed loop cooling water systems.

There is no stainless steel piping in the scope of this AMR. The stainless steel tubing used with the air monitors is in the Instrument Lines Commodity Evaluation.

Valves in the RMS have fasteners of carbon steel and alloy steel. These fasteners are used on carbon steel and stainless steel valves. The fasteners are exposed only to the air external to the valves. Air is a not an electrolyte.

68. Attachment 6 (pipe, valve) of the RMS AMR report indicates that all components process air, except for one valve (077-HV-04), which processes water from the Component Cooling And Service Water Systems. There appears to be no mention of any piping that processes component cooling and service water. Clarify the evaluation of the piping associated with that valve (077-HV-04). In addition, while BGE indicates that the valve (077-HV-04) may be susceptible to corrosion, the associated bolting is not. However, should leakage develop in the joint, the bolting and external valve surfaces would be exposed to the process fluid, potentially resulting in corrosion or cracking of the bolting and/or corrosion of the valve body external surfaces. Discuss the susceptibility of corrosion and cracking of these bolts and corrosion of the external surfaces of the valve body.

Response

Revised LR technical report will provide a discussion of the fact that the service water and component cooling water radiation monitors are evaluated with the AMRs for these systems. The evaluation of fluid system piping does not generally assume that the process fluid leaks out of the system, unless there is operating experience to show that such leakage has been a common or generic concern.

69. Wear has been identified as the most frequent failure mode of all types of valves. This report treated wear only as a plausible ARDM in one case, i.e., wear between the plug and seat of control valves. There are numerous cases of wear failures of motor control and check valves. The report should clarify whether motor control valves and check valves (body only) are susceptible to wear. In addition, Attachment 6 (motor-operated valve) of the RMS AMR report, Code 20, states that the ball valve design results in minimal stem wear. However, wear has been identified as the most frequent failure mode for all types of valves. Provide a discussion of the applicability of wear as an aging effect for all types of valves included in the RMS AMR report.

Response

Baltimore Gas and Electric Company believes that the NRC statement concerning wear being a common failure mode pertains to failure of valves to perform their active function of stroking open or shut. This active function is not addressed by the AMR. In the AMR, wear is addressed for the pressure retaining portions of the valve (i.e., body and bonnet), and for valve internals if the internals provide a containment isolation function, or if the internals are the SR/NSR boundary. Wear was determined to have minimal affect on the pressure retaining function of the valves in the RMS (with the exception of the control valves mentioned in the question).

70. Attachment 6 (check valve) of the RMS AMR report Codes 15, 17, 18 and 22 state that filtration of the air prevents the ARDMs associated with these Codes. This air filtration device should be considered WSLR, or a discussion should be provided justifying why it is not within the scope.

Response

The filtering function of these filters is a design feature credited with providing an internal environment which is not conducive to aging. The filters are in the scope of LR, but only for their pressure retaining function. See response to Question 60.

71. The report should provide complete descriptive material designations for all materials of construction. The material description should at least include the American Society for Testing Materials (ASTM) or ASME designation, such as 'A 36', rather than just 'steel.' Also discuss the Code classification of the components addressed in the report, that is, ASME Code Class 1, 2, 3, or non-Code Class which is described in the plant ISI program.

Response

The containment atmosphere radiation monitor containment penetration piping is Section XI Class MC. The original design Code is B31.7 Class II. No other pipe segments are in the AMR.

Material descriptions listed in the AMR depend on several factors. Some are:

- Vendor drawings and technical manuals may simply provide generic descriptions of materials - carbon steel, 316 stainless steel. If evaluation of the aging can proceed in a conservative manner based on this information, then no further information is sought. For instance, in most cases, evaluation of austenitic stainless steel components in an air environment at low temperatures will determine there are no plausible ARDMs, regardless of material specification.

- Where generic material descriptions as well as specifications are available, they are generally listed. In the RMS AMR, for example, see the Attachment 4 for group 077-HB-01. Emphasis on identifying material specifications whenever practical has been added to our process.

- In some cases, design requirements allow two or more material specifications to be used. In these cases, if the difference is pertinent to the aging evaluation, specific identification of the material specification is rigorously pursued. For instance, many hand valve design requirements allow either forged or cast stainless steel materials. For high temperature applications, cast austenitic stainless steel may be susceptible to thermal embrittlement. A forging in the same application may not.

72. Attachment 6 of the RMS AMR report states, "INPO Operations and Maintenance Reminder O&MR-132 describes operational failures of Radiation Monitoring Systems due to excess moisture. CCNPP recent history shows one case where water was introduced to the system due to blowdown tank vent being aligned to the main plant vent (MO 2199402504). However, per input from the system engineer this is not a common occurrence. The system has not experienced the moisture related problems described in O&MR-132." Provide additional information on the experience described in O&MR-132 and the experience at Calvert Cliffs. Discuss the potential for water intrusion into the specific systems under evaluation. Although water intrusion may not be "a common occurrence," and Calvert Cliffs may not have yet experienced a "moisture related problem," discuss the potential for developing applicable aging effects, such as corrosion and SCC, during the period of extended operation.

Response

Water was found in an air line in the RMS was on October 5, 1992. The main vent tritium sample apparatus was found to be saturated with water. The tritium sample apparatus is NSR and not WSLR. The water was from the steam generator blowdown tank. The relief valves had lifted due to a rapid down power transient. They discharge into the tank vent line. The tank vent line flows into the main vent. The main vent tritium sample apparatus is on a line shared by other NSR instruments. The event has not been repeated. The steam generator blowdown tank relief valves are not known to lift during normal operations or routine power level changes.

Stainless steel subjected to air with very infrequent exposure to moisture will not degrade to the point where the pressure retaining function will be prevented.

73. Attachment 3 (valve: 077-CV-01) of the RMS AMR report lists grouped components under the subheading for Device Type: Control Valve. The four components listed are all described as

"Isolation Valves." Control valves provide regulation of the process fluid flowing through the valve. Please clarify why isolation valves are subgrouped under DTs for control valves.

Response

All air-operated valves are designated as "Control Valves" in the CCNPP site database. This includes valves that are isolation valves that are operated by air.

74. Provide the "Component Grouping Summary Sheet" (Attachment 3) for hand valve 077-HV-02.

Response

The requested sheet is in the controlled copy of the AMR. Since the AMR will not be part of the final submittal, there appears to be no need to provide this sheet which was missing from the NRC copy of the AMR.

75. Attachment 6 (except for valve: 077-HV-04) of the RMS AMR report appears to indicate that the fluid is humid air. However, one of the systems in the report is the main steam line effluent radiation monitors. Discuss the fluid environment of this system.

Response

The main steam environment is not pertinent since the Main Steam radiation monitors are external to the pipe. They do not form the pressure boundary of the pipe and are not subject to AMR.

76. Attachment 6 (valve: 077-HV-04) of the RMS AMR report indicates that the process fluid chemistry does not perpetuate MIC. The fluid is the component cooling water and service water, which are closed-cycle systems for BGE. However, some closed-cycle systems may need to have a program in response to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." Provide additional discussion relating to MIC, including a discussion of the relevant operating experience with the Component Cooling And Service Water Systems related to aging, and whether these systems are subject to the program in response to Generic Letter 89-13 at BGE.

Response

Microbiologically influenced corrosion is not a plausible ARDM for the service water and component cooling water environment at CCNPP. Plant-specific operating experience with service water and component cooling water shows no sign of MIC. The systems are closed loop systems with very stringent controls over the purity of make-up water added to the system. Service Water and Component Cooling Water Systems at CCNPP are not subject to a MIC control program in response to Generic Letter 89-13. Microbiologically influenced corrosion is not and has not been an issue for the closed loop Service Water And Component Cooling Water Systems at CCNPP. See NRC letter "Calvert Cliffs Units 1 and 2 Service Water System Operational Performance Inspection (NRC Combined Inspection Report Nos. 50-317/94-80 and 50-318/94-80)," dated May 18, 1994. No closed loop service water and component cooling water MIC issues were raised. The only related issue raised concerned biofouling in the open loop Saltwater System.

77. In Attachment 6 (valve: 077-HV-04) of the RMS AMR report, Code 06 concludes that the ARDM is not perpetuated because of the presence of the process fluid chemistry controls imposed on the Component Cooling Water and Service Water Systems. The presence of process fluid chemistry control is to ensure that ARDMs will not occur or to minimize their effects and should not preclude consideration of an ARDM and resulting plausible aging effects. If a process fluid chemistry program can maintain an environment where parameters, such as oxygen and chloride concentration, are kept within required limits, ARDMs and their associated aging effects will be adequately managed. Provide a discussion of potential/plausible aging effects managed by the water chemistry program.

Response

In Matrix Code G for this group, the discussion states that the process fluid chemistry controls over the Service Water and Component Cooling Water Systems, in conjunction with age-related degradation inspections, will ensure that the effects of general corrosion, pitting, and crevice corrosion will not affect the pressure boundary intended function of the systems. For MIC and fouling, the environment created by the closed loop system with highly pure make-up water is the primary reason why this ARDM is not plausible. Chemistry control and age-related degradation inspections are performed primarily to mitigate the plausible ARDMs mentioned above.

78. Attachment 4 (valve: 077-MOV-02A) of the RMS AMR report lists the body and plug as the items subject to AMR report. Provide a description of the configuration of this type of valve and explain why the seating surfaces are excluded yet the plug is included in the AMR report.

Response

The valves in 077-MOV-02 are 1/4 inch motor-operated valves constructed of 303 stainless steel. The vendor characterizes the valves as "miniaturized plug" valves. Loss of the plug assembly would cause loss of the valve pressure boundary because the plug assembly includes the valve bonnet. The seating surfaces are excluded because they do not form a part of the pressure boundary, the valves have no containment isolation function and the valves are not the SR/NSR boundary.

FEEDWATER SYSTEM (Questions 79-119)

79. Since this is a plant-specific review, please discuss the quality assurance (QA) review and other documentation requirements for the Feedwater (FW) System IPA report (Appendix A, Attachment 3) and AMR report (Appendix A, Attachment 3, Enclosure 3) to ensure that these documents meet the QA and documentation requirements intended by 10 CFR 54.17, §54.29(a), §54.33(a), and §54.37(a).

Response

As stated in the BGE IPA Methodology Section 2.2.6, all IPA work is conducted in accordance with the BGE QA Program. The QA Program is described in the QA Policy for CCNPP. The QA Policy identifies NRC regulatory requirements, industry standards, and specific Codes applicable to the 18 criteria contained in 10 CFR Part 50, Appendix B.

80. Provide a discussion of the system-level intended function for the FW System.

Response

As agreed in the BGE template, the system intended functions will be provided in the revised LR technical report.

81. Identify the SCs of the FW System that are SR or relied upon during transient/accident conditions, and the SCs that are NSR whose failure could prevent SR components from performing their function. The FW IPA report (Section 5.8), FW AMR report, and UFSAR do not clearly indicate if the FW is SR, or supports a safety function.

Response

As agreed in the BGE template, the LR technical report will be revised to include, at the system level, a discussion of the §54.4 criteria which caused the system to be included in scope and the reasons for inclusion. However, as discussed during template interactions, CCNPP documentation does not support delineation between SR SSCs and SSCs that could fail and prevent SR SSCs from performing their intended functions. Therefore, that differentiation cannot be included.

82. Provide a discussion as to why any SR or safety-supporting portion of the FW System was not included WSLR.

Response

No SR or safety-supporting portion of the FW System was excluded from the scope of LR.

83. Identify the SCs of the FW System that are relied on for SBO, Anticipated Transient Without Scram (ATWS), and fire protection. Specifically discuss if FW flow, including flow relating to FW pump coast-down, is referenced in SBO/ATWS/fire protection reviews and how?

Response

As agreed in the BGE template, the LR technical report will be revised to include, at the system level, a discussion of the §54.4 criteria which caused the system to be included in scope and the reasons for inclusion. Specific components will not be listed. That information is very detailed and is available for review onsite. Steam generator feedwater pump coastdown is not credited for SBO, fire protection, or ATWS at CCNPP.

84. Provide a discussion as to why Section 1.1.1 of the FW AMR report, describes flow and heat transfer as the "conceptual functional requirements" for the FW System, and Section 1.1.3 of the FW AMR report contains a list of 11 "intended system functions," none of which relate to flow or heat transfer.

Response

Section 1.1.1 of the AMR report discusses the entire FW System, including portions in scope and not in scope of LR. Functional requirements are defined in Section 2.1 of the BGE IPA Methodology as the general, high level functions which systems and structures may be called upon to perform. These are used to define conceptual boundaries for systems during the initial scoping

steps so that when an intended function is discovered, it can be associated with the appropriate system or structure. Section 1.1.3 of the AMR report lists the actual intended functions of the FW System. Heat transfer is not one of these functions because the high pressure feedwater heaters do not satisfy any of the §54.4 criteria for scoping, and the steam generators are not in the FW System at CCNPP. Providing feedwater flow is also not an intended function since it does not meet any of the criteria in §54.4(a). See response to Question 85.

85. Provide an explanation as to why flow and heat transfer are not identified as system-level intended functions. Consider in your response the recently issued Information Notice 96-41, discussed in the Question 20 below.

Response

Flow and heat transfer are not intended functions of the FW System since these functions are not credited in any CCNPP design basis event, failure of these functions would not cause failure of any function credited in the events, and these functions are not credited in the BGE response to the SBO, ATWS, Fire Protection, Pressurized Thermal Shock or EQ Rules.

Information Notice 96-41 is related to the methods used for evaluating the loss of a feedwater heater in a UFSAR Chapter 14 design basis event. It is not related to the intended functions of the FW System. The implication in this question is that the loss of a feedwater heater can prevent the proper functioning of the Nuclear Instrumentation System and, therefore, the feedwater heaters meet §54.4(a)(2). (i.e., NSR components which could fail and cause failure of a SR component). The impact of operation without a feedwater heater is accounted for by plant operating procedures which limit maximum power allowed under such a condition.

86. Provide the system-level intended functions in the IPA report. The report appears to contain component-level intended functions, but does not identify any system-level intended functions.

Response

As agreed to in the LR template, the revised LR technical report will contain all the intended functions associated with the system.

87. Provide a discussion as to why the evaluation boundaries selected **include** but **limit** the scope of FW System to the FW System isolation valve to the steam generator FW nozzles, and the steam generator secondary instrumentation. Include a justification as to why all components from the FW isolation valves to the condenser are excluded from the scope.

Response

The portion of the FW System described as WSLR represents that portion which was identified (using the scoping process described in the BGE IPA Methodology) as either SR, could fail and prevent SR functions or required in response to one of the regulated events listed in §54.4(a)(3). The remaining portions of the FW System do not satisfy any of the §54.4 criteria and, therefore, were not included in the scope of LR.

88. Provide a justification as to why the FW System regulating valve (and bypass valve), and associated piping are not included in the scope of LR, when these components are relied upon as backup in the event of a single failure of the FW System isolation valve to close.

Response

The feedwater regulating valves do not satisfy any of the §54.4(a) criteria for inclusion in the scope of LR. Per the response to Question 17, BGE relies on the Q-List process to identify NSR components that could fail and prevent the performance of SR functions. The feedwater regulating valves are specifically addressed in Q-List documentation as serving only a power production function.

For your information, tripping of the steam generator feedwater pumps and other pumps, rather than shutting the feedwater regulating valves, is the back-up method of isolating flow to the steam generator during a main steam line break event.

89. Based on the recently issued Information Notice 96-41, "Effects of a Decrease in Feedwater Temperature on Nuclear Instrumentation," provide a justification for not including the FW heaters and associated piping WSLR.

Response

Feedwater heaters and associated piping do not satisfy any of the §54.4(a) criteria. See response to Question 85.

90. Provide additional discussion on the scope of electrical components and the evaluation boundaries used to determine the scope of electrical components in the FW AMR report.

Response

There are no passive electrical components WSLR in the FW System. Cable is not included as a part of any particular system in the site equipment database. In the IPA, all cables are evaluated in the Cables Commodity Evaluation Report. All electrical components in the FW System were determined to be active during the pre-evaluation task, with the exception of certain instruments which are only subject to AMR for the pressure-retaining function, and are addressed in the Instrument Lines Commodity Evaluation Report. There are no electrical panels in the FW System. The scope of equipment (including electrical) covered in the LR technical report will be described in accordance with the guidelines agreed upon in the LR template.

91. Provide information that clearly presents the evaluation boundaries and the scope of components included WSLR (i.e., marked-up drawings) to allow the staff to assess this information consistent with 10 CFR 54.29.

Response

The revised LR technical report, prepared per the LR template, will clearly describe the evaluation boundaries for the FW System.

