NUCLEAR ENERGY INSTITUTE

Douglas J. Walters
SR. PROJECT MANAGER, LICENSING
NUCLEAR GENERATION

March 27, 2000

Mr. Christopher I. Grimes
Chief, License Renewal and Standardization Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20006

SUBJECT: Generic Aging Lessons Learned Report Comments

PROJECT NUMBER: 690

Dear Mr. Grimes:

Enclosed are comments on various sections from three Chapters of the Generic Aging Lessons Learned (GALL) Report. Enclosure 1 provides comments on Chapter III, Section A1, Enclosure 2 provides comments on Chapter VI, Enclosure 3 provides comments on Chapter VII, Section B1, Enclosure 4 provides comments on Chapter VII, Section B2. Three documents are provided under each enclosure. One document is a mark-up of the existing GALL pages to reflect our comments. Each comment is identified by number. The second document is a table containing our comments, numbered consistent with the marked-up pages. The third document is a clean copy of the GALL pages to reflect how GALL reads with our comments incorporated.

We will discuss the enclosed comments with the NRC staff in meetings next week. In this regard please be aware that we may raise additional comments or advise the NRC staff of minor revisions to the enclosed comments during those meetings. This is because the industry is conducting a final review of the comments, and while we do not expect any substantive changes, there may be minor revisions.

We look forward to discussing the enclosed comments with the NRC staff. If you have any questions please call.

Sincerely,

Douglas J. Walters

Douglas J. Walters

C: Mr. Sam Lee
Mr. P.T.Kuo

D042

ENCLOSURE 1

A1. Group 1 Structures (BWR Reactor Bldg, PWR Shield Bldg, Control Rm/Bldg)

A1.1 Concrete Elements
A1.2 Steel Elements
A1.3 Masonry Walls

A1. Group 1 Structures (BWR Reactor Bldg, PWR Shield Bldg, Control Rm/Bldg)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A1 addresses the elements of BWR Reactor Building, PWR Shield Building, and Control Room Building. For this group, the applicable structural elements are identified: concrete, steel, and masonry walls. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Subsystem	Component	Material	Environment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking, Spalling	Freeze/ Thaw	10CFR50.65 NUMARC 93-01, Revision 2 Regulatory Guide 1.160, Revision 2

287

NUMARC 96-03, Rev. 0

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule (10CFR50.65) -Structures monitoring The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structure monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License	An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures ~~and component supports~~ will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for an acceptable aging management program follows: **(1)Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect/~~aging mechanism~~ combinations which are managed by the MR Structures Monitoring Program. For potential structure/aging effect/~~aging mechanism~~ combinations not covered by the MR Structures Monitoring Program, the applicant should justify that it is not significant for the applicant's plant, or identify the applicable aging management program. **(2) Preventive Actions:** ~~Inspection and maintenance of protective coatings which inhibit corrosion of steel structural elements should be included as part of Structures Monitoring. No specific preventive actions are identified for other aging mechanisms.~~ **(3) Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters ~~monitored or inspected is the responsibility of the licensee. For License Renewal, the specific parameters monitored or inspected~~ should be linked to ~~degradation of intended function(s) and should detect~~ the ~~presence and extent of~~ aging effects. The inspection scope should include bolt-tightness checks for concrete expansion anchors subjected to vibratory loads. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. **(4) Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the inspection schedule, inspection methods and inspector qualifications are defined by the individual licensees. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4.	No, if the structure/ aging effect ~~/aging mechanism~~ combination is within the scope of the applicant's MR Structures Monitoring Program ~~or if it is not applicable. Otherwise, justification for identifying the aging effect /aging mechanism as "non-significant" or details of plant-specific program need to be evaluated.~~

333

70

70

398

69

Delete text from this Column and re-insert in the "Evaluation and Technical Basis" Column.

71

Replace with wordi denoted in the comme

72

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Subsystem	Component	Material	Environment	Aging Effect	Aging Mechanism	References
							NUREG-1557 ASTM C33-90 ACI 318-63 ACI 349-85

355

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Renewal applicants are encouraged to take credit for existing programs.~~ ~~A well-formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal.~~ ~~The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structures monitoring under the Maintenance Rule. Plant-specific structures monitoring programs are identified and described, to demonstrate that adequate aging management programs are in place for structures and structural components. These programs were evaluated by the staff against the ten (10) criteria for an acceptable aging management program, defined in Section 3.0 of the Draft SRP-LR. For the most part, these programs are considered adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal.~~ ~~Basis for non-significance~~	**(5) Monitoring and Trending:** ~~Documentation and comparison of successive inspection results is needed to perform meaningful trending. An appropriate inspection schedule should be established to provide reasonable assurance that adequate monitoring and trending will be accomplished under the MR Structure Monitoring Program.~~ **(6) Acceptance Criteria:** ~~Acceptance criteria,~~ against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. ~~These criteria are defined~~ on a licensee-specific basis. ~~The acceptance criteria~~ should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the ~~acceptance criteria~~ utilized in its MR Structures Monitoring Program will provide for timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. **(7) Corrective Actions:** ~~Provided~~ the MR Structures Monitoring Program ~~is~~ conducted under 10 CFR 50, Appendix B (Quality Assurance), ~~the~~ Corrective Action ~~requirement of Criterion 7 is satisfied.~~ **(8) Confirmation Process:** ~~Provided~~ the MR Structures Monitoring Program ~~is~~ conducted under 10 CFR 50, Appendix B (Quality Assurance), ~~the~~ Confirmation ~~requirement of Criterion 8 is satisfied.~~ **(9) Administrative Controls:** ~~Provided~~ the MR Structures Monitoring Program ~~is~~ conducted under 10CFR50 Appendix B (Quality Assurance), ~~the~~ for Administrative Controls ~~requirement of Criterion 9 is satisfied.~~ **(10) Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation which threatens intended functions have only recently been implemented. ~~At this time, it appears that MR Structures Monitoring should be an effective program, provided the details of licensee-specific programs adequately address Criteria 1, 3, 4, and 6.~~ Per NUREG-1557, freeze/thaw is non-significant if located in a geographic region of negligible weathering conditions (weathering index <100 day-inch/yr); and if located in severe weathering conditions (weathering index >500 day-inch/yr) or moderate weathering conditions (100-500 day-inch/yr), the concrete mix design meets the air content (entrained air 3-6%) and water-to-cement ratio (0.35-0.45) requirements of ACI 318-63 or ACI 349-85. The weathering index is defined in ASTM C33-90, Table 3, Footnote E. Fig. 1 of ASTM C33-90 illustrates the various weathering index regions throughout the U.S..	

73

340

Change "acceptance criteria" to "classification of deficiencies"

should be for

should be for

should be

74

69

move deleted text to top of "Evaluation and Technical Basis" Column.

INSERT LANGUAGE FROM COMMENT # 225

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Permeability, Loss of Strength	Leaching of Calcium Hydroxide	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 201.2R-67
A1.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ASTM C295-54 ASTM C227-50 ACI 201.2R-67
A1.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 318-63 ACI 349-85 EPRI TR-103842 → 226
A1.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environment	Increase in Porosity and Permeability, Cracking, Spalling	Aggressive Chemical Attack	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, leaching of calcium hydrides is non-significant if not exposed to flowing water or if exposed to flowing water, constructed using the guidance of ACI 201.2R-67 to ensure dense, well-cured concrete with low permeability and control cracking through proper arrangement and distribution of reinforcement.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, reaction with aggregates is non-significant if the aggregates were investigated, tested, and subjected to petrographic examinations in accordance with ASTM C295-54 or ASTM C227-50 that showed the aggregates are non-reactive; or if the aggregates were potentially reactive, the provisions of ACI 201.2R-67 were followed.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, corrosion of embedded steel is non-significant for exterior above grade and interior if not exposed to aggressive environment (pH <11.5 or chlorides >500 ppm); or if exposed to aggressive environment, the concrete has low water-to-cement ratio (0.35-0.45), adequate air entrainment (3-6%), low permeability, and designed in accordance with ACI 318-63 or ACI 349-85. Per NUREG-1557, for components exposed to groundwater such as foundations and exterior concrete below grade, evaluate on a case-by-case basis to ensure the aging effects of corrosion of embedded steel on concrete surfaces will be managed to maintain intended functions during the period of extended operation.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, aggressive chemical attack is non-significant for exterior above grade and interior if not exposed to aggressive environment (pH <5.5), or to chloride or sulfate solutions beyond defined limits (>500 ppm chloride, or >1500 ppm sulfate); or if exposed to aggressive environment that exceeds the pH, chloride, or sulfate limits the exposure is for intermittent periods only. Applicant must define "intermittent periods" if it is the technical basis for non-significance. Per NUREG-1557, exterior below grade and foundation should be evaluated on a case-by-case basis to ensure that the aging effects of aggressive chemical attack on below-grade concrete surfaces will be managed to maintain the intended function(s) of Class I structure components during the period of extended operation.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*