92. Provide a discussion as to why thermocouples should not require an AMR report. Thermocouple voltage output does change with age as a result of normal aging.

Response

The temperature element thermowell was included in the AMR because of its contribution to the pressure boundary function. The function of providing a feedwater temperature signal is not an intended function and, therefore, the portions of the temperature element which are associated solely with this function were not included in the AMR.

93. Provide an explanation as to why in FW AMR report Table 3-2, pressure transmitters are identified as being passive, not subject to replacement and not evaluated under a commodity group but are not included in the remainder of AMR report.

Response

Some of the pressure transmitters WSLR are subject to replacement at a regular frequency (<40 years) in accordance with the BGE §50.49 program. The remaining pressure transmitters WSLR are included in the Instrument Lines Commodity Evaluation Report. The current intention is to exclude these transmitters during that commodity evaluation based on their explicit exclusion in the LR Rule at §54.21(a)(1).

94. Provide a discussion as to why loss of bolting preload, due to thermal load fluctuations or mechanical vibrations, were not determined to be ARDMs requiring an AMR. Attachment 4 of the AMR report indicates that bolting is WSLR with an intended function of maintaining system pressure boundary, and requiring an AMR. Table 4-2 of the AMR report and Table 5.8-2 of the IPA report do not contain bolts as a DT.

Response

Bolting applications that support an intended function for components within the scope of the AMR in the FW System consist of valve body-to-bonnet joint bolting. There are no in-line flanged piping joints. The vibrations experienced in the feedwater piping system in which these valves are installed are minimal and low frequency, unlike vibration induced by rotating or reciprocating machines, and, therefore, not conducive to loosening of properly designed and assembled bolted connections. The maximum thermal conditions to which the valve body-to-bonnet bolting is exposed is less than 550°F, which is below the creep threshold for ferritic steels (approximately 700°F) and, therefore, loss of preload due to stress relaxation is not expected. Since the application of the bolting is valve body-to-bonnet joints, thermal-induced load changes in the piping system will have no affect on this bolting. See response to Questions 12 and 51.

For second part of the question, bolting is not considered a distinct DT. Bolting is included, as appropriate, as a subcomponent of other DTs. The bolting subcomponent is evaluated for the effects of aging when it contributes to a passive intended function.

95. Justify not assessing corrosion and cracking for bolts. In your justification, consider the potential for leaks in the bolted joints and their exposure to fluids that have to potential to cause corrosion and cracking.

Response

Pressure boundary bolting was evaluated for the valve DTs in the FW System. The results of this evaluation revealed no plausible aging mechanisms. This determination was based on the normal environment that the bolting is subject to. This normal environment does not include fluid leaking from either the FW System or other adjacent systems since this is not a normal condition.

96. Determine if molydisulfide is used on bolts at Calvert Cliffs, if so, include an assessment of aging effects associated with sulfides .

Response

Thread lubricant containing molybdenum disulfide is restricted from use on FW System components at Calvert Cliffs.

97. Provide a discussion for including/excluding those components, such as gasket material, packing, and other items not replaced, based on qualified life or specified time period, and that are relied on to perform an intended function. Provide a bases for your position.

Response

Consumable subcomponents of passive SCs, such as gaskets, pump seal packing, valve packing, and O-rings, are not subject to AMR for the following reasons:

a. These subcomponents are not required to maintain the structural integrity of a component and are not considered to be part of the "pressure boundary" per ASME Piping Code. The pressure boundary piping and components are designed such that the gaskets are needed only to limit leakage.

   If a leak should develop due to aging of the gasket/O-ring/seal material, the degradation will generally result in a small leak. The leak rate will increase slowly over time, but will allow time for plant personnel to respond to the condition. Leakage will not result in loss of the intended function of the fluid retaining component. These small leaks will be observable by plant personnel performing routine walkdowns and inspections of plant equipment. The site corrective action process requires that such leakage be reported and corrected in a timely manner.

2. These items are categorized as consumable/expendable parts/subcomponents of passive SCs. As indicated above, their replacement is ongoing, performed on an as-needed basis.

98. Section 5.8 of the IPA report appears to contain "structure/component-level" intended functions, but the FW AMR report does not identify these same functions anywhere in the text of the AMR report, please clarify.

Response

The IPA report (i.e., the LR technical report on Feedwater) provided all passive SC intended functions that are associated with the FW System. The Feedwater AMR report provided all intended functions, both active and passive, that are addressed by the Feedwater AMR report. The differences are intentional. The list in the IPA report does not show any active functions. The AMR report does not show any functions that are addressed by a commodity evaluation, such as the cables or component supports commodity evaluation. The revised LR technical report will clarify this item.

99. Clarify the definitions for ET and DT provided by the applicant. Also, discuss how material of construction and/or environmental conditions are considered when developing these groups.

Response

As discussed in the BGE IPA Methodology, ET is:

> "a general categorization of components according to their function and design. Examples of specific ETs are valve, piping, instrument, etc. For those SCs subject to AMR, the list of age-related degradation mechanisms (ARDMs) which needs to be addressed is developed for each ET. Structural components are categorized into generic groupings of concrete/architectural and steel components."

and DT is

> "A more specific categorization of components according to their function and design. Equipment types (ETs) are broken into a number of DTs. For example, the ET for valves include DTs hand valve, check valve, control valve, and others. Device types are the starting point for grouping in the AMR task. Components are grouped by DT as they enter this task. Device types may be divided to form more specific groups if needed, or the DT may define the component group for evaluation. Whenever the LR Rule calls for justifications for SCs, the discussions provided by the BGE IPA process are at the device-type level."

Further discussion of how materials of construction and environments are considered in grouping is provided in the IPA Methodology Section 6.2.2. The results of grouping are documented in AMR Report Attachment 3, where the specific grouping attributes are provided.

100. Provide a discussion for the grouping of components into DT for assessing plausible ARDMs/aging effects for the FW System.

Response

Section 6.2.2 of the IPA methodology explains that components within a system are grouped initially by DT, i.e., all hand valves, all piping segments of a particular class, all tanks. The site equipment database includes the DT as an integral part of each identification number in the site

equipment database. Therefore, every component is grouped by DT by its unique device identifier. The DT groups may be further subdivided by internal or external environment, material, function, or other attributes that add efficiency to the AMR process. The attributes that distinguish each group are documented on the Attachment 3s (Grouping Summary Sheets) in the AMR Report.

101. Table 3-1 presents a list of "intended system functions" and a determination if **the system-level intended function(s)** is passive. Table 3-2 presents a listing of eleven DTs (not the same as commodity groups), and the results from four separate assessments, including Component Support Passive Function(s) (Y/N). Please explain the purpose of Table 3-1, since the passive determination needs to be made at the component level.

Response

Table 3-1 of the FW AMR Report provides a summary documentation of the results of the pre-evaluation task which is documented in detail in a separate IPA product onsite. Table 3-2 of the FW AMR Report summarizes the results of the component-level determination; i.e.:

- whether the components contribute to an intended function which requires moving parts or a change in configuration or properties;
- whether the components are replaced based on time or qualified life; and
- whether the component is covered by a commodity evaluation.

Note that Table 3-2 lists 20 DTs, rather than 11 as stated in this question.

102. Provide a discussion that explains your determination that transformers and heat exchangers perform their component-level intended function **with/without** moving parts or a **change/no change** in configuration or properties.

Response

No determination was made about the active or passive nature of heat exchangers in the Feedwater AMR since there are no heat exchangers WSLR in this system. Transformers were determined to be active as discussed in the BGE response to Question 6.

103. Identify any fuses that are relied on to meet an FW System intended function, or relied on by a FW component WSLR. For any fuse identified, provide a justification for excluding it from the scope of LR.

Response

The component level scoping results for the FW System contains a listing of all fuses in this system which contribute to any intended function. These fuses were all determined to be active using the process described in the BGE IPA Methodology Section 5.1.2. (Fuses were listed parenthetically as an example of an active component in this section of the methodology.) See response to Question 6 for more justification.

104. Determine if any in-line components (orifice, venturi, etc.) are needed to sense FW System safety parameters. If any such in-line components exist, include them within the scope of your assessment of the FW System.

Response

Any in-line components (flow elements, etc.) in the FW System are not WSLR because they do not contribute to an intended function.

105. Provide a complete list of ARDMs. The potential ARDMs assessed in the IPA report is different from the potential ARDMs assessed in the AMR report. Table 4-1 in the AMR report shows fouling as a potential ARDM and requiring an AMR, and Table 5.8-2 in the IPA report does not show fouling as a potential ARDM. (Note, Table 4-1 identifies three additional potential ARDMs that are not identified in Table 5.8-2, but none of these three ARDMs result in an AMR report.)

Response

The potential ARDM list in the AMR for each ET includes a standard set of ARDMs which are addressed for a particular ET. Some ARDMs are judged not to be potential for each AMR report. Only the ARDMs that are potential for some ETs in the system are listed in the IPA report. Baltimore Gas and Electric Company will ensure this convention is consistently applied during the revision to the LR technical reports.

106. Determine if fouling is an ARDM, and provide a discussion as to the bases of your decision on fouling for piping, valves, and elements.

Response

Fouling is not expected in a feedwater environment. However, if it were to occur, fouling would not affect the intended function (i.e., pressure retaining boundary) of the piping, hand valves, or elements. Therefore, fouling could not be a plausible ARDM.

107. Provide a discussion as to why two valve device types with the same functions, material and environment are not susceptible to the same ARDMs. Why would crevice corrosion, fatigue, or erosion corrosion apply to one valve DT but not to another. Each DT passive intended function is to maintain system boundary and have grouping attributes of carbon steel material, controlled environment, and water temperatures of 435°F or 550°F.

Response

The plausibility determination is based on a number of factors, including material, environment, and intended function. When parameters associated with these factors are different for different hand valve groups, the plausibility determination is different. In the FW AMR:

- Crevice corrosion was determined to be plausible for all device types; and
- Erosion corrosion was determined to be plausible for the check valves, but not for the hand valves since there is no flow through the hand valves. All the hand valves WSLR for the FW System are instrument root isolation valves, or header vent or drain valves.

108. Provide additional discussion on the susceptibility of carbon and other low alloy steel components to SCC. Baltimore Gas and Electric Company indicates that carbon and other low alloy steels are not susceptible to SCC. However, the susceptibility of these materials to SCC depends on the applicable stresses and environments. For example, these materials may be susceptible to SCC in the presence of sulfur, welding residual stress, dissolved oxygen, chlorides, temperature, localized pitting, localized high tensile stresses, etc. (Reference B. E. Wild, "Stress Corrosion Cracking," Metals Handbook, Ninth Edition, Volume 11, Failure Analysis and Prevention, American Society for Metals, Metals Park, Ohio, 1986, pp. 207-108). Therefore, the susceptibility of carbon steel and other low alloy steels to SCC would depend on specific applications.

Response

Stress corrosion cracking occurs in the simultaneous presence of three elements: (1) sufficiently high tensile stress; (2) an aggressive environment; and (3) a susceptible material. Removal of any one of these factors will typically result in reduction of the susceptibility to SCC to insignificant levels. In the case of carbon and low-alloy steel FW System components, applied or residual (in the case of weldments) tensile stresses may be present, but are typically not excessive. For applied stresses, the design and application of piping and components limits general stresses to low levels relative to yield stresses. For weldments, shop and field controls over welding processes and stress relief requirements minimize residual stresses as much as practical. The controls over the environment for FW System components results in extremely low levels of oxygen, carbon dioxide, halogens and sulfates. Although carbon and low alloy steels can be susceptible to SCC under certain environmental conditions, and the effect of stress raisers and cyclic loading (such as due to thermal effects) cannot be discounted, the fluid environment of the FW System is not conducive to the occurrence of SCC. The corrosive elements necessary to result in SCC of carbon steels, per the referenced ASM Metals Handbook, are not present in the FW System fluid. The effects of thermal cycling and fatigue is evaluated further under the Thermal Fatigue ARDM sections of the AMR.

109. Provide a discussion that describes the operating experience reviewed for the FW System, and specifically discuss how this information was factored in when determining the plausible aging effects for the FW System.

Response

Industry and plant-specific operating experience was factored in throughout the BGE scoping and IPA process. The method of using this experience was a reliance on the site process which incorporates operating experience into all aspects of plant documentation, maintenance, and operations, currently proceduralized in NS-1-100, "Use of Operating Experience and the Nuclear Hotline." This procedure was provided to the NRC as an attachment to BGE letter dated December 15, 1995, "Response to Request for Additional Information Concerning the Baltimore Gas and Electric Company Report entitled 'Integrated Plant Assessment Methodology,' dated August 18, 1995." Because the scoping and IPA process utilized sources of information which already had industry and site operating experience factored in, BGE believes that the IPA results have already factored in operating experience. As agreed to in the BGE template discussions, BGE will include in the revised LR technical reports (including the FW System Report), a discussion of relevant operating experience with respect to aging in the system. These operating

experience discussions will provide further assurance that the IPA results have factored in the appropriate operating experience.

110. Provide a discussion as to why "thermal damage" from stratification was not considered as a plausible ARDM for the FW System, NRC generic communications (i.e., NRC Bulletin 79-13, Information Notices 84-87, 93-20, and others) indicate that this ARDM should be considered.

Response

Thermal fatigue was determined to be plausible for the feedwater piping with the potential for thermal stratification a major consideration in this determination. See the Matrix Code D explanation for piping group 045-DB-01. "Thermal fatigue due to thermal cycling of the feedwater piping in this group (low-cycle fatigue) is plausible due to thermal stratification of the piping . . . ." Thermal damage is a separate ARDM related to aging of non-metals, and this ARDM was determined to be not plausible.

111. Determine if fatigue assisted corrosion, stress assisted corrosion, and other phenomena discussed in Bulletin 79-13 are potentially applicable ARDM for cracking of feedwater nozzle-to-pipe welds, as is identified in the generic communication referenced in the previous question.

Response

The generic correspondence (NRC Bulletin 79-13) reported instances of cracking in feedwater nozzles, and directed utilities to conduct volumetric examinations of these nozzles to ensure that no such cracking existed at their facilities. Baltimore Gas and Electric Company performed these inspections and received approval of the results in a Safety Evaluation Report dated March 5, 1980. The phenomena which caused the cracking at other utilities was determined to be corrosion fatigue in all cases except one, and stress assisted corrosion in the other. Fatigue assisted corrosion (termed "corrosion fatigue" in the AMR) and stress assisted corrosion (term refers to either "stress corrosion cracking" or "corrosion fatigue," both of which are addressed in the AMR), as well as thermal fatigue, are all considered potential ARDMs for FW System piping adjacent to the steam generator nozzle, which includes the nozzle attachment weld, in the AMR.

112. Determine if the thermal fatigue for long sections of horizontal piping is an applicable ARDM as discussed in Information Notice 91-38, "Thermal Stratification in Feedwater System Piping." The applicant's AMR report, Attachment 6, indicates that only the piping adjacent to the steam generator nozzle is subject to thermal stratification.

Response

The portions of the feedwater piping which are potentially susceptible to thermal stratification are the entire horizontal run of feedwater piping adjacent to the steam generator nozzle for each steam generator. In the AMR, thermal fatigue is considered a plausible ARDM for these horizontal runs of piping adjacent to the steam generator nozzle. This will be described in more detail in the revised LR technical report.

113. Assess the aging effects identified in resolved GSI 14, "PWR Pipe Cracks," in the AMR report including SCC, vibration and thermal fatigue, and dynamic loading occurrences that have resulted in FW line cracking in certain Westinghouse and Combustion Engineering Plants.

Response

The FW System AMR currently evaluates SCC, thermal fatigue, and dynamic loading (including vibration) as potential ARDMs for the piping adjacent to the steam generator nozzle. This is the section of piping that is the subject of GSI 14. Refer to responses to Questions 108, 111, 112, and 117 for additional information.

114. Provide a discussion on the degradation of internal appurtenances in light water reactors, as it relates to the FW System.

Response

The miscellaneous appurtenances that are WSLR (i.e., thermowells for temperature elements) have been addressed in the current AMR report. Miscellaneous appurtenances in the NSR portions of the FW System do not satisfy any of the §54.4(a) criteria and are not WSLR. Therefore, these items have not been addressed in the AMR or LR technical reports.

115. Provide a discussion relevant to operating experience of the steam generator secondary side instrumentation loops.

Response

The steam generator secondary side instrument loops are either excluded from the AMR because they are replaced at intervals less than 40 years or are covered in the Instrument Lines Commodity Evaluation Report. Any relevant operating experience discussion which is needed will be included in the LR technical report for that commodity evaluation.

116. Fatigue cracking of pipe and damage to pipe supports from dynamic loading should be considered a "plausible aging effect." Attachments 5 and 6 of the AMR report indicates that dynamic loading is not a plausible ARDM, in part because water hammers are not considered "routine." Water hammer could over stress piping, cause low-cycle fatigue, and damage supports. Unless the FW System is designed such that water hammer has not and will not occur, it should be assumed that this high flow water system is susceptible to water hammer and, therefore, the effects of dynamic loading needs to be considered.

Response

Water hammer has occurred in the past. Past events have been evaluated as appropriate. Several design changes to the system have been made and several operating precautions are proceduralized to minimize the possibility of water hammer in the future. For this reason, water hammer is not considered an aging mechanism which is plausible for the system.

117. Include in your assessment of water hammer a discussion relating to the NRC generic communication, Information Notice 91-50, A Review of Water Hammer Events After 1985."

Response

The BGE evaluation of Information Notice 91-50 concluded that no FW System-related water hammer events have occurred since 1985. Additionally, the potential for age-related degradation associated with water hammer is considered in the evaluation of the Dynamic Loading ARDM of the AMR. The conclusion of the evaluation is that water hammer is not a normal or routine event for the FW System and is not a source of long-term age-related degradation of FW System components. It is expected, however, that the effects of any water hammer events that have occurred in the FW System will be accounted for in the determination of any accumulated damage to components, such as fatigue effects, when establishing inspection criteria or fatigue usage limits/status.

118. Provide a discussion as to why wear and erosion were determined to be non-plausible aging effects for the seat and disk of 045-HV-02D. The AMR report, Attachment 4, indicates that the seat and disk of 045-HV-02D serve a passive function of maintaining system pressure boundary and require an AMR report.

Response

Erosion was considered not plausible because these header drain valves are not exposed to fluid flow. Seat wear was considered not plausible because these valves, being header drain valves, are rarely operated.

119. Identify specifically which portion of the FW System piping is susceptible to thermal stratification. A description of adjacent to the steam generator nozzle is not an acceptable description.

Response

See response to question 112.

CLASS 1 STRUCTURES (Questions 120 - 137)

120. The boundaries for all Class 1 Structures were not defined clearly. The report did not indicate which part of the pipe or equipment supports were within the boundary of evaluation. Please provide detailed boundary description for all Class 1 Structures, including pipe or equipment supports, with appropriate sketches or drawing(s) to indicate the portion of structures WSLR and the interface with other SCs.

Response

The boundaries of the Class 1 Structures will be clearly defined in the revised LR technical report for structures. Sketches will be included if needed to make the boundaries clear.

121. Please provide copies of the following BGE documents:

a. Table 1S of "Component Level Scoping Results for all class 1 structures." (Page 1-2, Section 1.1.3)

b. EN-1-305, Rev 0, "Component Aging Management Review Procedure for Structures"

c. LCM-11S

Response

Copies of the structures' component level scoping results, procedure for AMR of structures, and procedure for component level scoping of structures are available for review onsite.

122. Significant changes in ground water table could cause ground settlement. A de-watering system installed during construction at the CCNPP site to minimize fluctuation of ground water level may not be functional; therefore, the ground water level could be different than anticipated. Since the ground water level could have an effect on settlement, reaction with aggregate, leaching of calcium hydroxide, and aggressive chemical attack, the staff believes that the de-watering system should continue to function as designed during the extended period of operation. Please provide a discussion about aging effects on the de-watering system and the basis for your determination.

Response

The extent of reliance on the de-watering system during the AMR is documented in the AMR reports. Current site processes will be adjusted, as needed, to ensure that future plant activities (e.g., modifications and maintenance practices) consider the role that this system plays in the AMR non-plausibility determinations. However, the de-watering system is not subject to an AMR because it does not meet any of the criteria in §54.4(a).

123. Sketches, diagrams, and general layout plans for Class 1 Structures should be attached to the IPA and AMR reports to assist the reviewer. These materials are essential for the staff to review your scoping results.

Response

Sketches, diagrams and general layout plans for Class 1 Structures are available for review onsite.

124. ASME Section III, Division 2 was cited for every report, but Division 2 is only for concrete reactor vessels and containments. It should be deleted from all reports except the containment structure.

Response

This change will be made during the next update to AMR reports.

125. In most of the Class 1 Structure AMR reports, Page 2-2, Table 2-1, lists the intended functions of the cast-in-place anchors/embedments to include LR-S-2, "Provide shelter/protection to safety related equipment," and LR-S-4, "Serves as a missile barrier (internal or external)." Please explain how anchors can provide shelter for SR equipment or serve as missile barriers.

Response

The association of all intended functions to structural component types are explained in the component level scoping results for each structure and are maintained onsite. For example, Function 2 is associated with cast-in-place anchors in the Intake Structure, because these bolts provide support to the water tight doors which provide shelter and protection for SR equipment. Function 4 is associated with the post-installed anchors for the No. 21 FOST Enclosure because these anchors are used for roof beams which provide missile protection for the enclosed FOST. These are just a two examples of the many applications in which cast-in-place anchor bolts are used and the associated intended function determination.

126. Section 7.1 of the Structures IPA report (Appendix A, Attachment 4 to the May 22, 1996 letter) indicates that the Seismic Category I structures are: Containment Structure, Auxiliary Building, Intake Structure, Turbine Building, No. 21 FOST Enclosure, and No. 12 Condensate Storage Tank (CST) Enclosure. However, there are other typically Seismic Category I structures at plants, such as the Diesel Generator Building, refueling water storage tank, switchgear room, auxiliary feedwater pump house, and piping tunnels. Provide a copy of the BGE plant building drawing, such as an oversized Figure 1-2 in the UFSAR, annotating Seismic Category I Structures and explain why these structures are not WSLR.

Response

The revised LR technical report will clearly establish the scope of the Class 1 Structures. The diesel generator rooms and switchgear room are part of the Auxiliary Building. As stated in BGE IPA Methodology Section 2.2.5, tanks are included as components of a system rather than as separate structures. The refueling water tank is evaluated as a component in the Safety Injection System. The auxiliary feedwater pump room is the only Class 1 portion of the Turbine Building, and is the primary reason that the Turbine Building was included WSLR. According to CCNPP UFSAR Section 5A.2.1.2, "Calvert Cliffs has no [Seismic] Category I tunnels or underground cells."

127. Table 7.1-3 does not list leaching of calcium hydroxide as a plausible aging mechanism for any Seismic Category I structures. Appendix B to the AMR report discusses the basis of this determination by indicating that the concrete was designed in accordance with codes and standards "to maximize resistance to leaching of calcium hydroxide." Although Appendix B to the AMR reports references American Concrete Institute (ACI)-201.2R-67, "Guide to Durable Concrete," for a description of the aging mechanism, it is not clear whether BGE applied this particular reference in plant design and construction. Verify that BGE applied ACI-201.2R-67 for the design and construction of Seismic Category I structures.

Response

Baltimore Gas and Electric Company did not apply ACI-201.2R-67 for the design and construction of Seismic Category I Structures. The UFSAR Section 5.5.1.1 contains details of the industry codes and standards used for concrete in Seismic Category I Structures at CCNPP.

Appendix B of the AMR report states that the concrete used in Class 1 Structure conformed to ASTM C-94 Specification for Ready Mix Concrete, ACI 318-63 Building Code Requirements for Reinforced Concrete, ACI 301-66 Standard Specifications for Structural Concrete for Building and the ACI Manual of Concrete Inspection. The appendix provides the specific characteristics that the concrete was required to meet by the procurement specifications which ensured that the concrete was of low permeability. Based on the specified concrete characteristics, the CCNPP architect engineer and an independent contractor (also an architect engineer at other nuclear facilities) concluded that leaching of $CaOH_2$ is not a plausible ARDM for Seismic Category I structures at CCNPP.

128. Table 4-2 of the AMR reports indicates that the only plausible aging mechanism for post-installed anchors and cast-in-place anchors is corrosion in steel. However, cracking in concrete surrounding the anchors can degrade the capacity of the anchors and vibratory loads could cause a loss of preload. Discuss the effects of cracking of concrete and vibratory loads on anchors.

Response

Cracking of concrete due to vibratory loads from equipment is addressed as an ARDM associated with the component supports in the Component Supports Commodity Evaluation Report. The boundary between the Structures AMR and the Component Supports Commodity Evaluation Report will be more clearly described in the revised LR technical report. See response to Question 212.

129. Appendix E, Section 1.0, of the AMR reports for all Seismic Category I structures states: " . . . stray electrical currents can aggravate active corrosion, they are not age-related." The staff believes that corrosion is age-related and if stray currents "may accelerate the corrosion process" as stated in the AMR reports, their contribution to corrosion should be considered when managing the aging effects of corrosion. Provide additional discuss on corrosion.

Response

The discussion in Appendix E referred to in this question is related to stray electrical currents from lightning arrestors in contact with reinforcing steel in the structure. The position taken in these AMRs, and in the Class 1 Structures Industry Reports, is that such currents are not considered ARDMs. There is no evidence of stray electrical currents being the singular cause for significant age-related structural degradation. Such currents can only aggravate the corrosion process, when corrosion is active (see EPRI TR-103842, p. A-20 comment S-3 and p. A-38 comment S-20).

130. Appendix E, Section 1.0 of the AMR reports uses pH < 4.0 as the threshold value for significant corrosion rate while the Class I Structures License Renewal Industry Report (p. 4-12, Section 4.1.3) uses the pH < 5.5 to be the threshold. Please provide clarification for this discrepancy.

Response

The threshold (not significant if pH > 5.5) referred to in the Class 1 Structures Industry Report (Section 4.1.3) is related to aggressive chemical attack of concrete, not corrosion of embedded steel/rebar. Appendix E of the AMR report addresses corrosion of embedded steel/rebar. Therefore, the question does not represent a discrepancy between the AMR and the industry report. Two different aging mechanisms are being addressed in the sections of the two reports referred to in this question.

The basis for the ground water pH threshold (corrosion of embedded steel/rebar is not plausible if pH > 4.0) in the BGE AMR report is as follows. The pH threshold in the industry report states that corrosion of embedded steel/rebar is not significant if pH > 11.5 in the vicinity of the rebar. Since this pH cannot be measured directly, BGE determined an alternate threshold to determine the potential for corrosion of embedded steel/rebar. If ground water pH is maintained at greater than 4.0, the concrete environment adjacent to the rebar would not lead to any significant corrosion effects on the embedded rebar. This determination is consistent with the industry report conclusion but allows for measuring a parameter which is accessible for measurement (i.e., ground water pH rather than pH in the vicinity of the rebar). The BGE conclusions are based on a number of factors. American Concrete Institute 515-79 indicates that boric acid solution (pH ≈ 3 - 4) will have a negligible effect on concrete strength. Additionally, BGE's Materials Engineering and Inspection Unit conducted a series of corrosion tests of carbon steel rod embedded in concrete and exposed to boric acid solution. The tests were conducted to support a separate plant evaluation; however, the results provide useful information regarding the effects that acidic ground water would have on embedded steel/rebar. The tests exposed carbon steel rods embedded in concrete to 1.5% and saturated borated water solutions (pH ≈ 3 - 4) at 70 - 120°F for up to 207 days. None of the sample rods experienced measurable corrosion. Based on these tests, the corrosion rate of rebar in wetted Type II concrete with a chloride concentration of .3% (3000 ppm) or less was conservatively assumed to be approximately 0.1 mils per year. This corrosion rate would result in an insignificant loss of rebar cross section in the below grade concrete exposed to ground water over the remaining life of the plant, including the period of extended operations. (Measured ground water pH was in the range of 7 - 7.5 during initial construction, and has recently been measured and found to still be in this range.)

131. Appendix E, Section 1.0, of the AMR reports states, "Low water-to-cement rations and adequate air entrainment increase resistance to water penetration and thereby provide greater resistance to corrosion." Please describe the water-to-cement ration and air entrainment of concrete in Class I Structures at CCNPP, and discuss whether those values are considered adequate. Also discuss the concrete strength in CCNPP Class I Structures.

Response

Class 1 Structures and Pressurized Water Reactor [PWR] Containment Industry Report conclude that corrosion of embedded steel/rebar is not a potentially significant ARDM if

a. the concrete is not exposed to ground water. This approach is taken for a number of structural components; however, ground water will be in contact with certain below grade concrete structural components. OR

b. the ground water is determined to be non-aggressive. The BGE Structures AMR concludes that, for below grade concrete structural components which may be in continuous or near continuous contact with ground water, corrosion of embedded steel/rebar is a plausible ARDM. The first step of an aging management strategy for this ARDM is to sample the ground water and determine whether it is aggressive. If during these samples, the ground water is determined to be aggressive, further action is required.

c. At the point of determining that the ground water is aggressive, the industry reports provide the guidance that if the concrete is relatively high strength (4000 psi), has a low water-to-cement ratio (.35 to .45) and adequate air entrainment (3 to 6%), then the concrete will have low permeability; and if the structure was designed in accordance with ACI 318 or ASME Section III Division 2, significant age-related degradation of the embedded steel components due to embedded steel corrosion will be prevented. The BGE AMR never reached the point where it was concluded that the ground water is aggressive; therefore, the information requested in this question is not pertinent to the conclusions.

In other appendices where this information is more applicable, (such as Appendix A Freeze Thaw), the CCNPP concrete specification is provided. This specification ensures that: (1) the strength of Containment basemat slab and other structural concrete is 4000 psi; (2) concrete is capable of entraining 3-5% air; (3) water-to-cement ratio is .35 to .47; and (4) the concrete conforms with ACI 318. Therefore, even if the ground water is determined to be aggressive (it was not based on recent samples), the reinforcement distribution will minimize crack development, and the concrete cover over embedded steel components will effectively prohibit exposure of embedded steel components to a corrosive environment.

132. Discuss the potential aging effects resulting from concrete interaction with aluminum for CCNPP Class 1 Structures.

Response

The Class 1 Structure Industry Report concluded that this phenomenon is not an aging mechanism, but rather an issue which was resolved as part of original construction. The CCNPP UFSAR Section 5.6.1.1 provides the following discussion of concrete aluminum reaction:

"During the week of May 8, 1969, part of the concrete for the Auxiliary Building walls was pumped through aluminum pipe (Figure 5-17). During the week of August 15, 1969, 20% of concrete pour No. C-5.5a, i.e., for the base slab, Containment Structure, Unit 1, was also pumped through aluminum pipe. The area to which the concrete was pumped is shown in Figures 5-18 and 5-19. Upon the discovery, extensive tests were performed on the concrete, initially with the "Swiss Hammer," which indicated the average strength of the concrete to be above 5000 psi, for walls in the Auxiliary Building. The design strength of the concrete for the walls of interest in the Auxiliary Building and for the base slab in the Containment Structure is 4000 psi. Five cores were taken from the above walls for further testing. These tests indicated the minimum strength of concrete to be 4727 psi and maximum strength 5583 psi. Since the actual calculated stresses in the concrete are well below allowable stresses, and since the tests on concrete pumped through aluminum pipe in the Auxiliary Building indicate that the strength of the concrete is well above the design strength of 4000 psi, it is evident that the concrete pumped through aluminum pipe, in

the base slab of the Containment Structure Unit 1, and in the Auxiliary Building wall, is structurally adequate."

Because the effects of significant concrete aluminum reaction would be an inability of the concrete to achieve its full strength potential, and because the UFSAR provides justification that concrete which was pumped through aluminum pipe reached adequate strength per its design specifications, concrete aluminum interaction is not judged to be an aging mechanism which needs to be addressed for CCNPP concrete.

133. The AMR reports do not discuss the evaluation of cranes (the polar crane and refueling crane in the Containment Structure, the gantry crane in the Intake Structure, and the overhead crane in the Turbine Building) and their supports for Seismic II over I consideration. Please provide a discussion of the cranes and their supports if they are within the scope of the Class I Structures. If cranes and their supports are addressed as commodity, then their boundaries should be clearly defined.

Response

The revised LR technical report will clarify the boundary between the Cranes and Fuel Handling Commodity Evaluation Report and the structures evaluations. Generally, the crane rails for heavy load handling cranes in the Containment and Auxiliary Building were included in the structures evaluations, while the remaining structural components of the cranes were handled in the Cranes and Fuel Handling Equipment Commodity Evaluation Report. The exception to this is that the Intake Structure Semi Gantry Crane Rails were included in the Cranes and Fuel Handling Commodity Evaluation Report, rather than the Intake Structure Evaluation. As described in Section 7 of the BGE IPA Methodology, the Cranes and Fuel Handling Commodity Evaluation Report included a step to review the results of all structures evaluations and to determine what portions of cranes and load handling equipment were not included in the structures evaluations, so that they could be included in the commodity evaluation.