INSERT NEW P - See CMT #226

Insert wording from CMT # 335

INSERT WORDING FROM CMT # 226

317 MOVE TEXT TO "MATERIALS" COLUMN

INSERT WORDING FROM CMT # 29

334

COMMENT 75

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Groundwater Conditions	Cracks; Distortion; Increase in Component Stress Level	Settlement	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 318-63 ACI 349-85
A1.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Foundation Strength	~~Erosion of Porous Concrete Subfoundation~~	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* IN 97-11 ~~IN 98-26~~
A1.2	Steel Components	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557

399

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Consideration of settlement is required by ACI 318-63 or ACI 349-85. For sites with soft soil or changes in the groundwater table, a settlement monitoring program is needed. Applicant should justify non-significance or identify program credited for monitoring settlement.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* IN 98-26 identifies MR Structures Monitoring for managing this aging effect, if applicable.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, inspection and maintenance of protective coatings are effective preventive measures for accessible areas. Inaccessible areas should be evaluated on a case-by-case basis to ensure that aging effects of corrosion will be managed.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A1.3	Masonry Walls	All	Concrete Block	Ambient Environment Inside Building	Cracking	Restraint; Shrinkage; Creep; Aggressive Environment	~~IE Bulletin 80-11~~ ~~IN 87-67~~ → 76

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~IE Bulletin 80-11~~ ~~IN No. 87-67;~~ ~~The IE Bulletin No.80-11 titled "Masonry Wall Design" was issued to address the concern with regard to the adequacy of the design criteria used in the design of masonry walls and the apparent lack of design criteria coordination between the structural and piping/equipment design groups. It required all operating nuclear power plants to address this issue by 1) identifying all masonry walls in close proximity or having attachments from safety-related piping or equipment, and 2) performing reevaluation of design adequacy of the walls and the construction practices employed in the construction of these walls.~~ ~~The NRC Information Notice (IN) No. 87-67 titled "Lessons Learned from Regional Inspection of Licensee Actions in Response to IE Bulletin 80-11" documented the inspection experience conducted by the NRC staff with respect to plant-specific implementation and corrective actions in executing the IE Bulletin 80-11 requirements. During the inspections performed at several plants, a number of deficiencies having the potential for affecting plant safety were identified. In each case of the identified deficiencies, remedial action was required by the licensee. The IN No. 87-67 concluded that the recurring nature of some of the observed cracks may justify the need for a periodic surveillance program to ensure that the level of structural adequacy to which licensees committed is maintained.~~ ~~Applicant should develop a program with procedural controls requiring engineering notification, reevaluation, and periodic inspections to ensure that the structural integrity of these walls is maintained. IN No. 87-67 states that these programs ensure that the physical condition of the walls, such as lack of mortar cracking and boundary conditions, remain as analyzed. Therefore, a periodic inspection and surveillance program instituted by the licensee in accordance with the insights provided in IN No. 87-67, constitutes part of a aging management program for masonry walls that were covered by IE Bulletin 80-11. Such program, if properly managed, should provide reasonable assurance that any recurrence of aged-related deficiencies (e.g. mortar cracks) that could potentially compromise masonry wall's intended~~	~~*(1) Scope of Program:* The IE Bulletin 80-11 and IN No. 87-67 apply to all masonry walls which are in proximity to or having attachments from safety-related piping or equipment such that wall failure could affect a safety-related system. However, during the implementation of USI A-46, numerous instances of masonry walls which are important to safety but not covered by the IE Bulletin 80-11 were identified, due to either reclassification of non-safety-related system to safety-related, or failing of non-safety-related system onto safety-related systems. In these cases, if the verification can be established that the masonry walls were evaluated and maintained in accordance with the requirements of the IE Bulletin 80-11 and the insights provided by the IN No. 87-67, the subject walls should be treated as within the scope encompassed by the IE Bulletin 80-11 and IN No. 87-67. *(2) Preventive Actions:* The IN No. 87-67 called for a periodic surveillance program by the licensee to monitor any specific conditions (e.g. mortar cracks) of masonry walls to ascertain that the level of structural adequacy to which licensees committed is maintained. It also suggested that the licensee's periodic surveillance program for managing the effects of cracking in masonry walls should include: 1) an analysis of the probable cause of the cracks;~~ 2) documentation of the repair efforts for these cracks or a demonstration of the structural adequacy of the walls, including the effects of the cracked block and mortar; and 3) a description of the measures to be taken to prevent recurrence of similar cracking in these and other safety-related masonry walls that are not reinforced. ~~However, no specific interval for the periodic inspection was suggested by the IN No. 87-67. 10 CFR 50.65(a) Paragraph 3 requires that the effectiveness of maintenance programs be assessed at least every two years. *(3) Parameters Monitored/Inspected:* The IN No. 87-67 identified cracks in masonry walls, especially unreinforced walls, as being the primary age-related degradation mechanisms for masonry wall structures as encompassed in Scope, and discussed the extent to which the age-related degradation mechanisms impact the intended functions of the safety-related piping or equipment being supported by the walls, if the effects of aging-related degradation of masonry walls are left undetected, uncorrected and unmanaged. *(4) Detection:* If properly conducted, inspection programs following the IE Bulletin 80-11 and IN No. 87-67 should provide reasonable assurance that any recurrence of aged-related deficiencies (e.g. mortar cracks) that could potentially compromise a masonry wall's intended functions will be identified. *(5) Monitoring and Trending:* The IN No. 87-67 suggested periodic surveillance to monitor any specific conditions (e.g. mortar cracks) of masonry walls to ascertain that the level of structural adequacy to which licensees committed is maintained, and abnormalities affecting facility safety identified by the surveillance program should be met with corresponding corrective action. The periodic inspections should also provide predictability of the extent of age-related degradation.~~	No. Acceptable for managing aging effect.

76

77

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
functions will be identified and corrected in a timely manner, so that the structural adequacy of these walls will be maintained."	***(6) Acceptance Criteria:*** The IE Bulletin 80-11, Section 2.b.(iii) provides the acceptance criteria for the re-evaluation of masonry walls. The licensee can use existing test data to justify alternate re-evaluation acceptance criteria, provided the criteria are shown to be conservative and applicable for the actual plant conditions. As an alternate, the IE Bulletin 80-11, Section 3 specifies that a confirmatory masonry wall test program can be conducted; the test program should address all appropriate loading conditions (seismic, tornado, missile, etc.). ***(7) Corrective Actions:*** As described in Preventive actions, the inspection report includes provisions for technical assessment of the causes of abnormal conditions and recommendations for remedial or mitigating measures. Therefore, issues related to corrective actions, including root cause determination and prevention of recurrence are adequately addressed. ***(8) Confirmation Process:*** Although the IN No. 87-67 did not require written response from licensees, the commission's regulations, as summarized in Regulatory Guide 1.16, "Reporting of Operating Information – Appendix A Technical Specifications" does require that any abnormal hazardous conditions observed during the inspection should be reported to the NRC staff. The age-related degradation mechanisms associated with masonry walls as identified in the IN No. 87-67 should provide guidance for determining abnormal hazardous conditions for masonry walls. ***(9) Administrative Controls:*** The IN No. 87-67 identified that lack of procedural control in some facilities contributed to compromising the structural qualification bases developed in the IE Bulletin 80-11 program, and concluded that inspection programs with procedural controls, requiring engineering notification of plant modifications, re-evaluation, and periodic inspections to ensure that the structural integrity of these walls is maintained, should provide adequate assurance that current plant conditions are used in the structural qualification of masonry walls. ***(10) Operating Experience:*** Although the IE Bulletin 80-11 implementation was measured as being a reasonably successful program, there were instances where masonry walls not included in the IE Bulletin 80-11 program were later identified to be important to safety in the USI A-46 program. This problem occurred largely because of reclassification of non-safety-related systems to safety-related systems and identification of certain non-safety-related systems whose failure could prevent the successful accomplishment of intended functions of safety-related systems. Lessons learned from A-46 program should be incorporated into the licensee's inspection program to assure that the structural integrity of all masonry walls important to safety are adequately managed for the extended period of operation.	

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
75	Group 1 Structures	A1.1		General Comment regarding concrete: What about elevated temp? NUREG-1557 states that this is non-significant for concrete. What about irradiation of concrete? NUREG-1557 states that this is non-significant for concrete. What about abrasion and cavitation of concrete? NUREG-1557 states that this is non-significant for all structures except Intake. This would be managed by MR for Intake structure. What about corrosion of steel piles? NUREG-1557 states that this is non-significant.
287	Group 1 Structures	A1.1	III A1-3	The NRC and licensees need to recognize that the structural monitoring program (as submitted by NEI to NRC) is comprised of a host of utility specific programs, which, taken together provide for an effective aging management program. It may be appropriate to identify these typical programs. Also, NEI 96-03 should be included as a reference. Although not endorsed by the NRC, it is used by many licensees to develop their structural monitoring programs.
69	Class 1 Structures	A1.1	III A1-4	Delete the text in the column "Existing Aging Management Program (AMP)" and identify "Maintenance Rule (10 CFR 50.65) Structures Monitoring" as the program. The text should be provided in the "Evaluation and Technical Basis" column

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
70	Group 1 Structures	A1.1	III A1-4	Revise attribute (1) Scope of Program, in the "Evaluation and Technical Basis" to clarify that aging mechanisms are not addressed by the Rule and they do not need to be identified. The scope of the program should clearly identify the structure/aging effect combinations only.
71	Group 1 Structures	A1.1	III A1-4	Attribute (2) Preventive Actions in the "Evaluation and Technical Basis" should reflect the finding in the Oconee SER. Revise GALL to state "No preventive actions are specified and the staff has found this acceptable." (See ONS SER).
72	Group 1 Structures	A.1	III A1-4	Revise attribute (3) Parameters Inspected or Monitored, in the "Evaluation and Technical Basis" column to state that the parameters inspected or monitored should be directly linked to the aging effects. For concrete, this should be cracking and loss of material due to freeze thaw, if applicable. Corrosion of steel should also be added since this is referenced from A1.2, steel components on page III A1-9
333	Group 1 Structures	A1.1	III A1-4	In the "Evaluation and Technical Basis" column it states that "An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures and component supports will be maintained, consistent with the current licensing basis, for the period of extended operation."

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				Delete component supports from the GALL statement Licensee implementation of the monitoring program specified in 10CFR50.65 may not always include component supports.
398	Group 1 Structures	A1.1	III A1-4	The "Further Evaluation" column requires justification of aging mechanisms/effects unless the structure/aging effect/aging mechanism is within the scope of MR structures monitoring Program. Certain aging effects are considered non-significant per NUREG 1557, and NUREG 1611. These should not require additional justification unless evaluation basis criteria are not met. Therefore, the wording statring with "...or if it is not applicable. Otherwise, justification..." should be deleted.
340	Group 1 Structures	A.1.1	III A1-5	Typically, Maintenance Rule Program structural monitoring programs classify deficiencies in structures as either a minor or significant deficiency. A minor deficiency is defined as a deficiency which, if not corrected will not threaten the structure's ability to perform its functions until the next regularly scheduled structural inspection. A significant deficiency is defined as a deficiency which requires corrective action and/or more frequent monitoring to provide confidence that the associated structure will remain functional until the next regularly scheduled structural inspection.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				Recommend replacing the phrase "acceptance criteria" with "classification of deficiencies."
355	Group 1 Structures Also a generic comment	A1.1	III A1-5	Technical references (NUREG-1557, ACI 318-63, ACI 349-85, and ASTM C33-90) are included throughout GALL. Each standard's year of record will probably not be consistent with existing licensing basis for many plants. What are the plans for these references and GALL as standards are revised and issued?
73	Group 1 Structures	A1.1	III A1-6	Attribute (5) Monitoring and Trending, in the "Evaluation and Technical Basis" column should reflect the finding in the Oconee Safety Evaluation Report. Reword the attribute to say "No monitoring and trending processes are specified and the staff has found this acceptable." (See ONS SER Section 3.2.6.3)
74	Group 1 Structures	A1.1	III A1-6	Attributes (7), (8), (9), and (10), in the "Evaluation and Technical Basis" column states that the maintenance rule program is conducted under 10 CFR 50, Appendix B. Not all aspects of maintenance rule program are conducted under 10 CFR Part 50, Appendix B. Reg. Guide 1.160 Revision 2 recognizes that the M rule program includes non safety related structures and does not require that the licensee develop paper work for BOP to meet the requirements of 10CFR 50 Appendix B requirements.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				Recommend the wording be changed from "...is conducted under..." to "...should be conducted..."
225	Group 1 Structures	A1.1	III A1-6	The write-up should include the following finding from NUREG- 1705, the Calvert Cliffs Safety Evaluation Report "NUREG-1705 includes five pages of specific discussion of the Calvert Cliffs Structure and System Walkdowns in the Program section. This procedure evolved from a good practice to incorporate the requirements of the Maintenance Rule. The NRC Staff credits this procedure as an aging management program for each structure, for component supports, and for numerous systems."
226	Group 1 Structures	A1.1	III A1-7 III A1-8	Add reference to EPRI TR-103842 In the first paragraph, after "chlorides > 500 ppm", insert "with oxygen available". Add a third paragraph: "EPRI TR-103842 emphasizes that oxygen and on-going exposure to an aggressive environment are required for corrosion. It states that corrosion is potentially significant for intake structures at ocean sites, due to constant exposure to seawater. For other structures, it points to the zone of fluctuating groundwater level as the only susceptible region for corrosion. Below this zone, there is insufficient oxygen. Above this zone, there is insufficient water.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
290	Group 1 Structures	A.1.1	III A1-8	In the "Evaluation and Technical Basis" column, the criteria for an aggressive environment needs to be expanded to include Sulfate limits to <1500 ppm (see NUREG/CP-0100, Page 86). The acceptable pH criteria for aggressive groundwater is given as <5.5 in the same reference, and not <11.5 (it is correct in the next entry for "Aggressive Chemical Attack"
317	Group 1 Structures	A1.1	III A1-8	This is one of the 17 open license renewal technical issues identified and described in EPRI TR-107521 (NEI/NRC 98-0041). No criteria are provided in the "Material" column on page II A1-10 for the determination of potential significance of the effects of alkali-aggregate reactions. On page III A1-8, the report states that "Per NUREG-1557, reactions with aggregates is non-significant if the aggregates were investigated, tested, and subjected to petrographic examinations in accordance with ASTM C295-54 or ASTM C227-50 that showed the aggregates are non-reactive; or if the aggregates were potentially reactive, the provisions of ACI 201.2R-67 were followed." These are material criteria that should be listed in the "Material" column on page III A1-7, and which also apply to containment concrete. Therefore, these same criteria should be listed in the "Material" column on page II A1-10.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				This same comment applies to other portions of the report related to alkali-aggregate reaction effects.
334	Group 1 Structures	A1.1	III A1-8	The "Evaluation and Technical Basis" column states: "Per NUREG-1557, for components exposed to groundwater such as foundations and exterior concrete below grade, evaluate on a case-by-case to ensure the aging effects of corrosion of embedded steel on concrete surfaces will be managed to maintain intended functions during the period of extended operation." The basis for non-significance identified for above grade concrete should apply to the below grade concrete as well. Therefore, the reference to a case-by-case basis evaluation requirement for below grade and foundation concrete should be deleted.
335	Group 1 Structures	A1.1	III A1-8	The "Evaluation and Technical Basis" column states that "Per NUREG-1557, corrosion of embedded steel..., or if exposed to aggressive environment, ..." Recommend it be reworded as follows : "Per NUREG-1557, corrosion of embedded steel..., or if exposed **for an extended period of time** to aggressive environment, ..."
291	Group 1 Structures	A.1.2	III A1-9 Corrosion	The findings of NUREG-1557 for Reactor Building Steel Corrosion (page B-143) is not reflected in the Evaluation column. The NUREG-1557 Basis for Agreement reads: Routine pressure retaining

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				capability testing is effective in verifying the integrity and timely detection of corrosion for metal siding and roof decking of BWR RB. Tech Specs require periodic leak testing of the Reactor Building. Additionally, the MR SMP is now in effect and includes the scope of the RB siding, roof and enclosures.
357	Group 1 Structures	A1.2	III A1-9	**E&TB incorporates NUREG-1557.** – GALL is incorporating requirements of NUREG-1557.
399`	Group 1 Structures	A1.1	III A1-9	IN 98-26 provided information on degradation associated with containment foundation founded on porous sub-grade. The IN required no specific actions to be taken by the licensees nor impose new requirements. Thus its reference in this report as a potential requirement is inappropriate. It is true, degradation of sub-foundation may yield to structure settlement, which is consider an aging effect and monitored by MR structural program. The degradation however may be a result of aging mechanisms different from those associated with porous concrete. Why is "Erosion of Porous Concrete" an aging mechanism? If this needs to be addressed, then the structure/component is "Porous concrete" and the aging mechanism is "erosion or abrasion" due to flowing water.
227	Group 1 Structures	A1.1	III A1-10	Calvert Cliffs is a "soil site" but has never had a Settlement Monitoring Program. The Calvert Cliffs License Renewal Application (LRA) provided

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				justification that the program is not needed. In NUREG – 1705, the NRC Staff agreed that settlement is not a plausible ARDM for the Calvert Cliffs structures, and did not require a program to manage. There should be a note to clarify: "Note: this ARDM may not be plausible for a structure. If settlement is not plausible, no aging management program is required." See Note 1
341	Group 1 Structures	A1.1	III A1-10	This area is inaccessible and will not be inspected by IWL or M. Rule programs for structures for Virginia Power. Settlement monitoring has been discontinued for all but few areas at North Anna. See comments concerning settlement by J. S. Thornton.
76	Group 1 Structures	A1.3	III A1-12	The "Existing Aging Management Program (AMP) column references IE Bulletin 80-11 and Information Notice 87-67. These references should be deleted since neither document require monitoring programs. The information in this column should simply be "Masonry Wall Inspection". It may be implemented as part of the applicant's maintenance rule structural monitoring program. Also, delete the references to the documents on Page III A1-11