134. Concrete and steel structures in a marine environment are suspect to MIC on steel and microbiologically induced surface degradation of concrete. The root structure of seaweeds can break down the concrete by physically bursting action. Therefore, marine fouling should be considered as a plausible ARDM. Please provide a discussion on this subject.

Response

Marine fouling could occur on the fluid retaining walls and slabs of the Intake Structure which are in contact with the Chesapeake Bay. If such fouling were allowed to remain for extended periods of time, it could lead to the type of degradation mentioned in this question. However, two aging mechanisms, aggressive chemical attack, and corrosion of embedded steel/rebar were already determined to be plausible for these structural components. The recommended aging management program for discovery of the effects of these ARDMs is a surface inspection of the concrete in conjunction with the current procedure which cleans the surfaces of the walls at periodic intervals. Because this program removes any marine growth at frequent intervals in order to allow inspection of concrete surfaces for other plausible ARDMs, BGE believes that marine fouling will never progress to the point where the fouling itself will contribute to the aging of the concrete or

embedded steel in contact with the bay. Therefore, fouling does not need to be considered as a separate aging effect.

135. Missing and loose anchor bolts may result from aging-related degradation and they should be addressed in the reports. If they are addressed in the commodity evaluation, they should be clearly identified.

Response

The boundary between the structures evaluation and the Component Supports Commodity Evaluation Report will be clearly described in the revised LR technical report. Aging of anchor bolts from the equipment being supported, such as vibrations or thermal loading, was addressed in the Component Supports Commodity Evaluation Report. Loose anchor bolts is an effect which could result from certain aging mechanisms which are addressed in the commodity evaluation.

136. Please provide information of the use of de-icing salts on the concrete surfaces at CCNPP.

Response

De-icing salts are used on walkways at CCNPP and may be used on roads, but are not used on SR structures. Therefore, de-icing salts will not affect the progress of concrete degradation.

137. Appendix J, Section 3.0 of the AMR report states, "Long-term settlement is not expected to continue after 40 years." Please provide technical basis to support this conclusion.

Response

The technical basis to support the conclusion is described in Section 2.1 through 2.6 of Appendix J and summarized in the wording immediately preceding the sentence quoted in the question - "CCNPP's containment is situated on Miocene soil, which is exceptionally dense and will support heavy foundation loads. Additionally, the structural load on the containment basemat is about the same as the removed overburden weight. Therefore, the soil bearing stress is well below its ultimate bearing capacity, and the long-term settlement is predicted to be only 1/2 inch. In addition, the settlement rate declined after completion of construction, and the ground water table is maintained by the de-watering system. Long-term settlement is not expected to continue after 40 years. Therefore, settlement is not a plausible aging mechanism for the structural components of the containment."

CONTAINMENT (Questions 138-161)

138. Appendix E, Section 2.1 of the Containment Structure AMR report (Appendix A, Attachment 4, Enclosure 9) states, "Because of the safety significant of these systems, undetected leakage of borated water for an extended period of time cannot occur. Therefore, . . ." Please provide detail information to justify this statement.

Response

Aging evaluations of systems and structures do not assume that piping is allowed to leak for an extended period of time such that it would degrade the surrounding structure.

139. Appendix E, Section 2.5 of the AMR report states, "Based on the discussion in Sections 2.1 and 2.4, corrosion is not a plausible aging mechanism . . ." and Section 2.6 states, "There is no existing programs . . . ." Explain the technical bases for this non-plausible determination.

Response

The discussions in Sections 2.1 through 2.4 explain that corrosion of embedded steel/rebar is not considered a potential ARDM for embedded steel inside containment due to the lack of any aggressive environment which would lead to corrosion. The discussion continues by providing concrete characteristics (e.g., low permeability and proper concrete cover per applicable standards) which ensure the external surfaces of the concrete dome and above ground portions of the concrete containment walls are not susceptible to corrosion of embedded steel/rebar. These conclusions are consistent with the conclusions of the PWR Containment Industry Report.

140. Appendix S, Section 2.4 of the AMR report lists the normal service doses from the BGE EQ Design Manual, which are lower than the radiation degradation threshold value from various documents referenced. Therefore, irradiation is considered not a plausible aging mechanism. Please provide evidences to show the actual radiation level and the estimated radiation level under all current licensing basis design considerations (not just normal service) of the Primary Shield Wall at various locations to be lower than the threshold value.

Response

The other than normal radiation levels on the primary shield wall are not a factor in the aging of the concrete. The normal service doses are the stressor which affect aging. The EQ Design Manual [now referred to as "Summary of Ambient Environmental Service Conditions (ES-014)"] is a site reference controlled under the CCNPP quality control process. The estimated dose levels in that manual are periodically validated against actual plant data.

141. Table 4-1 of the AMR report List of Potential Aging Mechanisms for Containment Structural Components. Under fatigue, it only lists concrete structural elements that are potentially subjected to this aging mechanism without mentioning steel elements, such as crane girder and penetrations. Please provide justification for this determination.

Response

Appendix T and Attachment 1 of the AMR document that fatigue is a potential ARDM for a variety of steel components also. For consistency and completeness, the AMR Table 4-1 will be revised to reflect that structural steel is also a material potentially affected by fatigue.

142. Appendix R, Section 2.5, of the AMR report indicates that elevated temperature is not a plausible aging mechanism, in part, because of cooling systems in the reactor cavity and around hot pipe penetrations. The Staff considers the cooling systems' function is to protect the concrete from being exposed to elevated temperatures; and thus, the aging effects from elevated temperatures should be considered plausible, and the cooling systems should be proposed as part of the aging management program. Discuss the applicability of elevated temperature as an aging mechanism.

Response

The extent of reliance on the cooling water and ventilation systems during the AMR (with respect to elevated temperature) is documented in the AMR report. The role of these systems in cooling the concrete is also documented in the UFSAR. Therefore, current site processes will ensure that future plant activities (e.g., modifications and maintenance practices) consider the role that these systems play in preventing the concrete from being exposed to excessive temperature for a prolonged period. However, the systems referred to in this question are not aging management programs.

143. Attachment 7 of the AMR report is the 1992 Walkdown Report for the Containment Structure and the report was referenced frequently through out the report. Please provide a copy of the walkdown report.

Response

The 1992 walkdown report for the containment structure is available for review onsite.

144. Appendix B, Section 2.5, of the AMR report indicates that, "A walkdown in 1992 observed only slight traces of leaching on the containment dome and wall and were judged to have no adverse impact . . . . Therefore, leaching of calcium hydroxide is not a plausible aging mechanism for . . . the concrete basemat." Please explain how the concrete basemat was inspected during the walkdown and the bases for your judgment.

Response

The discussion in Appendix B refers to several factors which are pertinent to preventing this ARDM (leaching of calcium hydroxide) from affecting the intended function of the concrete. The confirmatory inspections in accessible areas merely served to confirm that the factors referred to had been effective. It is not the only reason listed for the non-plausibility determination. The report clearly states that the inspection covered the containment dome and wall, not the basemat.

The focused inspections performed by BGE in conjunction with the evaluations of structures were recommended by the NRC Staff during the review of the Containment and the Class 1 Structures Industry Reports. These inspections are intended only to confirm the plausibility determinations and provide additional assurance that aging management will focus on the applicable aging effects. They are never the sole basis for determining plausibility.

145. Lubrite plate is listed as a structural component in Table 2-1, but no detail information is provided in the report. Any aging effects or ARDMs associated with the lubrite plate should be discussed.

Response

Appendix K, "Corrosion of Steel," concludes that corrosion of the lubrite plates is a plausible ARDM which needs to be managed. This appendix concludes that for inaccessible areas, an age-related degradation inspection will be performed to inspect a representative sample of inaccessible steel locations to ensure that corrosion of steel in these locations is not progressing differently from corrosion of steel in accessible locations.

146. Page 2-2, Table 2-1 of the AMR report lists coating as a structural component. The Staff considers protective coating as part of an aging management program if it is used solely to protect components from aging effects, such as corrosion. Page O-2, Section 2.3, states, " . . . coatings inside the Containment Structure are only safety-related because of the potential impact of coating failure on the operation of the emergency sump in the event of a design basis accident inside the Containment Structure." The staff believes that the aging effects on the emergency sump resulting from age-related coating failure or other causes should be managed to maintain the sump's intended functions; but the Staff does not consider coating a separate component. Revise your statement or provide additional discussion.

Response

Baltimore Gas and Electric Company has evaluated the coatings as separate structural components in the Class 1 Structures evaluation. These coatings were found not to be WSLR for all structures except containment. For the other structures, the coatings are considered part of the aging management approach for the coated surfaces. For the containment, such coatings are controlled as SR in site documents because coating failure could cause failure of other SR equipment, e.g., the containment sump. To be consistent with this determination, the coatings in the containment are included WSLR as SR.

147. The containment tendon system has been reported to have many industry problems, including tendon corrosion. Appendix M, Section 2.6, of the AMR report states that the tendon system in CCNPP containment is tested and monitored by tendon surveillance program Surveillance Test Procedure M-663-1/2. The surveillance history should be summarized to provide positive evidence that aging effects are effectively managed by the existing program.

Response

A brief summary of the tendon surveillance history will be provided in the revised LR technical report.

148. Table 7.1-1 of the IPA report indicates that there are no jet impingement barriers or pipe whip restraints included in the containment evaluation. Discuss why they were not identified in this table, and where the aging management of jet impingement barriers and pipe whip restraints inside containment will be evaluated.

Response

There are no jet impingement barriers in containment. The pipe whip restraints in containment and in the Turbine Building are covered under the category of structural steel bracing. Integrated Plant Assessment products will be updated to address these pipe whip restraints consistently from one structure to the next.

149. Table 7.1-2 indicates that only the containment (the containment system) has the intended function of "Maintain the functionality of electrical components addressed by the EQ program." However, electrical components outside the containment may also be subject to the 10 CFR 50.49 EQ requirements. Please discuss whether any other Seismic Category I Structures have this intended function to "maintain the functionality of electrical components addressed by the EQ program" outside the containment.

Response

As described in the BGE IPA Methodology, any structure which is identified in the site equipment database as a system was scoped using both the system and the structures scoping processes. The containment is such a system and it contains system-type electrical components which are subject to the CCNPP §50.49 program. The Intake Structure is the only other structure which is also documented as a system in the site database. The component level scoping of this structure revealed that none of the system type components contribute to any intended functions. The other structures have no system type components associated with them. Therefore, the containment is the only structure which contributes to the EQ intended function. All other components subject to §50.49 are addressed as part of a system.

150. Page L-1, Section 1.1, excludes SCC as a plausible degradation mechanism for the carbon steel liner. Please provide evidence to show that carbon steel liner is not subject to localized high tensile stress and environmental conditions that have been known to promote SCC.

Response

The material of the containment liner (ASTM A36 carbon steel) is not susceptible to SCC under the conditions of a mild environment (air) and compressive stresses. This conclusion is consistent with the PWR Containment Industry Report which states, "Because PWR containment liners are not designed to resist mechanical loads, and only experience compressive stresses, due to dead load and prestress (for prestressed containment structures), age-related degradation of PWR liners from SCC will not cause significant degradation during the LR term and requires no further evaluation."

151. Appendix L, Section 1.2 of the AMR report does not address the degradation of the stainless steel liner by pitting and corrosion fatigue cracking (CFC). The environmental factors that can lead to pitting in stainless steels may be present inside or outside the liner. The CFC damage can occur at weld joints or junctions with penetrations. Please provide justification that these plausible degradation mechanisms are addressed and managed.

Response

Pitting corrosion is not a plausible ARDM for a stainless steel liner at relatively low operating temperature (less than 150°F) unless raw water is used in the system. The water used for the refueling pool and spent fuel pool is maintained at low temperatures (normally less than 127°F). This water does not contain the level of impurities which would lead to pitting corrosion at these temperatures. This conclusion is consistent with the Class 1 Structures Industry Report and with the industry operating experience documented in the Aging Management Guideline on Tanks and Pools (February 1996). Corrosion fatigue cracking is not addressed for the stainless steel liner because these liners are not subject to the cyclic stresses which cause this ARDM.

152. Appendix L, Section 2.1.3, of the AMR report does not consider residual stress from fabrication as a potential complement for SCC. " . . . [it states] Degradation of the stainless steel liner due to IGSCC (intergranular stress corrosion cracking) in the pool is typically evidenced by leakage and detected by observation of an increased amount of pool water leakage." The staff considers that

leakage detection alone is not sufficient to manage this plausible aging mechanism. Please provide further evidence that this mechanism is effectively managed.

Response

The evaluation does consider the residual stresses from fabrication in the determination that SCC is a plausible ARDM for the liner. See Sections 1.2 and 2.1.3 of Appendix L. Attachment 5 (Adequate Program Evaluation) pages 15 - 17 provide the justification for why leak detection is an appropriate technique for aging management of the refueling pool liner.

153. Page 4-7, Table 4-2, of the AMR report lists coating as having no plausible aging mechanism. Baltimore Gas and Electric Company indicates that coatings inside the containment are SR due to the fact that loose coating during a design basis accident becomes debris which may block the recirculation sump. However, Information Notice 93-34, "Potential for Loss of Emergency Cooling Function due to a Combination of Operational and Post-LOCA Debris in Containment" indicates that there may be coatings inside containment that may become loose during a design basis event and could affect the function of the sump. Discuss whether BGE has considered the effects of aging on coatings inside containment.

Response

Baltimore Gas and Electric Company has considered these effects. As discussed in the response to Question 146, this is one reason why these coatings in containment are controlled as SR onsite, and why they were included in the scope of LR. Part of the controls onsite for these coatings is to ensure that the appropriate coating materials are used such that if they do degrade, they will not clog the containment sump. For this reason, there is no plausible aging that affects the intended function of these coatings.

154. Appendix L, Section 2.1.1, of the AMR report states, " . . . the containment liner from the concrete side is not exposed to aggressive chemicals from the outside environment, such as acid rain, salt-containing atmosphere, and ground water." Discuss the susceptibility of the below grade containment wall liner from the concrete side and below grade liner anchors to corrosion.

Response

The AMR concludes that corrosion of basemat liner surface in contact with concrete is plausible because of the potential for small cracks in the basemat concrete which could allow ground water to come into contact with this liner. Corrosion of the below grade containment wall liner and liner anchors is determined to be not plausible. The reasoning behind this latter determination is not made clear in the AMR and additional discussion will be added. Because the concrete exterior to the liner is three feet, nine inches thick on the walls, and eight feet thick on the basemat, and because it is installed in accordance with appropriate ACI standards, and because the concrete design ensures low permeability, the likelihood of any concrete cracking allowing ground water to come into contact with the containment liner surface or anchors is extremely remote for both the basemat liner and below grade wall liner and anchors. However, an additional factor is also pertinent for the concrete covering the containment walls and liner anchors. This concrete is subject to the prestress forces of the containment tendons, which makes the likelihood of concrete cracking even less. Any cracks which do occur would be more tightly closed due to the prestress forces, allowing less potential for ground water to penetrate as far as the liner. Therefore,

corrosion of the concrete wall liner exterior surfaces below grade and liner anchors was determined to be not plausible.

155. Appendix R, Section 2.1, of the AMR report indicates that, "The primary loop RTDs which are located in the containment pump bays, experience higher temperatures, assumed to be 160°F based on unverified temperature monitoring." Discuss whether this temperature is the room temperature or a local temperature at the resistance temperature detectors. Also provide information on the activities associated with this "unverified temperature monitoring."

Response

The quoted statement from Appendix R supports the assertion that even at conservatively high assumed temperatures, the affects of elevated temperature on concrete are not significant. The CCNPP Engineering Standard entitled, "Summary of Ambient Environmental Service Conditions (ES-014)" replaced the "EQ Design Manual "previously referenced in Appendix R. This updated version of the design standard now states that the maximum measured temperature in the reactor coolant pump bay is 145°F. The conclusions of the AMR are still valid. The AMR will be updated to reflect the more recent, measured temperature data in the design standard results.

156. Appendix T, Section 2.4, of the AMR report discusses the fatigue of components subjected to fully-reversed mechanical loadings. The high-cycle fatigue design described may not be appropriate if low-cycle fatigue damage is presented. Therefore, the conclusion that fatigue is not a plausible aging mechanism may not be true. Please provide a discussion of this matter.