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
77	Group 1 Structures	A1.3	III A1-12	A1.3 Evaluation and Technical Basis: The information should be rewritten as below: (1) Scope of Program: The scope of the program includes those masonry walls within the scope of license renewal. (2) Preventive Actions: The program is a visual inspection and no preventive actions are identified. The staff has found this acceptable (See ONS SER Section 3.2.6.3). (3) Parameters Monitored/Inspected: The visual inspection is performed to identify cracking of masonry walls. (4) Detection: A visual inspection performed using the guidance of IE Bulletin 80-11 and IN 87-67 provides reasonable assurance that the aging effect of cracking will be identified prior to loss of the component intended function. (5) Monitoring and Trending: There are no monitoring and trending processes associated with this program and the staff has found this acceptable (SEE ONS SER Section 3.2.6.3). (6) Acceptance Criteria: Acceptance criteria are no unacceptable visual indication of cracking of masonry walls. (7) Corrective Actions: The program is conducted under 10 CFR 50 Appendix B (Quality Assurance); therefore, the Corrective Action requirement is satisfied. (8) Confirmation Process: The program is conducted under 10 CFR 50 Appendix B

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION III A1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				(Quality Assurance); therefore, the Confirmation Process requirement is satisfied. (9) Administrative Controls: The program is conducted under 10 CFR 50 Appendix B (Quality Assurance); therefore, the Administrative Controls requirement is satisfied. (10) Operating Experience: Incorporation of lessons learned from the implementation of IE Bulletin 80-11, USI A-46, and the MR Inspection should assure the structural integrity of all masonry walls important to safety are adequately managed. At this time, it appears that the program will be adequate for assuring the structural integrity of the masonry walls within license renewal scope for the extended period of operation.

A1. Group 1 Structures (BWR Reactor Bldg., PWR Shield Bldg., and Control Rm./Bldg.)

A1.1 Concrete Elements
A1.2 Steel Elements
A1.3 Masonry Walls

A1. Group 1 Structures (BWR Reactor Bldg., PWR shield Bldg., and Control Rm./Bldg.,)

System, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A1 addresses the elements of BWR Reactor Building, PWR Shield Building, and Control room Building. For this group, the applicable structural elements are identified: concrete, steel, and masonry walls. The aging management review is presented for each applicable structural element/aging effect combination.

System Interface

Physical interfaces exist with any system or component, which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports, which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems, which provide plant cooling water and residual heat removal.

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Item	Subsystem	Component	Material	Environment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking, Spalling	Freeze/ Thaw	10 CFR50.65 NUMARC 93-01 Revision 2 Regulatory Guide 1.160, Revision 2 NEI 96-03 Revision 0

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule (10CFR50.65) -Structures monitoring	The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic structures, systems, and components. The nuclear power industry, through the developed guidance for the development of such programs. Rev.2 to NUMARC 93-01 was issued tin April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structure." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev 2, states that the Maintenance Rule does not treat components. The attributes of an acceptable structure-monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License Renewal applications are encouraged to take credit for existing programs. A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structure monitoring under The Maintenance Rule. Plant-specific structure monitoring programs are identified and described, to demonstrate that adequate again management programs are in place for structure and structural components. These programs were evaluated by the staff against the ten- (10) criteria for an acceptable aging management program, defined in Section 3.0 of Draft SRP-LR. For the most part, these programs are considered Adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal. "NUREG-1705 includes five pages of specific discussion of the Calvert Cliffs Structure and System Walkdowns in the Program section. This procedure evolved from a good practice to incorporate the requirements of the Maintenance Rule.	No. if the structure/aging effect combination is within the scope of the applicant's MR Structures Monitoring Program.

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Item	Subsystem	Component	Material	Environ-met	Aging Effect	Aging Mechanism	References
							NUREG-1557 ASTM-C33-90 ACI 318-63 ACI 349-85

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	The NRC Staff credits this procedure as an aging management program for each structure, for component supports, and for numerous systems." An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for any acceptable aging management program follows: (1) **Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components, which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect combinations, which are managed by the MR Structures Monitoring Program. For potential structure/aging effect combinations not covered by the MR Structures Program, the applicant's plant, or identify the applicable aging management program. (2) **Preventive Actions:** No preventive actions are specified and the staff has found this acceptable. (3) **Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters monitored or inspected should be linked to aging effects. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. (4) **Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the individual licensees define the inspection schedule, inspection methods and inspector qualifications. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4.	

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(5) **Monitoring and Trending:** No monitoring and trending processes are specified and the staff has found this acceptable. (See ONS SER Section 3.2.6.3) (6) **Acceptance Criteria:** Classification of deficiencies against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. These criteria are defined on a licensee specific basis. The classification of deficiencies should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the classification of deficiencies utilized in its timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. (7) **Corrective Actions:** The MR Structures Monitoring Program should be conducted under 10 CFR 50, Appendix B (Quality Assurance,), for Corrective Action. (8) **Confirmation Process:** The MR Structures Monitoring Program should be conducted under 10 CFR 50, Appendix B (Quality Assurance), for Confirmation. (9) **Administrative Controls:** The MR Structures Monitoring Program should be conducted under 10 CFR 50 Appendix B (Quality Assurance), for Administrative Controls. (10) **Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation, which threatens intended functions, have only recently been implemented. Per NUREG-1557, freeze/thaw in non-significant if located in a geographic region of negligible weathering conditions (weathering index <100 day-inch/yr); and if located in severe weathering conditions (weathering index >500 day-inch/yr) or moderate weathering conditions (100-500 day-inch/yr), the concrete mix design meets the air content (entrained air 3-6%) and water-to-cement ratio (0.35-0.45) requirements of ACI 318-63 or ACI 349-85. The weathering index is defined in ASTM C33-90; Table 3, Footnote E. Fig. 1 of ASTM C33-90 illustrates the various weathering index regions throughout the U.S.	

II STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Permeability, Loss of Strength	Leaching of Calcium Hydroxide	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 201-2R-67
A1.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ASTM C295-54 ASTM C227-50 ACI 201.2R-65
A1.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 318-63 EPRI TR-103482
A1.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environment	Increase in Porosity and Permeability, Cracking, Spalling	Aggressive Chemical Attack	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule – see A1.1., Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, leaching of calcium hydrides is non-significant if not exposed to flowing water or if exposed to flowing water, constructed using the guidance of ACI 201.2R-67 to ensure dense, well-cured concrete with low permeability and control cracking through proper arrangement and distribution of reinforcement.	*Same as A1.1, Freeze/Thaw Aging Mechanism*
Maintenance Rule – see A1.1., Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, reaction with aggregates is non-significant if the aggregates were investigated, tested, and subjected to petrographic examinations in accordance with ASTM C295-54 or ASTM C227-50 that showed the aggregates are non-reactive; or if the aggregates were potentially reactive, the provisions of ACI 201-2R-67 were followed	*Same as A1.1, Freeze/Thaw Aging Mechanism*
Maintenance Rule – see A1.1., Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, corrosion of embedded steel is non-significant for exterior above grade and interior if not exposed to aggressive environment (sulfate limits to <1500 ppm, pH <5.5 or chlorides >550 ppm with oxygen available) or if exposed to aggressive environment for an extended period of time, the concrete has low water-to-cement ration)0.35-0.45), adequate air entrainment (3-6%), low permeability, and designed in accordance with ACI 318-63 or ACI 349-85. EPRI TR-103842 emphasizes that oxygen and on-going exposure to an aggressive environment are required for corrosion. It states that corrosion is potentially significant for intake structures at ocean sites, due to constant exposure to seawater. For other structures, it points to the zone of fluctuating groundwater level as the only susceptible region for corrosion. Below this zone, there is insufficient oxygen. Above this zone, there is insufficient water. Per NUREG-1557, for components exposed to groundwater such as foundations and exterior concrete below grade, evaluate the aging effects of corrosion of embedded steel on concrete surfaces will be managed to maintain intended functions during the period of extended operation.	*Same as A1.1, Freeze/Thaw Aging Mechanism*
Maintenance Rule – see A1.1., Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, aggressive chemical attack in non-significant for exterior above grade and interior if not exposed to aggressive environment (pH,<5.5), or to chloride or sulfate solutions beyond defined limits (>500 ppm chloride, or >1500 ppm sulfate); or if exposed to aggressive environment that exceeds the pH, chloride, or sulfate limits the exposure is for intermittent periods only. Applicant must define "intermittent periods" if it is the technical basis for non-significance. Per NUREG 1557, exterior below grade and foundation should be evaluated to ensure that the aging effects of aggressive chemical attack on below-grade concrete surfaces will be managed to maintain the intended function(s) of Class I structure components during the period of extended operation.	*Same as A1.1, Freeze/Thaw Aging Mechanism*

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Groundwater Conditions	Cracks; Distortion; Increase in Component Stress Level	Settlement	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 318-63 ACI 349-85
A1.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Foundation Strength		*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* IN 97-11
A1.2	Steel Components	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Maintenance Rule – seeA1.1, Freeze/Thaw Aging Mechanism* NUREG-1557

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – seeA1.1, Freeze/Thaw Aging Mechanism* Consideration of settlement is required by ACI 318-63 or ACI 349-85. For sites with soft soil or changes in the groundwater table, a settlement monitoring program is needed. Applicant should justify non-significance or identify program credited for monitoring settlement.	*Same as A1.1, Freeze/Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* IN 98-26 identifies MR Structures Monitoring for managing this aging effect, if applicable	*Same as A1.1, Freeze/Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, inspection and maintenance of protective coatings are effective preventive measures for accessible areas. Inaccessible areas should be evaluated on a case-by-case basis to ensure that aging effects of corrosion will be managed.	*Same as A1.1, Freeze/Thawing Aging Mechanism*

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Item	Subsystem	Component	Material	Environ-met	Aging Effect	Aging Mechanism	References
A1.3	Masonry Walls	All	Concrete Block	Ambient Environment Inside Building	Cracking	Restraint; Shrinkage; Creep; Aggressive Environment	

III STRUCTURE AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, and Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Masonry Wall Inspection	(1) **Scope of Program:** The scope of the program includes those masonry walls within the scope of license renewal. (2) **Preventive Actions:** The program is a visual inspection and no preventive actions are identified. The staff has found this acceptable (See ONS SER Section 3.2.6.3). (3) **Parameters Monitored/Inspected:** The visual inspection is performed to identify cracking of masonry walls. (4) **Detection:** A visual inspection performed using the guidance of IE Bulletin 80-11 and IN 87-67 provides reasonable assurance that the aging effect of cracking will be identified prior to loss of the component intended function. (5) **Monitoring and Trending:** There are no monitoring and trending processes associated with this program and the staff has found this acceptable (SEE ONS SER Section 3.2.6.3). (6) **Acceptance Criteria:** Acceptance criteria are no unacceptable visual indication of cracking of masonry walls. (7) **Corrective Actions:** The program is conducted under 10 CFR 50 Appendix B (Quality Assurance); therefore, the Corrective Action requirement is satisfied. (8) **Confirmation Process:** The program is conducted under 10 CFR 50 Appendix B (Quality Assurance); therefore, the Confirmation Process requirement is satisfied. (9) **Administrative Controls:** The program is conducted under 10 CFR 50 Appendix B (Quality Assurance); therefore, the Administrative Controls requirement is satisfied. (10) **Operating Experience:** Incorporation of lessons learned from the implementation of IE Bulletin 80-11, USI A-46, and the MR Inspection should assure the structural integrity of all masonry walls important to safety are adequately managed. At this time, it appears that the program will be adequate for assuring the structural integrity of the masonry walls within license renewal scope for the extended period of operation.	

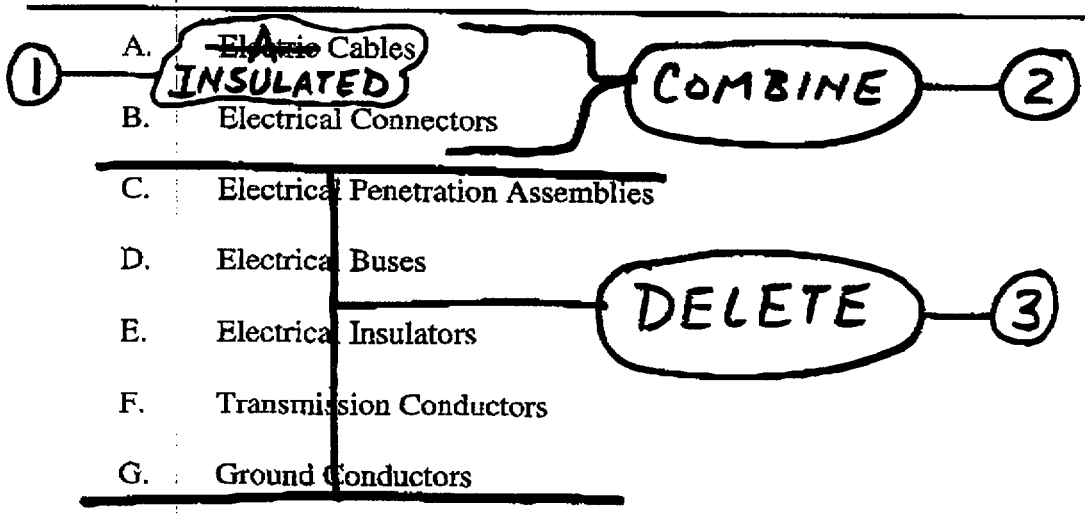
ENCLOSURE 2

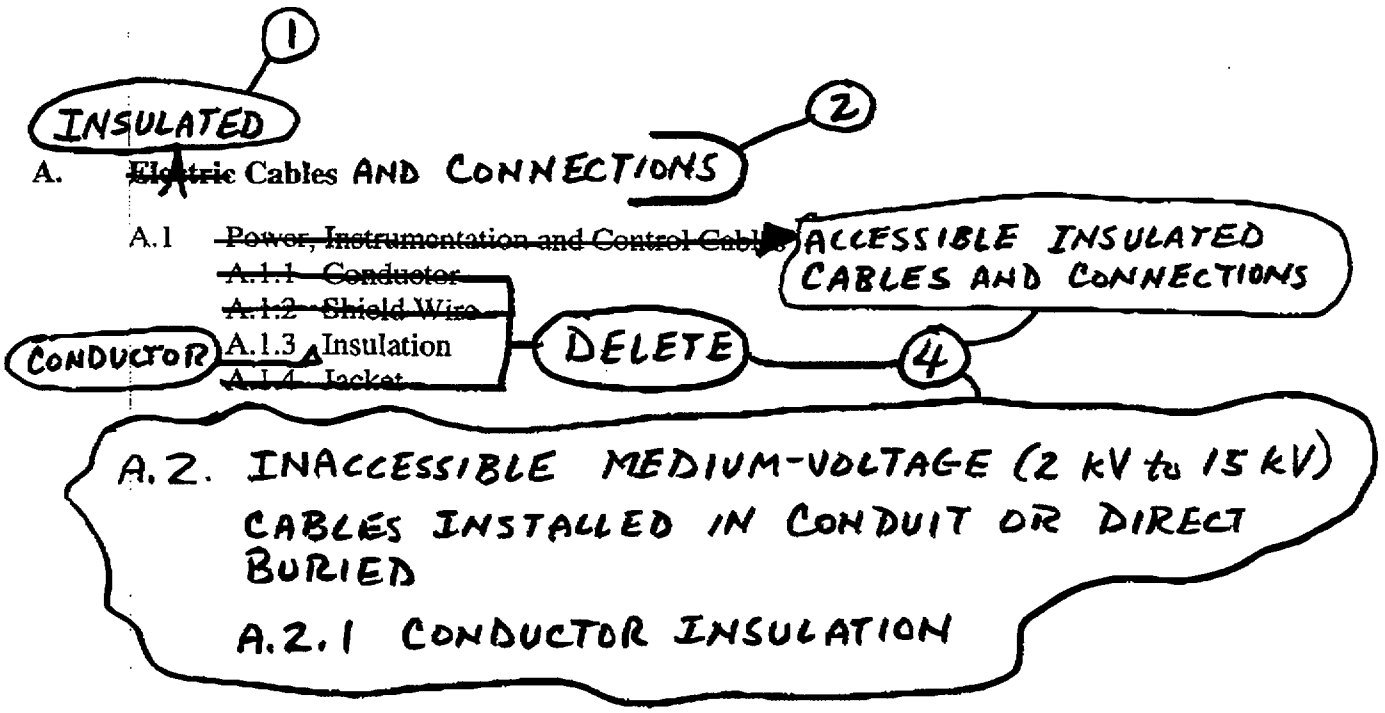
CHAPTER VI

ELECTRICAL COMPONENTS

MARKED-UP COPY TO MATCH NEI COMMENTS

Major Electrical Components




1
INSULATED
2
A. ~~Electric~~ Cables AND CONNECTIONS
A.1 ~~Power, Instrumentation and Control Cables~~
ACCESSIBLE INSULATED CABLES AND CONNECTIONS
~~A.1.1 Conductor~~
~~A.1.2 Shield Wire~~
CONDUCTOR
A.1.3 Insulation
~~A.1.4 Jacket~~
DELETE
4
A.2. INACCESSIBLE MEDIUM-VOLTAGE (2 kV to 15 kV) CABLES INSTALLED IN CONDUIT OR DIRECT BURIED
A.2.1 CONDUCTOR INSULATION

VI. ELECTRICAL COMPONENTS

A. ~~Electric~~ Cables AND CONNECTIONS (2)

INSULATED (1)

ARE NOT NORMALLY USED A NUCLEAR POWER PLANTS,

APPLICATIONS

Systems, Structures and Components

This review table addresses ~~electric~~ cables, including power, instrumentation and control (I&C) ~~cables~~. The power cables addressed are low-voltage (< 1000 V) and medium voltage (2 kV to 15 kV) ~~which have similar constructions to I&C cables~~. High voltage power cables (>15 kV) have unique, specialized construction and must be evaluated on an application specific basis. Since the cable types addressed herein are very similar in construction and aging effects, they are grouped together in the table. Individual sub-components for a typical cable are addressed in terms of aging mechanisms and effects.