Response

In Section 1.0 of Appendix T, low cycle fatigue is addressed as follows: "Two types of fatigue exist for structural components. The first mechanism, sometimes referred to as low-cycle fatigue, is low frequency (<100 cycles for concrete structures and $<1 \times 10^5$ for steel structures) of high-level repeated loads due to abnormal events, such as safe shutdown event or strong winds. Structures exposed to such events must be thoroughly evaluated by analysis or by inspection or both after occurrence. The fatigue degradation caused by such loading may not occur or may occur only a few times during the service life of a structure. Therefore, low-cycle fatigue is not age-related and is not a LR issue." Based on this conclusion, the description of high cycle fatigue loading in Section 2.4 is appropriate since low cycle fatigue damage is not present. This conclusion is consistent with the conclusion in the PWR Containment Industry Report regarding low cycle and high cycle fatigue.

157. Appendix A, Section 3.0 of the AMR report indicates that, "A walkdown inspection of the Unit 1 containment structure performed in 1992 found no indication of freeze-thaw effect on the concrete structure." Please provide a further discussion about the plausibility of the freeze-thaw cycle mechanism for the period of the extended operation.

Response

The AMR report provides several reasons related to the characteristics of the concrete used in construction of the structures as the reason why freeze thaw is not plausible. The confirmatory inspection is also cited as additional justification.

158. Appendix B, Section 2.1 of the AMR report states, "The containment dome is provided with a roof drainage system to prevent ponding." Please provide a discussion about the functionality and potential aging effects/degradation of this drainage system.

Response

The extent of reliance on the containment roof drains during the AMR (with respect to leaching of calcium hydroxide) is documented in the AMR report. Current site processes will be adjusted, as needed, to ensure that future plant activities (e.g., modifications and maintenance practices) consider the role that these drains play in the AMR non-plausibility determinations. However, the containment roof drains are not subject to an AMR because they do not meet any of the criteria in §54.4(a).

159. Page 2-2. Table 2-1, of the AMR report lists coating as a structural component type and lists its intended functions as LR-S-1, 2, 3, 4, 5, and 7. Please explain how coating can provide all those stated functions.

Response

The coatings inside containment are within the scope of license renewal because these coatings could fail and prevent safety-related components (e.g., the containment sump. See response to RAI 146.) from performing their safety functions. The component level scoping results for the containment structure will be revised to show that the coatings' intended function is LR-S-02: *(Provide shelter or protection to SR equipment)* with an explanatory note.

160. Appendix F, Section 1.0, of the AMR report states that the sustained stress results from dead load and live load and temperature. However, the primary component triggering the creep mechanism is the internal reaction stress resulting from the prestressed construction, which does not readily fall into the three categories listed. The paragraph should be revised to specifically identify the sustained stress due to prestress.

Response

Appendix F, Section 1.0, of the AMRs will be revised to refer to internal reaction stress resulting from the prestressed construction, in addition to stress caused by dead load, live load and temperature. However, the conclusions of the AMR (i.e., that creep is not a plausible ARDM) are still valid.

161. Appendix T, Section 2.2 of the AMR report, the list should include penetrations and supports.

Response

Penetrations and supports are addressed in separate reports. The penetrations are listed in the site equipment database with unique identifiers and, therefore, are addressed in the Containment System AMR Report. The supports are addressed in the Component Supports Commodity Evaluation Report. Fatigue of these components is addressed in both of the reports.

AUXILIARY BUILDING (Questions 162 - 176)

162. Page 2 of 3 of Attachment 1 of the Auxiliary Building AMR report (Appendix A, Attachment 4, Enclosure 8) does not list leaching of calcium hydroxide and corrosion in embedded steel/rebar as its potential ARDMs for the concrete ground floor slab. If the de-watering system would not function properly, the ground water level could be higher than anticipated. In such a case, these ARDMs should be considered for the concrete ground floor slab. Freeze-thaw may also be applicable. Please justify your exclusion of these ARDMs.

Response

The structural component type referred to as "Ground Floor Slab" in the Auxiliary Building AMR are interior components, and they do not come into contact with ground water. Therefore, leaching of Ca OH_2 and corrosion of embedded steel/rebar do not need to be considered for this structural component type. The structural component type referred to as foundation (footings, beams and mats) and the below grade portions of the concrete walls do come into contact with the ground water. For these latter structural component types, leaching of $CaOH_2$ and corrosion of embedded steel/rebar are considered and credit is not taken for the ground water de-watering system.

Freeze thaw is considered a potential ARDM for structural components exposed to cold outdoor temperatures. Ground floor slabs in the Auxiliary Building do not fall within this category.

163. Attachment 7 of the AMR report, "LCM Walkdown Inspection - Auxiliary Building," Item I states that no cracking was observed on the masonry walls. NRC Inspection Reports 50-317/86-01 and 50-318/86-01 indicated that two masonry walls in the Auxiliary Building (Walls T and U at elevation 45 ft.) were found to have cracks over the entire length of the wall-ceiling junctions. Furthermore, Information Notice 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in response to I&E Bulletin 80-11," identifies the need for continued activities to ensure that the physical conditions of masonry walls remain as previously analyzed. Provide additional discussion relating to cracking of masonry block walls during the period of extended operation.

Response

The excerpt from the NRC inspection report is shown below.

"On January 16, 1986, 11 masonry block walls were field inspected by the inspection team. The results of this effort indicated that field conditions appeared consistent with those indicated in the licensee's surveys and analyses except for two walls in one area. Wall T at elevation 45 ft. in the Unit 1 auxiliary building was found to have boundary conditions deviating from those used in the analysis. Relative motion between the wall and ceiling beam was observed and the mortar joint between the wall and the ceiling beam appeared cracked for its entire length. At some points this joint contained voids such that probing of the interior of the wall could be accomplished. Wall U at this same elevation is adjacent to wall T. Wall U also showed evidence of cracking at the wall to ceiling beam mortar joint. The licensee's reanalysis for wall T assumed a simple support at the wall to ceiling beam location. The reanalysis for wall U assumed a fixed support at this location. Consequently, it was the conclusion of the inspection team that the actual boundary conditions deviated from those assumed in the reanalysis for wall T and U. Subsequent effort by the licensee's personnel disclosed that no steel dowels or other connection could be found in wall T.

On January 17, 1986, the inspection team field verified walls EE and CC in Unit 2 which correspond to walls T and U in Unit 1. Walls EE and CC did not show any evidence of relative motion at the wall to ceiling beam joint. It was concluded that these walls probably did contain a positive connection and the reanalysis was, therefore, acceptable. Based upon the reviews discussed above, the inspection team concluded that the deviating conditions found in walls T and U were an isolated case."

From the inspection report it can be seen that the cause of this cracking was determined to be lack of steel dowels or other connection between the wall and the ceiling. The inspection team also determined that this cracking was an isolated case.

These inspection results do not reflect an inconsistency with the determination in the Auxiliary Building AMR; i.e., the determination that cracking of masonry block walls will not result in failure of the walls to perform their intended function, and no aging management is needed for this aging mechanism during the period of extended operation. The cracking reported in the inspection report was determined to be the result of factors unrelated to aging. It was determined to be an isolated case and all other block walls inspected during that inspection and in conjunction with the AMR of the Auxiliary Building revealed no cracking of the masonry block walls. Additionally, recent walkdowns of masonry block walls by the CCNPP IPEEE project also revealed no concerns with cracking of these walls.

With respect to the second part of this question (related to Information Notice 87-67), BGE evaluated the applicability of this information notice to CCNPP as part of the site process for generic correspondence review. This review resulted in revision of one procedure to formalize Civil Engineering review of plant modifications that could impact the previous analysis of masonry block walls. This review did not result in the conclusion that masonry block walls need to be periodically inspected for cracking. The results of this generic correspondence review are consistent with the determination in the AMR report that cracking of masonry block walls does not require an aging management program during the period of extended operations.

164. Appendix R, Section 2.5, of the AMR report indicates that elevated temperature is not a plausible aging mechanism. However, Section 2.4 indicates that the Main Steam Isolation Valve (MSIV) rooms are at an elevated temperature, and the effects of which were evaluated by BGE and found acceptable. For this case, the Staff believes that an environment with elevated temperature is conducive to producing aging mechanisms that are applicable for the MSIV. Provide an evaluation that demonstrates that the effects of aging resulting from this environment would not result in a loss of the intended function during the period of extended operation.

Response

Section 2.4 of Appendix R contains an evaluation specifically applicable to the MSIV room with respect to elevated temperature:

"The higher temperature of 151.9°F noted in Section 2.1 is limited to the MSIV rooms. Since temperatures on the other side of the concrete walls and slabs would typically be more than 50°F less than this maximum, the temperature in the concrete, conservatively assuming linear heat loss, would reduce to 150°F within the first inch of the concrete. And since concrete outside the rebar

layers are not considered in the strength designs, the room temperatures of 151.9°F will not degrade the concrete in the MSIV rooms."

"Additionally, under BG&E Task 055595, the effect of ambient temperatures up to 160°F in the MSIV rooms were evaluated and found to be acceptable. A walkdown performed for the Task 05559 evaluation and a walkdown performed in November, 1994, for the LCM program, have confirmed that no concrete damage has occurred in the MSIV rooms, due to elevated temperature."

"Also, as noted above, and in the Task 05559 evaluation, no structural degradation would be expected in concrete subjected to temperatures less than 180°F."

165. Page 5-1, Section 5.2.1, of the AMR report references several BGE procedural documents for maintaining leakage in the spent fuel pool. These procedures are relied on, without modification, to manage aging effects without modifications. It is not clear what aging effects are being managed. The Staff notes that, typically, leakage detection alone is not acceptable to manage the effects of aging. Further, boraflex has been known to cause aging degradation, but is not addressed in your report. Please provide additional information regarding aging effects on the spent fuel pool.

Response

The report concludes in Section 4 and Attachment 2 that the only plausible aging effect for the spent fuel pool liner is SCC. The program mentioned in Section 5 addresses this aging mechanism. The justification for why leak detection is an adequate aging management program in the case of a pool liner is provided in Attachment 5 page 7 of 14.

Reliance on leak detection for aging management of stainless steel liners is the method described in the Class 1 Structures Industry Report and agreed to by the NRC, as documented in NUREG/CR-1557 "Summary of Agreements from Nuclear Management and Resources Council Industry Reports Addressing License Renewal."

The TLAA associated with boraflex will evaluate the aging of the boraflex, itself, in a separate IPA report on TLAAs.

166. Appendix I, Section 2.1, of the AMR report indicates that, "the concrete blocks are staked . . . are then laced with steel . . . ." Please provide a sketch or drawing to show its construction arrangement.

Response

A drawing of the arrangement of these concrete blocks is available for review onsite.

167. Page L-2, Section 2.1, states that both spent the fuel pool liner and the spent fuel storage racks are made of stainless steel. But, in Section 2.5 on Page L-4, corrosion of the spent fuel storage racks is not considered a plausible aging mechanism. Please provide justification for the non-plausible determination.

Response

Section 2.1 of the AMR report states that the spent fuel racks are constructed of Type 304L stainless steel, which is not subject to SCC in the conditions present in the spent fuel pool. The stainless steel liner is made of Type 304 stainless steel, and is susceptible to SCC due to residual stresses in the heat affected zones of the liner welds.

168. Appendix L is entitled, "Corrosion of Liner," and spent fuel storage racks can hardly be called liner. To avoid confusion, the spent fuel storage racks should be moved to Appendix K "Corrosion of Steel."

Response

This editorial suggestion will be considered during the next scheduled update to the Auxiliary Building AMR Report.

Intake Structure

169. Page 1-1, Section 1.1, of the Intake Structure AMR report (Appendix A, Attachment 4, Enclosure 7), second sentence, uses the term "intake structure system," and Section 1.1.2 states, "Intake structure components which have unique identifiers in the NUCLEIS Equipment Technical database (such as penetrations) were evaluated using the AMR procedure for systems." Please provide detail explanations for:

a. Structural components identified in the NUCLEIS Equipment Technical database;

b. The difference between the AMR procedure for system and that for structures;

c. The rationale used to evaluate certain Intake Structure structural components as system;

d. The difference between the Intake Structure and the Intake Structure System.

Response

As discussed in the BGE IPA Methodology, certain structures are also documented as systems in the site equipment database. These structures (currently just the Containment and the Intake Structures) are scoped using the scoping process for systems described in Section 4.1 of the methodology, and the scoping process for structures described in Section 4.2 of the methodology.

The system type components of the Intake Structure include a variety of components associated with the traveling screens, screen wash pump, etc. These components were scoped using the scoping process for systems, and it was determined that none of the components are WSLR. The Intake Structure was also scoped using the process for structures and the structural component types which contribute to intended functions of the structure were evaluated for effects of aging using the AMR process.

The minor differences between the AMR process for systems and that for structures is explained in BGE IPA Methodology Section 6.

170. Both leaching of calcium hydroxide and reaction with aggregates were considered non-plausible for the Intake Structure based on the report of a 1994 walkdown. The walkdown report indicated that visual inspections were not performed for inaccessible portions of the fluid retaining walls and slabs. Please provide the basis for your conclusion. In addition, a walkdown inspection should not be used as the sole basis for determining whether an aging effect is plausible or not. Provide technical justification for excluding these aging effects for the period of extended operation.

Response

The walkdown was never the sole basis for any non-plausibility determination. The appendices for leaching of calcium hydroxide and for reaction with aggregates provide a justification for why the ARDMs are not plausible, which is based on the make-up of the concrete used in this structure. The inspection of accessible areas was a confirmatory inspection.

171. Page 2-2, Table 2-1, of the AMR report does not list Function LR-S-4, serves as missile barrier (internal or external) as an intended function for the roof slab. There are SR pumps located in the Intake Structure which need protection from potential missiles. Please explain.

Response

Per CCNPP UFSAR Table 5-7, only the walls of the Intake Structure (including associated columns and beams) are credited as a tornado missile barrier.

172. Page 2-2, Table 2-1, of the AMR report does not list Function LR-S-2 (provide shelter/protection to SR equipment) as an intended function for the watertight doors. Safety-related pumps are located inside the doors. Please explain.

Response

The watertight doors are currently associated with the function of providing a flooding barrier (Function LR-S-06). However, the only flooding that this function accounts for is internal flooding. The Intake Structure water tight doors also protect against external flooding, which is more appropriately accounted for under Function LR-S-02. The scoping results will be updated to reflect this additional function for these watertight doors.

173. Page 2-2, Table 2-1, of the AMR report does not list the intended functions for trash racks, screen well enclosure, and vertical guides. These structures are protecting the SR saltwater pumps located inside the Intake Structure. Please explain.

Response

The trash racks, screen well enclosure and vertical guides are not identified in site documentation as components which are SR, or whose failure could prevent the function of SR equipment. They are also not relied upon in BGE's response to any of the regulated events in §54.4(a)(3). Therefore, these components are not included in the scope of LR and no intended function is identified.

174. Appendix C, Section 2.1, of the AMR report states that there are no aggressive chemicals stored inside the Intake Structure. However, Page E-2, Section 2.1, states that there is no significant inventory of aggressive chemicals stored inside the Intake Structure. Please explain this discrepancy.

Response

This editorial comment will be addressed in the next scheduled update to the AMR report.

175. Appendix J, Section 2.5, of the AMR report states that the design contact pressure of the Intake Structure is lower than the removed overburden. Section 3.0 of the report states that the structural load on the Intake Structure foundation is lower than the removed overburden weight. A discussion should be provided on why the overburden weight adjacent to the Intake Structure does not cause a differential upward movement on the Intake Structure as a function of time.

Response

Updated Final Safety Analysis Report Section 2.7.6.2 provides the following discussion of removed overburden weight.

"Generally, the weight of soil removed by site grading and pit excavation for the structures is greater than the loads imposed by plant construction. This verified the results of the analyses made using the triaxial shear data, i.e., that bearing capacity is no problem. The ultimate bearing capacity of the foundation strata is in excess of 80,000 psf. The allowable bearing capacity is in excess of 15,000 psf. In addition to bearing capacity, settlement of the proposed structures was also considered. The settlement of the foundations can be divided into two categories: (1) elastic settlement; and (2) time-dependent or hydrodynamic settlement. Elastic expansion of the confined soil occurred as a result of excavation unloading. This resulted in a slight upward movement. During construction, the soil moved downward as load was applied. This elastic movement is small and was complete when construction was completed. It had no effect on the structures or function of the plant. The excavation unloading and structural loading caused a small change in void ratio. This change allowed a very small amount of hydrodynamic settlement to occur. The time-dependent or hydrodynamic settlement will be very small or negligible because the structural load is either less than the overburden removed, or only slightly greater than the removed overburden weight. Considering the types of soils present, contact pressures of 1500 to 2000 psf greater than the overburden removed would not result in large consolidation settlements. The magnitude of maximum possible post-construction settlement is 1/2".