INSULATED CABLES AND THEIR REQUIRED TERMINATIONS...

System Interfaces

(1) INSULATED

~~Electric~~ cables functionally interface with all plant systems that rely on electric power and/or instrumentation and control. ~~Physical interfaces include routing in cable trays and conduits~~.

(2) AND CONNECTIONS

INSULATED CABLES AND CONNECTIONS ALSO INTERFACE WITH...

(5) (11)

(6)

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.1	Power, Control, & Instrument Cables	Conductor	Copper • coated or non-coated • stranded or solid	Humid, Chemical Exposure	Increased circuit resistance, heating, signal noise, circuit failure	Corrosion	IE Bulletin 79-1B (DOR Guideline) NUREG-0588 IEEE Standards • 323-1971 • 323-1974 • 383-1974 • 317-1976 • 338-1987 • 1205-1993 Regulatory Guide 1.89, Rev. 1 10CFR50.49 EQ Rule

DELETE (4)

MOVE TO TLAA CHAPTER (11)

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment For electrical equipment that is environmentally qualified for use in nuclear power plants, the environmental qualification program may be applicable as a tool for aging management. **Environmental Qualification (10CFR50.49: EQ Rule)** EQ requirements have evolved over the years; therefore, plants of various vintages are licensed based on different EQ requirements. There are three main documents that chronicle the EQ requirements, starting with the IE Bulletin 79-01B (DOR guidelines) issued in 1979. This was followed by NUREG-0588, which specifies two categories of qualifications, and finally the current EQ Rule (10 CFR 50.49). The DOR Guidelines and NUREG-0588 Category II are consistent with the original IEEE Standard for qualifying Class 1E equipment (IEEE Std 323-1971), while NUREG-0588 Category I and 10 CFR 50.49 endorse a later version of the standard (IEEE Std 323-1974). IEEE Standard 323-1974 includes more stringent requirements than the 1971 version, including the application of margins to test parameters and pre-aging of equipment prior to accident testing. It should be noted that the NRC has not endorsed a later version of the standard (IEEE Std 323-1983). While many of the older vintage plants were licensed based on the DOR Guidelines/NUREG-0588, Category II, many of the electric cables inside containment (over 70%) included pre-aging as part of their original qualification, or have been re-qualified to Category I criteria. Many older plants still utilize cable connections and electrical penetrations that were environmentally qualified in accordance with the DOR Guidelines and/or the NUREG-0588, Category I requirements. The original qualification of many of these components might not have included pre-aging prior to exposing them to accident conditions.	**A. Environmentally Qualified Equipment** In general, the EQ process accounts for aging through the use of a Time Limited Aging Analysis (TLAA) for the equipment to be qualified. It does not require the use of prevention or mitigation measures, or the use of condition/performance monitoring. Therefore, EQ cannot be considered a typical aging management program. However, the TLAA does provide some assurance that the effects of aging will not be problematic during the qualified life of the equipment. As such, EQ can be considered part of an aging management program for license renewal if the licensee can show i) the TLAA remains valid for the period of extended operation, ii) the TLAA is projected to the end of the period of extended operation through re-analysis, or iii) the effects of aging on the intended function(s) will be adequately managed during the period of extended operation. For case (i), the existing qualification is acceptable for extended life and no further evaluation is necessary. For case (ii), a re-analysis is necessary to extend the qualified life of the equipment. In the re-analysis, attributes that should be addressed include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met and the period of time prior to the end of qualified life when the re-analyses will be completed In light of case (iii), the EQ process was evaluated as an aging management program based on the 10 criteria identified in the draft SRP-LR. The following summarize this evaluation: *(1) Scope of Program:* The EQ requirements apply to electric equipment important to safety, which includes those electrical components within the scope of license renewal (i.e., cables, connectors, and penetration assemblies). *(2) Preventive Actions:* EQ does not require the use of preventive actions to manage the effects of aging. Aging is addressed through the use of a TLAA. As such, the EQ process identifies no preventive actions. *(3) Parameter Monitored/Inspected:* EQ is not a condition or performance monitoring program. As such, it does not identify any parameters to be monitored to manage the effects of aging. Aging is addressed through the use of a TLAA. *(4) Detection of Aging Effects:* In general, EQ does not require the detection of aging effects for equipment while in service. When the qualified life is less than the current plant license period, EQ requires a program to replace or refurbish the component at the end of its qualified life. *(5) Monitoring and Trending:* EQ does not rely on monitoring and trending of condition or performance parameters of equipment while in service to manage the effects of aging. As such, no monitoring or trending activities for assessing	**A. Environmentally Qualified Equipment** Yes. In the case where the TLAA is projected to the end of the period of extended operation, the analysis attributes identified should be addressed

8 REPLACE TEXT

10 REPLACE TEXT

12

MOVE TO TLAA CHAPTER

11

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	the impact on equipment condition due to aging are identified by [illegible]	

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	the impact on equipment condition due to aging are identified by the EQ process. It should also be noted that currently, there are no recognized in situ condition monitoring methods that are effective for monitoring the condition of electric cables. Research is ongoing to determine if acceptable methods exist. ***(6) Acceptance Criteria:*** EQ does not rely on monitoring and trending of condition or performance parameters to manage the effects of aging. As such, no acceptance criteria are established for equipment operation while in service. ***(7) Corrective Actions:*** As part of the EQ process, a qualified life is established for the equipment being qualified. Once the equipment reaches the end of its qualified life, the only acceptable corrective action is refurbishment or replacement. ***(8 & 9) Confirmation process and Administrative Controls:*** EQ does not rely on preventive or corrective actions to address the effects of aging. As such, the EQ process identifies no confirmation process. EQ documentation for each qualified component is maintained at the plant site in an auditable form for the duration of the installed life of the equipment. ***(10) Operating Experience:*** Passive electrical components are typically reliable devices under normal plant conditions and have very little evidence of significant failures. In a study performed by Sandia (SAND96-0344, 9/96), a database of nuclear plant component failure records was reviewed to identify relative number of failures, as well as typical failure modes and causes for electrical cables and terminations. The review covered data for the time period from 1975 to 1994, and generated 1,458 reports applicable to low and medium voltage cables and terminations. An analysis of these records showed the following: - In general, these components have good reliability. However, aging degradation does occur and has led to failures. - For low-voltage components, connectors accounted for the highest percentage of failures (30%). Cables (14.5%), terminal blocks (3.5%) and splices (2.5%) had relatively fewer failures. - For medium voltage components cables had the highest percentage of failures (69%), followed by connectors (11%) and splices (17%). - Most of the failures are detected by operation of the component; relatively few are detected by maintenance or surveillance. Another EPRI study on low-voltage environmentally qualified cables presented in an industry report (EPRI TR-103841, 6/94) analyzed Licensee Event Reports for the period from 1968 to June 1992. Only 87 LERs related to cables were considered attributable to aging and the failures were categorized as follows: thermal degradation (13 reports), mechanical damage (23 reports), misapplication (11 reports), and unknown (40 reports). Roughly half of these failures occurred in the first 6 years of operation, and the number of failures decreased significantly after 10 years of operation.	

10

REPLACE TEXT

MOVE TO TLAA CHAPTER

11

13

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	NRC's aging assessment on cables, connections, and electrical penetration assemblies analyzed LER/NPE data for the period from mid-1980 to 1988 (NUREG/CR-5461, 6/90). An analysis of these failure data showed the following: • Out of 151 reported events on cables, more than 70% involved some type of electrical failure either shorting, open circuit, or grounding faults. • Out of 196 reported events on connections, almost 80% involved shorted, grounded, loose, or open connections. • Out of 39 reported events on EPAs, pressure leakage (41%) and electrical failure (26%) caused the most events.	
	Based on the results presented by these studies, it is seen that qualified electrical equipment does have good reliability, and aging degradation is usually well managed. These components receive little or no preventative maintenance. Under accident conditions, however, the reliability of these components is relatively unknown. Many of the causes of failures in accident conditions would not be detected during normal operation because of the absence of high temperatures and humidity. Note that not all degradation is detected and mitigated before it results in failure. Therefore, additional aging management practices are needed to completely manage the effects of aging for these electrical components.	
	As discussed in SECY-93-049, during the staff's review of license renewal issues, the EQ process was found to be a significant issue. Of particular concern was whether the EQ requirements for older plants (i.e., DOR guidelines, NUREG-0588 Cat. II), whose licensing bases differ from newer plants, are adequate for license renewal. Further, a question was raised as to whether the EQ requirements for older plants should be reassessed for the current licensing term. Upon subsequent review, additional concerns were raised related to the EQ process and it was concluded that differences in EQ requirements constituted a potential generic issue that should be evaluated for backfit, independent of license renewal. This came to be identified as Generic Issue 168. Key items to be addressed in GSI-168 are: • The adequacy of older EQ requirements for license renewal, as well as for the current licensing term • The adequacy of accelerated aging techniques to simulate long-term natural service aging • The possibility that unique failure mechanisms exist for bonded jacket and multi-conductor cable configurations that are not adequately addressed in EQ • The feasibility of using condition monitoring (CM) techniques to monitor current cable condition in situ as a means of offsetting uncertainties in the process used to predict long-term service aging Presently, GSI-168 is an open generic issue related to license renewal, and research is ongoing to provide information to resolve it. Specific issues being addressed in this research are presented in	

14

15

17

10

REPLACE TEXT

11

MOVE TO TLAA CHAPTER

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	NUREG/CR-6384. Once this generic issue is resolved, guidance will be provided as to the impact on license renewal. In the interim, NRC letter dated June 2, 1998 "Guidance on Addressing GSI-168 for License Renewal," (C. Grimes, NRC to D. Walters, NEI) provides guidance on addressing GSI-168 in license renewal applications. It states that, until the generic issue is resolved, "*...an acceptable approach described in the SOC is to provide a technical rationale demonstrating that the current licensing basis for EQ, pursuant to 10 CFR 50.49 will be maintained in the period of extended operation.*"	
	It should be noted that, currently, there are no acceptable non-destructive CM techniques to measure the integrity of electric cables in situ. It does not appear that utilities can take credit for current functional testing of cables by periodic system or circuit testing as a means of satisfying the criteria for an item to be considered a replacement item. The effectiveness of several promising CM techniques for monitoring degradation of cables is the subject of an ongoing NRC research program. The results of this program will be part of the resolution of GSI-168.	
B. Non-environmentally Qualified Equipment In many applications, electrical equipment may not be environmentally qualified, and other aging management programs may be applicable. The following are examples.	**B. Non-environmentally Qualified Equipment** The aging management programs discussed are generic in nature and should be developed based on specific plant applications. These programs will be evaluated on a plant specific basis.	**B. Non-environmentally Qualified Equipment** Yes. A plant specific evaluation is required.
Aging Inspection Program For those electrical components that are accessible, a visual inspection can be used to provide some indication of aging degradation. The visual inspection can check for surface anomalies, such as discoloration, cracking or surface contamination that would indicate the presence of active aging degradation. For cables, if the jacket or insulation can be touched, a qualitative indication of material hardening can be made. Observation of aging degradation would indicate the need for further investigation of the component.		
Instrument Calibration Program Instrument calibration programs, including technical specification surveillance, may be used to provide an indirect indication of the condition of various electrical components. If calibration drift is noted for instruments, this could be an indication that aging degradation is affecting the electrical circuit. Further investigation could then be initiated to determine the nature of the degradation and the component affected.		

10 REPLACE TEXT

11 MOVE TO TLAA CHAPTER

18

DELETE 19

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.2	Power, Control, & Instrument Cables	Shield Wires	Braided copper, Aluminum Foil, Metallized mylar tape	Humid, Chemical Exposure	Signal noise or error in control and instrument cable	Corrosion	*Same as effect of corrosion on conductor for cables (A.1.1).*
~~A.1.3~~ A.2.1	Power, Control, & Instrument Cables	Insulation	Polymers ~~such as~~ (e.g., XLPE, EPR, SR)	Humid, High voltage gradient (Power Cable)	Loss of dielectric strength, signal noise/ error, leakage current	Moisture diffusion/ absorption; Formation of water trees in power cables	*Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE 20

DELETE 4

4

21

CONDUCTOR

VARIOUS ORGANIC

REPLACE

7

REPLACE

INACCESSIBLE MEDIUM-VOLTAGE (2 KV to 15 KV) CABLES INSTALLED IN CONDUIT OR DIRECT BURIED

ADVERSE LOCALIZED ENVIRONMENT CAUSED BY MOISTURE AND VOLTAGE EXPOSURE

NUREG-1705
NUREG-1723
IEEE Std. 1205
SAND96-0344
EPRI TR-109619

FORMATION OF WATER TREES, LOCALIZED DAMAGE, LEADING TO ELECTRICAL FAILURE (BREAKDOWN OF INSULATION) CAUSED BY MOISTURE INTRUSION, WATER TREES

21

VI. ELECTRICAL COMPONENTS

A. ~~Electric~~ Cables AND CONNECTIONS (2)

INSULATED (1)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* DELETE (4)	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* Note: The most probable location for shield wire corrosion is at exposed sites, such as terminations on equipment or terminal strips	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables*
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* DELETE (11)	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1)* REPLACE TEXT (22)	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* Note: Underwater cables or cables with prolonged exposure to humid environment, should be specifically designed for such applications.	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

VI. ELECTRICAL COMPONENTS

A. ~~Electric~~ Cables AND CONNECTIONS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
~~A.1.2~~ A.1.1	Power, Control, & Instrument Cables REPLACE	Insulation CONDUCTOR	Polymers ~~such as~~ (e.g., XLPE, EPR, SR)	High temp., Radiation, Oxygen and Internal Ohmic heating (Power Cables)	Loss of dielectric strength, leakage current, signal noise/ error, circuit failure	Hardening, Cracking	*Same as effect of corrosion on conductor for cables (A.1.1).*

1 INSULATED

2

23

VARIOUS ORGANIC

DELETE 20

4

ACCESSIBLE INSULATED CABLES AND CONNECTIONS

ADVERSE LOCALIZED ENVIRONMENT CAUSED BY HEAT OR RADIATION IN THE PRESENCE OF OXYGEN

NUREG-1705
NUREG-1723
NUREG/CR-5643
IEEE STD. 1205
SAND96-0344
EPRI TR-109619

7

23

EMBRITTLEMENT, CRACKING, MELTING, DISCOLORATION, LEADING TO REDUCED INSULATION RESISTANCE, ELECTRICAL FAILURE, CAUSED BY...

VI. ELECTRICAL COMPONENTS

A. ~~Electric~~ Cables AND CONNECTIONS (2)

(1) INSULATED

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~A. Environmentally Qualified Equipment~~ *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* Note: Some applications use different insulation materials, such as mineral insulation and polyimides (e.g., Kapton) which may be susceptible to different aging mechanisms. Cracking can be initiated in a an embrittled cable by any movement of the cable, such as a seismic event, maintenance activities, or vibration from nearby operating equipment. While embrittlement and cracking of cable insulation may not affect cable performance under normal, dry conditions, the aging effects noted would be probable when cables with cracks are exposed to moisture, such as in a design basis event. Moisture intrusion through the cracks could lead to shorting and possible circuit failure.	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE (4)

REPLACE TEXT (24)

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.4	Power, Control, & Instrument Cables	Jacket	Polymers such as Neoprene, CSPE, PVC	High temp., Radiation, Oxygen	Loss of mechanical and environmental protection to underlying insulation. Exposure of insulation to outside conditions.	Hardening, Cracking	*Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE

4

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* Note: Jackets provide some degree of protection to underlying insulation from exposure to outside stressors, such as radiation, oxygen, moisture, dirt, dust and other contaminants. For bonded jacket cables, in which the jacket is bonded to the insulation, cracking in the jacket has been found to propagate through to the insulation in some cases.	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE

4

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.4	Power, Control, & Instrument Cables	Jacket	Polymers such as Neoprene, CSPE, PVC	High temp., Radiation, Oxygen	Loss of fire protection	Loss of fire retardant	*Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE
4

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* Note: The primary purpose of the jacket is to protect the insulated conductors from fire and environmental stressors. No known condition monitoring method is available to determine the amount of fire retardant lost with the age of the jacket material.	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE
4

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.4	Power, Control, & Instrument Cables	Jacket	Polymers such as Neoprene, CSPE, PVC	Vibration, maintenance abuse	Exposure of insulation to outside conditions	Wear and tear	*Same as effect of corrosion on conductor for cables (A.1.1)*