As stated in the UFSAR, the potential for settlement and upward movement has been minimized through appropriate design of structures. Additionally, any settlement or upward movement of the Intake Structure is expected to occur early in plant life, not after 40 years. Therefore, this ARDM was determined to be not plausible.

176. The report does not mention whether the intake structure is equipped with a cathodic protection system. If it does, please provide information on the present status of the system and how it will be kept functional during the extended period of operation.

Response

There is no cathodic protection system for the Intake Structure.

TURBINE BUILDING (Questions 177 - 186)

177. Page 2-2, Table 2-1, of the Turbine Building AMR report (Appendix A, Attachment 4, Enclosure 6) shows that building siding clips is one structural component type considered in the evaluation, but siding and roof are not mentioned. Please provide the intended functions for the siding clip, siding, and roof.

Response

The intended function of several specific siding clips in the Turbine Building is to break at a pre-determined pressure in order to relieve the pressure in the Main Steam Pipe Tunnel resulting from a high energy line break outside containment. The Turbine Building roof and siding do not perform an intended function.

178. Page 2-2, Table 2-1, of the AMR report lists fluid retaining walls and slabs as a structural component type. More information relating to scoping, such as location of the fluid retaining walls and type of fluid it contains is needed to assess the adequacy of the intended functions and aging effects. Please provide detailed scoping information about the fluid retaining walls and slabs.

Response

The walls of the auxiliary feedwater pump room are the fluid retaining walls referred to in this table. These walls are considered to be fluid retaining walls since they are relied upon during an internal flooding event.

179. Page 2-2, Table 2-1, of the AMR report, and p.7.1-1, Table 7.1-1, of the IPA does not list foundations (footings, beams, and mats) as structural component type WSLR for the Turbine Building. Please provide clarification for the foundation design and discuss how the building is supported. Furthermore, discuss whether the foundation and building supports have any intended functions.

Response

The ground floor slab for the auxiliary feedwater pump room is in scope because this is the portion of the Turbine Building which is a Seismic Category I Structure. The remainder of the Turbine Building is not WSLR (except the siding clips referred to in Question 177 and underground cable duct banks).

180. Appendix I, Section 2.1, of the AMR report states, "There is no masonry block wall in the class 1 portion of the turbine building. Therefore, this aging mechanism does not apply to the turbine building." Is there any masonry block wall in the non-Class 1 portion of the building and its failure will impact the intended function of SR systems? Please elaborate.

Response

There are no masonry block walls in the vicinity of any SR equipment in the non-Category I portion of the Turbine Building. Therefore, failure of any masonry block walls in the Turbine Building would not affect any SR equipment.

181. Page 2-2, Table 2-1, of the AMR report lists the intended function for building siding clips as "provides shelter/protection to SR equipment, including radiation shielding for equipment qualification and HELB protection." Please elaborate on how the building siding clip can perform such functions.

Response

See response to Question 177.

182. Page 4-6, Table 4-2, of the AMR report does not address SCC in bolts and CFC in supports. Supports associated with cranes, motors, pumps, and piping are all susceptible to CFC. Please provide a discussion about this concern.

Response

Stress cracking corrosion is explicitly considered in the Component Supports and Cranes and Fuel Handling Commodity Evaluations Report. Corrosion fatigue cracking is indirectly considered in the Component Supports Commodity Evaluation Report and the Cranes and Fuel Handling Commodity Evaluations Report because two of the explicit ARDMs must be present to have CFC: (1) general corrosion; and (2) cyclic loading caused by any of the three loading-related ARDMs evaluated in the AMR (i.e., loading due to rotating or reciprocating equipment, loading due to hydraulic vibration or water hammer, and loading due to thermal expansion).

183. Appendix H, Section 1.0, of the AMR report states that cavitation damage is not common for velocities less than 40 fps and 25 fps. Please provide technical justification for these determinations.

Response

These numbers were taken from the Class 1 Structures Industry Report. The industry report references "Erosion of Concrete in Hydraulic Structures," ACI 210R-87.

184. Page 1-1, Section 1.1.1, of the AMR report, first paragraph, states that the building is an integrated steel structure. The second paragraph states that the members are designed as independent members. Please clarify these statements.

Response

The UFSAR provides the following discussion which is the basis for the information provided in the AMR report -

5.6.3.1 General Description

The building, comprising the turbine-generator bays and the heater bays, is an integrated steel structure, with metal siding, supported on reinforced concrete foundations. The circulating water intake and discharge conduits are incorporated into the spread footings. Turbine-generator Units 1 and 2 are separated by an expansion joint in the superstructure.

5.6.3.2 Design

The building is a Seismic Category II structure designed as described in Appendix 5A, except that the auxiliary feedwater pump enclosure is Seismic Category I. All of the structural steel columns, beams, and roof trusses of the building have been designed as independent members and in accordance with the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," 1963 Edition.

185. Page 5-2, Section 5.2.3, of the AMR report uses the term "Ground floor slab." Please define the boundary of this slab.

Response

This refers to the auxiliary feedwater pump room ground floor slab.

186. Attachment 5 of the AMR report only addresses two of the four plausible aging mechanisms. Please explain where the other two are addressed?

Response

Attachment 5 is a justification for why existing programs will adequately manage the aging. For two of the plausible aging mechanisms, no existing programs addressed the effects of the mechanisms. Therefore, these mechanisms are discussed in Attachment 8 under "New Programs."

NO. 12 CST AND NO. 21 FOST ENCLOSURES (Questions 187 - 197)

187. Page 1-2, Section 1.1.3.2, of the CST AMR report (Appendix A, Attachment 4, Enclosures 4) and the FOST AMR report (Appendix A, Attachment 4, Enclosure 5) lists the intended Function LR-S-2 as, "Provide shelter or protection to safety-related equipment." The footnote on the same page indicates that, for this enclosure, it does not perform radiation shielding, equipment qualification, and high energy line break protected aspects of this function. Please provide a list of all aspects of intended Function LR-S-2.

Response

The generic structural function is written in the BGE IPA Methodology, Section 4.2.2 as follows:

> 2. Provide shelter/protection to SR equipment. (This function includes radiation protection for EQ equipment and high energy line break-related protection equipment.);

Because the seven generic structural function statements are used during the structures scoping process, the intent of this note was to avoid any misconception that these enclosures satisfy any shelter/protection function associated with the parenthetical portion of this function statement.

188. Without the help of sketches or drawings, it is difficult to perform the scoping review. Table 2-1 of the AMR reports list (concrete) foundations, concrete walls, concrete roof slab, steel beams, roof framing, and (steel) decking as structural components WSLR. It is hard to tell where the steel roof framing may be located relating to the tanks. Please provide detail layout information for these structures.

Response

Detail layout information is available for review onsite.

189. In both the CST and FOST Enclosure evaluations, Table 2-1 of the AMR report lists the intended function(s) for steel beams, steel roof framing, and decking as LR-S-2 and LR-S-4. Function LR-S-2 provides shelter or protection to SR equipment. Function LR-S-4 serves as a missile barrier. Please elaborate on how these intended functions were developed.

Response

The component level scoping process for structures is described in detail in the BGE IPA Methodology Section 4.2, and in the NRC Safety Evaluation Report for that methodology.

190. Page 2-2, Table 2-1, of the AMR reports list the intended functions of caulking and sealants as LR-S-1 and LR-S-2. Function LR-S-1, as stated in Section 1.1.3.1, is to provide structural or functional support, or both, to SR equipment. Please explain how caulking and sealant can perform the stated intended functions.

Response

The caulking and sealants seal and protect SR structural components and, therefore, allow them to perform their safety functions.

191. Table 7.1-2 of the IPA report indicates that the concrete "No. 21 FOST Enclosure" does not have a pressure boundary intended function. However, Section 8.4.1 of the plant UFSAR states, "In the event of a failure of No. 21 FOST, fuel can be supplied to the EDGs from the concrete structure by way of a non-safety-related line." Should the No. 21 diesel FOST fail, its concrete enclosure would contain and continue to supply the fuel oil. Thus, the concrete enclosure would become a "tank" under this postulated situation. Discuss whether the concrete enclosure has a pressure boundary intended function under such a condition.

Response

The No. 21 FOST Enclosure's function as a backup to the tank in the event of a failure of the tank is not relied upon in any safety analysis, as evidenced by the fact that it is referred to as a NSR line. Failure of this tank enclosure bottom to retain fluid would not cause the failure of any SR functions. The tank enclosure bottom is not relied upon in the BGE response to any of the regulated events listed in §54.4(a)(3). Therefore, the function of retaining fluid in the tank enclosure bottom is not an intended function.

192. Table 7.1-1 of the IPA report indicates that there are no stairs or ladders in the containment, Auxiliary Building, or the CST enclosure that require AMR. Discuss whether these stairs and ladders have any intended functions, such as a "Seismic Category II over I" consideration.

Response

The Containment Structure Scoping and AMR results will be modified to show that stairs and ladders in Containment contribute to the intended Function LR-S-05 *(Provide structural and/or functional support to NSR equipment whose failure could directly prevent satisfactory accomplishment of and required SR function.)*. The stairs and ladders in the Auxiliary Building and No. 12 CST Enclosure were determined not to contribute to a II/I function. Note that ladders associated with a platform hanger are included WSLR under the structural component type "platform hangers."

193. Page 4, Attachment 7, of the AMR report indicates that the physical access to the steel roof beams are difficult. Please explain how those beams were inspected?

Response

As stated in Attachment 7, the steel beams that are visible were inspected. The steel portion of the roof beams, which are coated with fire proof materials, were not inspected. That is why these structural components are categorized as inaccessible areas in the Attachment 7. The report recommendation for inaccessible areas includes an age-related degradation inspection to confirm that corrosion of steel structural members in these areas is not an active aging mechanism.

194. Page 4-7, Table 4-2, of the AMR report lists an Report "IR 1995-01698" without explanation. Please provide an explanation as to what IR 1995-01698 is and discuss how can it resolves the weathering mechanism?

Response

The justification for this new program is contained in Attachment 8 of the AMR report.

195. The AMR report does not address the degradation of sprayed-on material for fire protection. Please provide a discussion to this concern.

Response

Sprayed-on fire protection material in FOST Enclosure is not credited under 10 CFR 50.48, and, therefore, does not perform an "intended" function.

196. Page 2, Attachment 7 (FOST), of the AMR report states, in the summary, that the interior and the exterior of the enclosure was inspected, with the exception of the enclosure roof. Please explain why the roof was excluded?

Response

The roof was not readily accessible and an adequate assessment of the condition of the concrete was achieved without inspecting the roof.

197. Appendix C, Section 3.0, of the AMR report concludes that attack by aggressive chemical is not plausible for the No. 21 FOST Enclosure, but does not address the issue of environmental chloride ions mentioned in Section 2.1. Please explain.

Response

Both the FOST and CST enclosures are located at a sufficient distance from the Chesapeake Bay and a height above bay level that accelerated aggressive chemical attack from exposure to chloride ions is not considered to be a plausible aging mechanism. The concrete in these enclosures is not in continuous contact with the bay. The only exposure to chloride ions would occur from wind spray during infrequent storms and exposure would be of short duration. This determination was substantiated during the walkdowns of the structure conducted during the initial AMR. These structures are readily accessible for routine visual inspection. If accelerated aggressive chemical attack had been occurring, it would be easily detectable by rust staining of the concrete surfaces of the structure. No such conditions were noted during these walkdowns or during other visual walkdowns by plant personnel.

CONTAINMENT SYSTEM (Questions 198 - 207)

198. Attachment 3 (penetrations) of the Containment System AMR report (Appendix A, Attachment 4, Enclosure 10) indicates that there are non-metallic materials: epoxy, sealant, and adhesives. Discuss the aging effects on these non-metallic materials. Also, identify any non-metallic materials, such as seals or gaskets, associated with the "doors." Because the degradation of these seals or gaskets could affect the intended function of the containment, discuss any applicable aging effects.

Response

The BGE IPA process does not address door gaskets and penetration sealants because these subcomponents are consumable subcomponents of the doors and penetrations. See response to Question 97.

199. Attachment 3 (penetrations) of the AMR report states that a Polysulfone material is used in the electric penetration assembly (EPA) made by Bunker-Ramo Corp. In Licensee Event Report No.-05000344 (May 1991), the Trojan Nuclear Power Plant reported that material in EPA module was causing leakage and potential loss of electric continuity. The EPA in the CCNPP is the same as those in the Trojan plant, all made by Bunker-Ramo Corp. The seal material in the Trojan EPA is polyurethane, which has a lifetime of 18 years. Calvert Cliffs should review this case and evaluate the aging effects of the EPA seal material.

Response

Baltimore Gas and Electric Company reviewed the issue when Information Notice 93-25 was issued. Based on this review, it was determined that Calvert Cliffs' EPAs are manufactured by Amphenol-Sams and Conax. None of our EPAs is of a design using elastomer seals such as those at Trojan. Instead, they incorporate solid glass seals in metal cases.

200. Attachment 3 (penetrations) 059-PEN-05 of the AMR report indicates that the containment sump recirculation penetrations consist of stainless steel materials and Inconel bellows. Discuss the potential of SCC in the containment sump environment.

Response

Stress corrosion cracking is addressed in Attachment 6 for the penetrations on page 3 of 8. The non-plausibility determination is based on low temperature and lack of an aggressive environment. As stated on Component Grouping Summary Sheet (Attachment 3, under internal and external environment), these components are subject to the normal Auxiliary Building environment, not the containment sump environment.

201. Attachment 6 (penetrations) of the AMR report indicates that the stainless steel fuel transfer tube is not subject to SCC. However, spent fuel pool liners in plants have experienced leakage. Provide additional discussion of the potential of cracking of the fuel transfer tube.

Response

Discussion of SCC is provided on page 3 of 8 of Attachment 6 for penetrations. The non-plausibility determination is based on the specifications for the shop fabricated fuel transfer tube, which minimize the potential for any sensitized areas, and, therefore, prevent SCC of this stainless steel material.

202. Attachment 6 (penetrations) of the AMR report indicates that MIC is not applicable to the containment sump recirculation penetrations because "they are not wetted surfaces." However, the containment sump is wet. Provide additional information on the potential of MIC.

Response

The containment recirculating penetrations are encapsulations in the Auxiliary Building which enclose the sump recirculating piping. They are not exposed to the containment sump environment.

203. Attachment 6 (penetrations) of the AMR report states that the penetrations "are designed to have good fatigue strength properties (1E5 cycles) of below yield load in accordance with ASME Section III." Identify the specific code paragraph and discuss whether this is being evaluated separately as a "TLAA." Similarly, identify penetration bellows and their fatigue design requirements, including the specific Code paragraph.

Response

The quoted statement in the AMR is referenced to the PWR Containment Industry Report, which states, "Containment concrete, reinforcing steel, prestressing system components, steel liners and free-standing steel containments are designed to have good fatigue strength properties (10^5 cycles) of below yield load application in accordance with ASME and ACI Codes." The design basis of CCNPP containment penetrations, including reference to the applicable Codes, can be found in CCNPP UFSAR Sections 5.1.4.3 and 5.1.4.4. The design basis of the fuel transfer tube penetration bellows is discussed in UFSAR Section 5.1.4.4.d. The containment sump penetration encapsulation bellows were designed to ASME Section III, Class 2, 1971 Edition, including 1971 Summer Addenda. The conclusion that fatigue of the penetrations is not a plausible ARDM for the containment penetrations is valid for the design of all of these penetrations, including the associated bellows. Fatigue is being evaluated separately as a TLAA, and will be discussed in the TLAA LR technical report.

204. Discuss the evaluation boundaries of the penetrations and "doors."

Response

The boundary between the components called 1/2DOOR67 (equipment hatch), 1/2DOOR68 (personnel air lock), and 1/2DOOR69 (emergency air lock) and the containment liner is the welds where these doors are attached to the reinforced containment liner. During the AMR process, only the portions of the doors which contribute to the pressure-retaining function of the containment were evaluated for the effects of aging. These portions consist of carbon steel plate, forgings, castings and bolting.

205. Discuss relevant operating experience with the penetrations and "doors" related to aging.

Response

As agreed to in the BGE template discussions, the revised LR technical report will discuss relevant operating experience of containment penetrations and doors aging.

206. if stainless steel bellows are used with carbon steel penetration vent lines or sleeves, discuss the potential for galvanic corrosion.

Response

Stainless steel bellows are not used with carbon steel penetrations vent lines or sleeves. The two instances of bellows in this system occur in the stainless steel fuel transfer tube and the stainless steel containment sump penetration encapsulations.

207. Discuss the potential for wear of the hatches and airlocks.

Response

This ARDM was judged to be not applicable to the passive portions of the doors and air locks as documented in the potential ARDM List for Doors, page 5 of 7. The basis for this determination was that there is no potential for relative motion between surfaces of the doors which maintain the

pressure boundary of the containment. Note that the moving parts of the doors and air locks are not subject to AMR.

COMPONENT SUPPORTS (Questions 208 - 248)

208. Please describe how the plant-specific current licensing basis is used in determining the intended functions of the component supports.

Response

The intended function of all supports is to provide support to a component WSLR. The intended functions of all the equipment to be supported is documented in each of the applicable AMR reports or commodity reports for that equipment.

209. Please provide a discussion of engineering and design data important to the aging effects of component supports (e.g., supports for Reactor Coolant System [RCS] components). This discussion should include: (a) structural materials (material description at least to include the ASTM or ASME designation); (b) environmental factors (temperature, relative humidity, and radioactivity) potentially affect the properties of the material in steel and concrete; and (c) applicable design and construction codes, standards, and regulations.

Response

Table 4-8 in the UFSAR documents the loading combinations and primary stress limits for RCS piping. The same information for ASME Class 2 and 3 piping supports is provided in UFSAR Table 5A-6 (Loading Combinations and Primary Stress Limits for Nuclear Class 2 and 3 Piping) Detailed materials information for selected equipment supports is provided in Section 5.1.2.3 of the UFSAR. However, none of this detailed design information is pertinent to the AMR for these component supports. Therefore, BGE believes that this information does need to be provided in a LR technical report. The requested environmental information will be provided in the revised LR technical report.

210. It is not clear in the component support commodity evaluation report (Appendix A, Attachment 5) whether there are any component supports that are normally inaccessible for monitoring aging effects. Please identify those inaccessible component supports, if any, to ensure that their intended functions would be maintained for the period of extended operation.

Response

There are only two inaccessible components on the CCNPP Unresolved Safety Issue (USI) A-46 Safe Shutdown Equipment List Seismic Review List: the Spent Fuel Pool Cooling filter and demineralizer. At the time of the Seismic Verification Project (SVP) walkdowns, the Spent Fuel Pool Cooling filter, which is accessed periodically for filter changing, was inaccessible due to ALARA [as low as reasonably achievable] concerns. The anchorage of the Spent Fuel Pool Cooling demineralizer, however, cannot be accessed directly due to the limited space between the demineralizer and the walls of the pit that contains it. Therefore, these components will be excluded from the group, "Frames and Saddles for Tanks and Heat Exchangers, Outside Containment," in the Component Supports Commodity Evaluation Report, and addressed with the demineralizer and filter vessel in the Spent Fuel Pool Cooling AMR.

The other inaccessible supports WSLR are 24 piping supports that are identified in the BGE response to the NRC Bulletin 79-14, dated October 19, 1984. Baltimore Gas and Electric Company will evaluate whether these inaccessible piping supports need to be baseline inspected, or whether the supports already inspected represent an adequate baseline inspection based on similarity of material, environment and loading conditions.

These clarifications will be made to the commodity evaluation report and the LR technical report.

211. Discuss how component supports, or component support types are identified for a given system subject to AMR.

Response

The identification of component support types is described in Section 2.1 of the commodity evaluation report. The basis for the support types was the classes of supports under the Seismic Qualification Utility Group methodology and experience with the component supports ISIs. Component support types for a given system were identified by reviewing the intended functions of the system and the type of component which contributes to those functions. Section 3 of the commodity evaluation report summarizes this process and provides the result in Tables 3 - 1 and 2.

212. One of the issues associated with the component supports is the aging effects on concrete expansion anchor bolts, and the potential cracking in the adjacent concrete area that may result in reducing the original design capacity of the component support anchorage. Provide a discussion about the aging effects on these anchor bolts and the local concrete degradation to ensure that their intended functions under current licensing basis conditions would be maintained. In particular, for those component supports subject to rotating machinery, vibrations, or thermal expansion (e.g., see Page 2-5 of AMR Report for Component Supports, Appendix A, Attachment 5, Enclosure 11, to the May 22, 1996 letter), identify all plausible aging effects.

Response

The CCNPP SVP, which was performed in accordance with the NRC-approved Seismic Qualification Utility Group's Generic Implementation Procedure (GIP), addressed the issues associated with potential aging effects on concrete expansion anchor bolts, even though aging management was not the purpose of the USI A-46 Program. Specifically, the condition of the concrete, including size and location of cracking, at the anchor bolt attachment is inspected during the seismic walkdown, in accordance with the criteria provided in GIP Section II.4 and Appendix C. Industry and CCNPP experience show, however, that degradation (or failure) of concrete at anchor locations rarely occurs, and typically only for supports subjected to abnormal conditions, e.g., significant imbalance in a rotating machine or a water hammer transient in a piping system, or a design or installation anomaly. The only instance of concrete anchorage degradation (cracking) identified by the SVP was for the switchgear room heating, ventilation and air conditioning compressors, which had unusual anchorage (i.e., an anchor DT not covered by the GIP) and cracking of the concrete pads. Baltimore Gas and Electric Company installed additional supports in sound concrete surrounding the concrete pads.

System engineer walkdowns conducted in accordance a Plant Engineer Guideline on System Walkdowns (PEG-7) will continue to check the condition of equipment anchorages to ensure that concrete anchorage degradation (cracking) does not occur.

213. Discuss relevant operating experience with the component supports related to aging.

Response

As agreed to in the BGE template discussions, the revised LR technical report will discuss relevant operating experience of component support aging.

214. Provide a discussion of the GSI/USIs reviewed, with respect to aging, for component supports.

Response

There are no unresolved GSIs or USIs which are related to aging of component supports at CCNPP.

215. Clarify whether pipe whip restraints are included in this component support commodity evaluation report. If so, identify which component support types these restraints are included in the evaluation.

Response

Pipe whip restraints were covered by the evaluation of the enclosing structure. They are not included in the component supports commodity evaluation. See response to Question 148.

216. Page 7.6-1 (second paragraph) states, "the scope of this report is limited to passive, long-lived component supports (such as pipe hangers and associated anchor bolts)."

a. please provide a discussion whether the component supports also include support elements such as base plates, embedded plates, or structural steel members embedded into concrete structures, bolting connections (fasteners) to structural steel members, or welded connections to structural steel members, which ever is applicable; and

b. provide a discussion whether integral and non-integral attachments of pressure retaining components (e.g., welded attachment to pipe) are included in the component support evaluation.

Response

The component support is defined as the connection between a system, or component within a system, and a plant structural member; e.g., concrete floor or wall, structural steel beam or column, or the ground outside the building. In this context, all component support subparts listed in Question 216.a are included in the component supports evaluation, when they exist within the component support type. All attachments to pressure retaining components that are within the support load path are also included in the component support evaluation, i.e., these evaluations include all portions of a support that are within the boundaries for Subsection IWF, ASME Boiler and Pressure Vessel Code Section XI, shown in Fig. IWF-1300-1. The portion of a support that is

integral (e.g., welded) to a pressure retaining component is covered by Code Subsections IWB, IWC or IWD as appropriate, but was evaluated in the component supports evaluation and is covered under the CCNPP ISIs.

217. Page 7.6-1, "component support" is defined as the connection between a system, or component within a system, and a plant structural member. Please discuss whether the component support evaluation boundaries associated with the connection are consistent specifically with the 1989 Edition of the ASME Section XI, Code Subsection IWF requirements for Class 1, 2, 3, and MC component supports (e.g., integral and non-integral supports as shown in Figure IWF-1300-1) for the period of extended operation. If not, please provide justification.

Response

As discussed above, the component support boundaries are consistent with Code Subsection IWF, including Figure IWF-1300-1, requirements, but also include the portion of the support that is integral (e.g., welded) to a pressure retaining component (i.e., the portion covered by Code Subsections IWB, IWC or IWD). Because CCNPP is currently working under the ISI program developed for the second 10-year inspection interval, the edition of the ASME Code is 1983 with Addenda through Summer 1983, not the 1989 Edition. Figure IWF-1300-1 is the same in both Code editions.

218. Page 7.6-1 (fourth paragraph) states, "Component support types are based on similarities of design, loading conditions, and environment." Section 2.1 of the AMR report states that component support types are selected based on similarity in form and degradation mechanisms.

a. Please identify the differences between the two statements "similarity in form" and "similarities of design, loading conditions, and environment," and their effects on selection of component support types.

b. Provide a discussion as to whether the same material of constructions and same code/standard used in design and construction are considered in the determination of component support types.

Response

Baltimore Gas and Electric Company believes the two statements (based on similarities of design, loading conditions and environment versus based on similarity in form and degradation mechanisms) are consistent. With few exceptions, the materials of construction of the component support types are similar enough with respect to aging considerations that it was not necessary to distinguish the exact material that each support was made from.

219. Page 7.6-2, Table 7.6-1, lists systems consisting of various component supports WSLR. Please briefly discuss each system evaluation boundaries with respect to supports, its reference to specific sections of LR application, and its intended function per 10 CFR 54.4 for the period of extended operation.

Response

The evaluation boundary of the component supports includes all "component supports" (as defined in the commodity evaluation report) for the portions of the systems listed that are WSLR (with the noted exceptions described in the commodity evaluation report; see Question 220 response). See response to Question 208 with respect to intended functions. Specific LRA sections for each system WSLR are not yet available.

220. Table 7.6-1 lists 35 systems WSLR. However, Section 3 of the AMR report for Component Supports states that there are 66 systems WSLR for CCNPP. Of the 66 systems, 42 systems have component supports within the scope of this report. It appears that seven systems are missing from Table 7.6-1.

a. Identify the missing systems that should have been included in Table 7.6-1 and revise the table as necessary.

b. Identify the 24 systems that are WSLR but not within the scope of this commodity evaluation report and indicate where they are addressed.

c. Section 3 of the AMR report states, "Systems whose component supports have already been, or are being addressed separately: Reactor Vessel Internals, Fuel Assemblies, and supports for the Reactor Vessels and Steam Generators are in this category." Please identify the specific documents that contain the evaluation for these systems and their component supports.

d. Provide a discussion as to how the AMR report was used in developing the commodity evaluation report and explain why the apparent inconsistency exists. Has a QA review been performed?

e. It appears that an early version (September 1995) of the AMR report was listed as Reference 10 in Page 7.6-20. Update it as appropriate.

Response

a. The revised LR technical report will include all of the systems covered by this report.

b & c. The 24 systems and structures listed in the system level scoping results which are not included in the commodity evaluation are explained in the commodity evaluation report, Section 3. They include:

- Systems that are really structures or parts of other structures (Containment, Intake Structure, Plant Areas and Doors, Refueling Pool, Fire Barriers and Barrier Penetrations, Auxiliary Building, No. 12 CST Enclosure, No. 21 FOST Enclosure, Turbine Building, Switchgear Structures) (10)

- Systems where the structural supports were addressed in the Cranes and Fuel Handling Commodity Evaluation Report (Spent Fuel Storage, New Fuel Storage and Elevator, Cranes/Test Equipment) (3)

- Systems where the only intended function is performed by a containment penetration (Extraction Steam, Plant Water, Nitrogen and Hydrogen, Liquid Waste* and Plant Drains*) (5)

- Systems whose components have been addressed in the another IPA document (Reactor Vessel Internals in the Reactor Vessel Internals AMR, Fuel Assemblies themselves are short-lived, but support for these assemblies is addressed in the Reactor Vessel Internals AMR, the reactor vessel in the Reactor Vessel AMR and steam generators in the RCS AMR) (2 since the steam generators and reactor vessel are not listed as individual systems, but are considered part of the RCS.)

- Systems whose intended function is performed by components which require no specific supports (Main Turbine - in scope only because of certain ATWS relays which trip the turbine, Cavity Cooling - in scope only because of certain relays which load shed the fans during the diesel sequencing) (2)

- Systems which only perform fire protection intended functions - (Liquid Waste* and Plant Drains* - in scope for fire protection because of drainage of fire fighting water and prevention of backflow of combustible liquids, Smoke and Fire Detection, Plant Communications) Because these function are not required to be performed under any loading conditions other than normal conditions, the Fire Protection Commodity Evaluation Report addresses the supports for this fire protection equipment. (2)

  (* - indicates systems which perform both containment isolation and fire protection function. These are "counted" under the containment isolation bullet.)

d. The missing systems in the LR technical report table was a clerical error. The technical content of the LR technical report reflects the results described in the commodity evaluation report. See response to Question 79 with respect to QA.

e. This reference will be updated to reflect the most recent version of the commodity evaluation report.

221. Table 7.6-1 lists the RCS WSLR which includes component supports. Please describe aging management evaluation scope for the RCS component supports, such as reactor coolant pump supports, including specific intended functions and evaluation boundaries. Also discuss whether the RCS supports are evaluated in Table 7.6-3 for aging effects.

Response

The RCS supports, with the exception of the steam generator supports and the reactor vessel supports, are included in the various component support type groups as shown in Table 3-2 of the commodity evaluation report. The revised LR technical report will provide a correlation of component support types to systems. Table 7.6-3 does contain an evaluation of RCS supports as part of the various component support type groups to which they belong.

222. Table 7.6-2 separates component supports into "inside containment" and "outside containment" groups. However, neither inside containment nor outside containment represents a homogeneous environment. A support within a group may be more susceptible to aging than the rest of the supports in that group based on its local environment. For example, a support under a boric acid tank may be more susceptible to boric acid corrosion. Discuss how the aging effects evaluation is bounding for the specified component support groups.

Response

a. Except for the ARDMs SCC of High Strength Bolts (see Questions 226 and 242), Radiation Embrittlement of Steel (see Question 248), and Abuse, Impacts & Accidents (see Question 228), the ARDMs considered plausible for each component support type are the same for inside containment as for outside containment. Those ARDMs could have been addressed with footnotes, however, because the frequency of inspections/surveillances, e.g., system engineer walkdowns, is much higher for component supports outside containment, the decision was made to assess CCNPP's aging management of supports inside and outside containment separately.

b. During the AMR, a specific step was included to ensure that the conclusions were valid for all component supports within a support type. As a result of this step, specific cases were identified in which a sub-group of a component support type was noted as not fitting within its support type. For example, the Cabinet Anchorage component support type included some sampling hoods that were susceptible to corrosion due to leakage of internal piping, and, therefore, a baseline inspection for all sampling hoods was recommended.

223. Page 7.6-3, Table 7.6-2, identifies 20 component support types requiring an AMR. Please provide a representative component support sketch or drawing for each component support types. Information shown in these sketches should include evaluation boundaries for those component support assemblies (e.g., base plates and anchor bolts to building structures) such that the required intended functions of the component supports would be maintained during the period of extended operation.

Response

The wide variety of support configurations does not lend itself to a "representative sketch" of each support type's configuration. The specific configuration of each support type is not pertinent to the commodity evaluation process used in this commodity evaluation.

224. Page 7.6-3 states, "The potential age-related degradation mechanisms (ARDMs) for component supports are identified in Table 7.6-3." Please provide a discussion why other potential ARDMs associated with component supports, such as mechanical wear, fatigue (particularly subject to dynamic loadings), creep and stress relaxation, concrete cracking in support anchorage area, low fracture toughness, and lamellar tearing (associated with RCS supports) are not addressed in the support commodity evaluation report. These ARDMs could cause considerable degradation to support structural integrity.

Response

Mechanical wear, fatigue, and concrete cracking in support anchorage area (not due to environmental factors) can only occur if the support is subjected to cyclic loading, as identified under the ARDMs "Loading due to Rotating/Reciprocating Machinery," "Loading due to Hydraulic Vibration or Water Hammer," and "Loading due to Thermal Expansion of Piping/Component." Concrete cracking in support anchorage area due to environmental factors is addressed under "Grout/Concrete Local Deterioration." Creep and stress relaxation (which are not plausible at the temperatures experienced by the CCNPP component supports) are addressed under the ARDM "Thermal Effects on Steel." Low fracture toughness (which is not plausible for the CCNPP component supports covered by this commodity evaluation as explained in the response to Question 248) is addressed under the ARDM "Radiation Embrittlement of Steel." Lamellar tearing (associated with RCS supports) would have occurred early in the life of the plant and been discovered through the ISI program; it is not, therefore, an aging issue. (This is consistent with the industry response to comment S-67 on the Class I Structures Industry Report p.A-70 of EPRI TR-103842.)

225. Page 7.6-3 states, "Those ARDMs which were not evaluated for a group of supports because they are not applicable to the group are noted by shading the corresponding blocks in this table (Table 7.6-3)." A review of this table found that no blocks were shaded.

a. Please clarify the above statement or revise the table accordingly,

b. Also clarify blank spaces in this table.

Response

All blocks which were had no check or NA should have been shaded. This word processing discrepancy will be corrected in the revised report.

226. Table 7.6-3 indicates that SCC is a plausible ARDM only for those high-strength bolts inside the containment, but not for those bolts outside the containment. Please discuss the basis for this conclusion.

Response

Electric Power Research Institute NP-5769 Table 4-1 lists the types of anchor bolts which have experienced structural support bolting failures due to SCC. The only two types of bolting in this table which can be found in anchor bolt applications at CCNPP are A354 and A490. This bolting is found in containment. Specifically, A354 bolting was used in the reactor vessel, pressurizer and safety injection tank anchor bolts, and A490 bolting was used in the steam generator supports. (Note that reactor vessel and steam generator supports were not included in the Component Supports Commodity Evaluation Report.) Therefore, the LR technical report and commodity evaluation will be revised to show that, inside containment, SCC is only plausible for pressurizer and safety injection tank support bolting. These supports are the only ones in the scope of this commodity evaluation where bolting is installed which has experienced SCC in structural support applications. For all other in-containment anchor bolting, as well as all anchor bolting outside containment, the report will show that SCC is not plausible. The justification for this non-plausible determination is that, based on the types of anchor bolts which were used in these other

applications (i.e., HILTI, Phillips, Unistrut, Kindorf, etc.), BGE has reasonable assurance that high strength bolting is not installed in other anchor bolting applications. Additionally, if any such bolting were installed in improper applications, it would have failed due to SCC soon after installation rather than after many years. These failures would have been detected by routine and programmatic inspections, e.g., NRC Bulletin 79-14, ISI, and the SVP's sampling of anchor bolt tightness.

227. Table 7.6-3 indicates that lead anchor creep is not a plausible ARDM for the entire commodity group. However, Section 2.2 of the AMR report indicates it is a potential ARDM. The AMR report states the current CCNPP design standard for piping and pipe supports does not allow the use of lead anchors. Please discuss whether the original design and construction standards allowed the use of lead (cinch) anchors for component supports within the scope of this report.

Response

As stated in report Table 2-1, BGE has reasonable assurance that such anchors are not installed in the supports for any SCs WSLR. See response to Question 240.

228. Table 7.6-3 indicates that "Abuse, Impacts, Accidents" as a potential aging mechanisms that may need to be managed for renewal. However, the staff does not believe that equipment damage due to abuses, impacts, and accidents from human error is only an aging issue awaiting resolution for renewal. If a safety significant piece of equipment is accidentally damaged by a licensee, the NRC would expect the licensee to take corrective action under existing procedures (e.g., 10 CFR Part 50, Appendix B requirements). The staff does not believe such equipment degradation is only due to aging or that corrective action is only necessary for renewal. Clarify the BGE intent to treat "Abuse, Impacts, Accidents" as aging effects that need to be managed for renewal.

Response

The ARDM "Abuse, Impacts, Accidents" will be deleted from the commodity evaluation.

229. Page 7.6-7 (third paragraph) states, "Inspections performed by the SVP examine the component supports for indications of the potential ARDMs, such as elastomer hardening." Please describe what aging degradation or effects were detected by the SVP inspections.

Response

Commodity evaluation report Table 6-2 and the LR technical report describe the results of the baseline inspections for each group in general terms. The detailed SVP inspection results are available for review onsite.

230. Page 7.6-7 (third paragraph), please describe what are the steel load path, concrete load path of the specific component supports, and their aging related degradation effects potentially caused by loadings from machinery, vibration, water hammer, and thermal expansion of piping/components.

Response

See response to Question 212. Guidance on what to look for regarding the steel load path and concrete load path is provided to the Seismic Capability Engineers in Section II.4 of the GIP.

231. Page 7.6-8, Footnote 2, states, "The Seismic Verification Project (SVP) inspections did not discover any high strength concrete expansion anchors for any equipment at CCNPP." Please describe how the SVP is used to discover high strength anchor bolts that are part of the component support assemblies. It is the staff's understanding that the SVP inspections did not intend to identify anchor materials nor did it inspect all anchors WSLR.

Response

The BGE response to Question 226 explains how the LR technical report and commodity evaluation will be revised to address SCC of high strength bolting. In this response, as well as in the original commodity evaluation, the reliance on SVP inspections is categorized as providing additional assurance that no high strength bolting was installed improperly in anchor bolt applications at CCNPP.

The additional assurance from the SVP inspections was provided by the anchor bolt tightness check performed on a sampling of anchor bolts. During this check, inspectors could visually identify that the installed anchor bolt was one of the standard types used at CCNPP and was, therefore, not a high strength material.

232. Page 7.6-13 describes supports not covered by either the SVP or ISI programs. For the supports not subject to ISI or SVP program, discuss how intended functions and aging effects are identified for those supports.

Response

As described in the commodity evaluation report and LR technical report, SVP and ISI served as a baseline inspection of a representative sample of the supports WSLR. Each support type was evaluated for coverage under these programs to determine whether a representative sample was covered. In some cases, the conclusion was that the supports not specifically covered by one of these programs were similar enough in materials, environment and loading considerations that the support type was adequately baselined. In other cases, additional baseline walkdowns will be conducted on the supports not baselined by the SVP or ISI program. The results of the baseline inspections merely determined the nature of ongoing aging management activities required. Where little or no aging effects were discovered, ongoing system engineer walkdowns and continued ISI are credited as the continuing aging management program. Where more active indications of aging were discovered, support type replacements or more focused inspections will manage these effects.

233. Page 7.6-13 states that all cable raceways in the containments were visually inspected during the SVP, and no significant aging effects were identified. Please identify those aging effects that you identified but determined to be insignificant during the SVP inspections. Describe also your criteria for "significant" and "insignificant."

Response

Table 6-1 (page 6-7) of the commodity evaluation states, "no active ARDMs were identified" for any raceways included in the SVP walkdowns. The LR technical report will be revised accordingly. The basis for this statement is that the walkdowns, which are conducted by trained Seismic Capability Engineers in accordance with Section II.8 of the Seismic Qualification Utility Group GIP, are required to look for and document on "Plant Area Summary Sheets" "Other Seismic Performance Concerns," including:

- Cracks in Concrete
- Corrosion
- Aging of Plastic Cable Ties

None of these concerns was identified at CCNPP.

234. Page 7.6-17 states that tanks and heat exchanger supports for most of the systems WSLR outside of containment were included in the SVP or ISI. Please describe your basis for determining which of these supports were covered by ISI Programs, which supports were covered by SVP, and which supports were not covered by either ISI or SVP.

Response

The scope of equipment covered by the ISI program and the SVP program, as well as the basis for inclusion, is documented onsite. The components WSLR are contained in the component level scoping results for each system WSLR. Initially, the criteria for inclusion of components in these programs and in the LR scope were compared, and this comparison provided the basis for much of the determination that equipment WSLR was covered by one of these programs. Where necessary, the documents that described the actual scope of components covered were also consulted to determine the coverage.

235. Page 7.6-18 states that general corrosion, SCC of high-strength bolts are the ARDMs plausible for tanks and heat exchanger supports and the containment cooler fan supports inside containment. Baseline activities indicate that these supports within scope were included in the SVP. Please describe how the SVP was used to identify general corrosion and SCC of high-strength bolts. Note 2 in p.7.6-8 needs to clearly describe the capability of the SVP inspections.

Response

For SCC, see response to Question 231. The effects of general corrosion on component supports are readily detectable by the visual inspection conducted during these walkdowns.

236. Page 1-1 of the Component Supports AMR report states that the SVP is to verify the seismic adequacy of mechanical and electrical equipment, including equipment supports and anchorage. The walkdown checklists in the SVP require evaluation of equipment anchorage, and assessments

of the as-found condition of concrete and other structural elements. (a) please describe what elements are included in the evaluation of equipment anchorage (e.g., base plate or anchor bolts); (b) describe whether the assessment includes concrete cracks in the adjacent area; and (c) describe what aging effects were identified.

Response

See the responses to Questions 212 and 216.

237. Section 1.1.1 of the Component Supports AMR report states that the snubber support includes hardware from the wall (should be building structure) and piping to the snubber pin connections. Please describe what are the elements included in the hardware from the building structure subject to AMR.

Response

The snubber support includes the subcomponents from the snubber pin connections to the structural component (wall, floor, beam) and from the other snubber pin connection to the pipe or component being supported.

238. Page 1-2 of the Component Supports AMR report states, "Supports (clips) for tubing are included in the Instrument Line Commodity Evaluation and therefore are not within the scope of this report." Clarify whether all supports on instrument lines are evaluated in the instrument line commodity group or only the "clips".

Response

All supports for tubing WSLR will be included in the Instrument Lines Commodity Evaluation Report.

239. Page 2-2 of the Component Supports AMR report states that hangers and snubber supports contain threaded fasteners in the load path which are loaded by thermal expansion (except snubber supports) and vibration induced loads, potentially resulting in fatigue damage or loosening of threaded joints. Please provide a discussion about the aging effects on those supports due to the potential fatigue damage and loosening of threaded joints for those component supports.

Response

As discussed in Section 5.2 of the commodity evaluation, piping supports with threaded fasteners are inspected for evidence of loading due to thermal expansion and hydraulic vibration. Such evidence includes loosening of bolts, which are occasionally discovered during CCNPP ISIs. The ISIs also look for signs of fatigue damage, e.g., structural deformation or degradation, which includes cracking.

240. Page 2-6 of the Component Supports AMR report indicates that "Lead Anchor Creep" is not plausible by stating, "Discussion with personnel . . . concluded that cinch (lead) anchors may have been used . . . Such items are not likely to be WSLR. Additionally, . . . lead relaxations, if there are any lead anchors, would become obvious." Provide definitive information on whether such anchors are WSLR. If they are WSLR, identify potential aging effects.

Response

Note 5 to Table 2-1 states the following: "The current CCNPP design standard for piping and pipe supports (DS-040) does not allow the use of lead anchors. Discussions with personnel involved in equipment installation at CCNPP concluded that cinch (lead) anchors may have been used to attach some light weight, non-safety electrical equipment items to block walls. Such items are not likely to be WSLR [within the scope of LR]. Additionally, since wall-mounted equipment puts a dead load on anchors, lead relaxation, if there are any lead anchors, would become obvious. This mechanism, therefore, is not a significant concern at CCNPP." Based on this discussion, BGE concluded that there is reasonable assurance that lead anchors are not used at CCNPP in any supports WSLR.

241. Table 2-1 of the Component Supports AMR report in note number 1 indicates that corrosion is due to normal humidity levels in the plant. However, another source of corrosion is due to leakage, such as boric acid or other contained fluid. Clarify Table 2-1 as appropriate.

Response

The AMRs do not assume that piping is allowed to leak for a prolonged period such that such leakage would be considered the normal environment which causes aging of the supports.

242. In Table 2-1 of the Component Supports AMR report, note numbers 2 and 6 appear to indicate that high strength bolting outside containment is not subject to SCC, even though these bolts would be subject to SCC inside containment because of differences in the environment. The Staff does not believe the environments inside and outside containment of PWRs are sufficiently different to eliminate SCC of high strength bolting outside containment as a plausible aging effects. Operating experience shows that high strength bolts are susceptible to SCC whether they are inside or outside of containment. In Generic Letter 91-17, the staff suggested licensees may wish to review EPRI NP-5067, "Good Bolting Practices, A Reference Manual for Nuclear Power Plant Maintenance Personnel," Volume 1: "Large Bolt Manual." This EPRI report states a technique for "fighting SCC" as, "Limit hardness of fastener material to less than 40 HRC, when the environment is no worse than humid air."

Either include SCC of high strength bolts outside containment as plausible or provide additional justification. Also note numbers 2 and 6 appear to be only applicable to anchor bolts. Clarify that high strength bolts, not limited to anchor bolts, are susceptible to SCC.

Response

a. As discussed in the BGE response to Questions 226 and 231, the LR technical report and commodity evaluation report will be revised to show that SCC is plausible only for pressurizer and safety injection tank anchor bolts because these are the only applications in the scope of this commodity report where "high strength bolts" were installed at CCNPP.

b. Other than the specific anchor bolts mentioned in Question 226, the threaded fasteners used in component supports within the scope of the commodity evaluation are not considered susceptible to SCC because high strength bolting was not used in these applications. These fasteners would include instrument mounting screws and bolts in pipe hangers.

243. Table 2-1 of the Component Supports AMR report, note numbers 16 and 18 state, " . . . would be subject to corrosion . . . if not coated with paint." However, EPRI NP-3784 (1984) report lists several instances of corrosion damage to bolting. This experience should be considered. It is unclear how corrosion is addressed for these components. It is not acceptable to use paint coating to eliminate corrosion as a plausible aging effect. Provide a discussion of corrosion as a plausible aging effect, or justify excluding it as a plausible aging effect.

Response

Corrosion was determined to be a plausible aging effect for every component support type, including pumps and tanks. These notes merely serve to categorize the role of maintaining painted surfaces with respect to corrosion.

244. Table 2-1 of the Component Supports AMR report, component support Types E-1 and E-3 contain elastomer isolators, and insulation material, respectively. Please provide a discussion about: (a) information on the expected life time or operating experience relating to these materials; and (b) potential aging effects.

Response

The aging mechanism of concern for these materials is elastomer hardening, which is already addressed by the commodity evaluation. The approach for managing the aging of the elastomer materials is not to predict an expected lifetime, but rather to continue to inspect them as part of the system engineer walkdowns to ensure their capability to perform their support function for elastomer materials used in E-1 type applications. For those materials used in E-3 type applications, deterioration of the insulation material will reveal itself by its impact on the active electrical equipment before such deterioration has any effect on the structural support function of this material. For this reason, no specific aging management practices are needed for maintaining the passive intended function of this material.

245. Table 2-1 of the Component Supports AMR report should address fatigue, CFC, and loss of bolt preload as potential ARDMs. The issue of loss of bolt preload needs to be discussed.

Response

a. Fatigue can only occur if the support is subjected to cyclic loading, as identified under the ARDMs "Loading due to Rotating/Reciprocating Machinery," "Loading due to Hydraulic Vibration or Water Hammer," and "Loading due to Thermal Expansion of Piping/Component."

b. Corrosion fatigue cracking is indirectly considered in the Component Support commodity evaluation because two of the explicit ARDMs must be present to have CFC: (1) general corrosion; and (2) cyclic loading caused by any of the three loading-related ARDMs evaluated in the commodity evaluation [loading due to: (a) rotating or reciprocating equipment; (b) hydraulic vibration or water hammer; and (c) thermal expansion].

c. Loss of bolt preload, unless due to relaxation of lead anchors, corrosion of the bolt, or concrete degradation (which are all addressed in the commodity evaluation) is not an aging

issue. Other causes for loss of bolt preload, e.g., overloading of a preloaded bolted connection, are design issues.

246. Page 3-1 of the Component Supports AMR report indicates that the supports for the fire and smoke detection system perform no intended function. Discuss whether or not this system is relied on to meet the fire protection regulation in 10 CFR 50.48. If so, these supports are WSLR.

Response

See response to Question 220.

247. Discuss the use of molydisulphide lubricants on bolting. In Generic Letter 91-17, the staff suggested licensees may wish to review EPRI NP-5067, Volume 1. This EPRI report states, "Avoid use of molydisulphide LUBRICANTS. The sulfides in these lubricants encourage stress corrosion cracking."

Response

Molydisulfide lubricants are restricted from use in bolting of SR components at CCNPP. Additionally, industry issues related to this lubricant document that the lubricant may accelerate the rate of SCC in the presence of high temperature and high moisture levels (such as steam turbine bolting application) and when subjected to boric acid. Neither of these conditions are normal conditions for component support bolting. Therefore, the presence or absence of this lubricant for component support applications is not judged to be pertinent to the SCC plausibility determination.

248. Page 2-4 of the Component Supports AMR report indicates that an accumulated neutron fluence below $6x10^{17} n/m^2$ would have an insignificant effect on ductility and tension test properties of steel. Provide additional information to justify the applicability of this value for component supports. Also discuss the associated neutron energy (MeV) when referencing the fluence.

Response

In NUREG-1509, "Radiation Effects on Reactor Pressure Vessel Supports," May 1996, the NRC Staff concludes that the higher than expected embrittlement exhibited by specimens from the High-Flux Isotope Reactor do not apply to reactor pressure vessel support steel embrittlement. The neutron fluence limit of $6 \times 10^{17} n/m^2$ (E>1 MeV) cited in the commodity evaluation was based on data obtained from tests conducted on the Shippingport Neutron Shield Tank, which are considered valid by NUREG-1509.