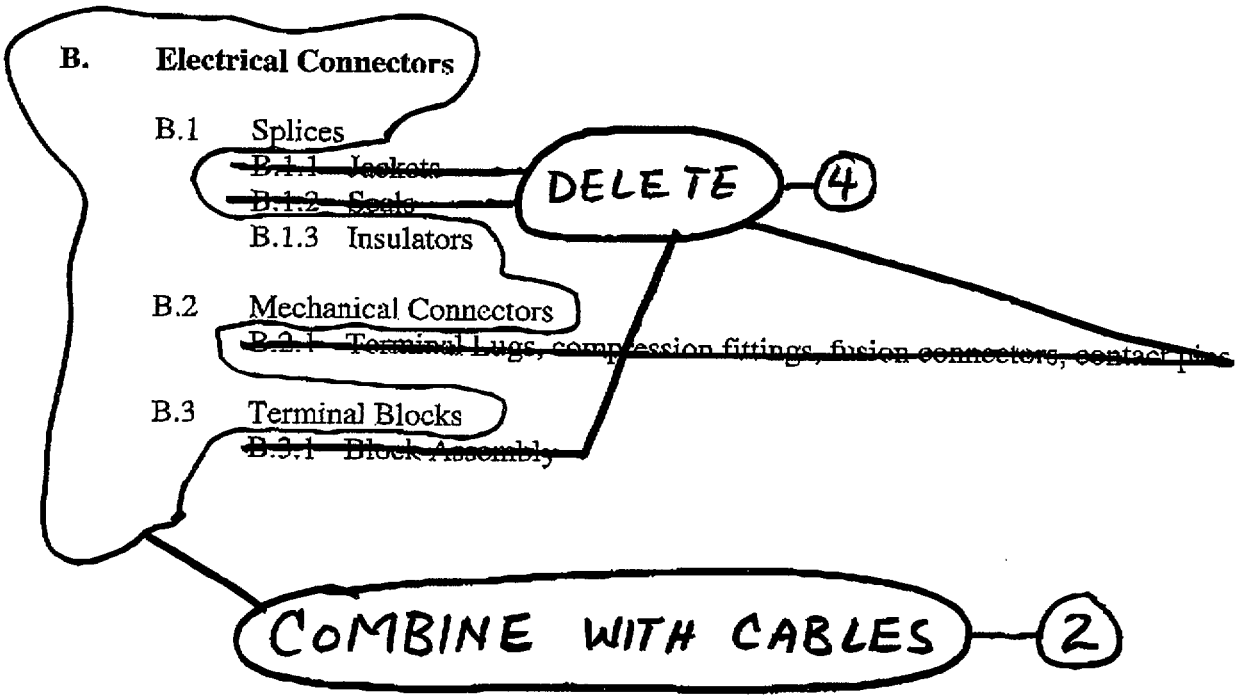
DELETE

4

VI. ELECTRICAL COMPONENTS
A. Electric Cables

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* Note: Wear due to vibration is most probable in locations where jacket is adjacent to rough or sharp objects capable of causing cutting, chafing or abrasion. Jackets provide some degree of protection to underlying insulation from exposure to outside stressors, such as radiation, oxygen, moisture, dirt, dust and other contaminants.	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE
4


B. Electrical Connectors
B.1 Splices
~~B.1.1 Jackets~~
~~B.1.2 Seals~~
B.1.3 Insulators
B.2 Mechanical Connectors
~~B.2.1 Terminal Lugs, compression fittings, fusion connectors, contact pins~~
B.3 Terminal Blocks
~~B.3.1 Block Assembly~~
DELETE
4
COMBINE WITH CABLES
2

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Systems, Structures and Components

This review table addresses the electrical connectors that are used in electrical circuits to join the various components electrically. This includes splices, mechanical connectors and terminal blocks. Individual sub-components for each connector are addressed in terms of aging mechanisms and effects.

System Interfaces

Electrical connectors are used in all electrical circuits, therefore, they functionally interface with all plant systems that rely on electric power and/or instrumentation and control. Physical interfaces include installation in junction boxes and various control panels.

DELETED
-APPROPRIATE TEXT COMBINED WITH CABLES DESCRIPTION (2)

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B.1.1	Splices	Jackets	Polymers	High temp., Radiation, Oxygen	Exposure of insulation and internal parts to outside conditions	Hardening and Cracking	*Same as effect of corrosion on conductor for cables (A.1.1).*
B.1.2	Splices	Seals (potting) Compounds (gaskets, sealant)	Organic Compounds or cement, Rubber	High temp., Radiation, Oxygen	Moisture intrusion, leakage current, Signal noise/ Error, circuit failure	Hardening and Cracking	*Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE 4

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE (4)

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B.1.2	Splices	Seals (potting) Compounds (gaskets, sealant)	Organic Compounds of cement, Rubber	High temp. hmidity, Mech. Stress	Moisture intrusion, leakage current, Signal noise/ Error, circuit failure	Creep, distortion	*Same as effect of corrosion on conductor for cables (A.1.1).*
B.1.3	Splices	Insulators (Heat shrink, Tape)	Organic materials, rubber, specialty tapes	High temp., Radiation, Oxygen	Leakage current, Signal noise/ Error, circuit failure	Hardening and Cracking	*Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE (4)

DELETE - INCLUDED IN NEW A.1.1 (4)

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* DELETE 4	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* DELETE 11	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* 4 DELETE - INCLUDED IN NEW A.1.1	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B.2.1	Mechanical Connectors	Terminal lugs, compression fittings, Fusion connectors Contacts/ pins	Copper (plated/ Nonplated)	Moisture, chemicals, oxygen	Increased circuit resistance, leakage current, signal noise/ error	Corrosion, oxidation	*Same as effect of corrosion on conductor for cables (A.1.1).*
B.2.1	Mechanical Connectors	Terminal lugs, compression fittings, fusion connectors, Contacts/ pins	Copper (plated/ Nonplated)	Vibration, thermal cycling, repeated connect/ disconnect	Increased circuit resistance, leakage current, signal noise/ error	Distortion, cracking, work hardening	*Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE 4

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).* DELETE 4	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B.3.1	Terminal Blocks	Block assembly	Organic Compounds	High temp., Radiation, Oxygen	Shorting	Hardening, Cracking	*Same as effect of corrosion on conductor for cables (A.1.1).*
B.3.1	Terminal Blocks	Block assembly	Organic Compounds	Moisture, Contami-nants	Shorting	Loss of insulating properties	*Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE (4)

VI. ELECTRICAL COMPONENTS
B. Electrical Connectors

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
A. Environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**A. Environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*
B. Non-environmentally Qualified Equipment *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*	**B. Non-environmentally Qualified Equipment** *Same as effect of corrosion on conductor for cables (A.1.1).*

DELETE 4

C. Electrical Penetration Assemblies (EPA)

C.1 Modular EPA
- C.1.1 O-ring seals
- C.1.2 Conductor-to-insulator seals
- C.1.3 Cable lead wires
- C.1.4 Interface connectors

DELETE SECTION C 3

D. Electrical Buses

D.1 Isolated Phase Bus
- D.1.1 Bus assembly
- D.1.2 Bus support assembly
- D.1.3 Bus enclosure assembly
- D.1.4 Baffle bushing assembly

D.2 Non-segregated Phase Bus
- D.2.1 Bus assembly
- D.2.2 Bus support assembly
- D.2.3 Bus enclosure assembly
- D.2.4 Baffle bushing assembly

D.3 Segregated Phase Bus
- D.3.1 Bus assembly
- D.3.2 Bus support assembly
- D.3.3 Bus enclosure assembly

D.4 Switchyard Bus
- D.4.1 Bus Enclosure

DELETE SECTION D (3)

E. Electrical Insulators

E.1 Station Post Insulators
E.1.1 Assembly

E.2 Strain/suspension Insulators
E.2.1 Assembly

DELETE SECTION E 3

F. Transmission Conductors

F.1 Conductor
F.1.1 Assembly

DELETE SECTION F 3

G. Ground Conductors

G.1 Conductor

G.1.1 Assembly

DELETE SECTION G (3)

11 MOVE TO TLAA CHAPTER REFERENCES

References

Code of Federal Regulations, Title 10, Part 50, Section 49, *Environmental Qualification of electric Equipment Important to Safety for Nuclear Power Plants.*

IEEE Guide P1205, *IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations,* 1993.

DELETE 3

IEEE Standard 317-83, *IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations,* 1983.

IEEE Standard 323-71, *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations,* 1971.

DELETE 25

~~IEEE Standard 323-74, *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations,* 1974.~~

IEEE Standard 383-74, *IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations,* 1974.

NRC Bulletin 79-01B, *Environmental Qualification of Class 1E Equipment, January 14, 1980.*

NRC Bulletin 79-27, *Loss of Non-Class 1E Instrumentation and Control Power System Bus During Operation,* November 30, 1979.

NRC Information Notice 86-87, *Loss of Offsite Power Upon an Automatic Bus Transfer,* October 10, 1986.

NRC Information Notice 86-100, *Loss of Offsite Power to Vital Buses at Salem 2,* December 12, 1986.

NRC Information Notice 88-55, *Potential Problems Caused by Single Failure of an Engineered Safety Feature Swing Bus,* August 3, 1988.

NRC Information Notice 89-64, *Electrical Bus Bar Failures,* September 7, 1989.

NRC Information Notice 91-57, *Operational Experience on Bus Transfers,* September 19, 1991.

NRC Information Notice 92-09, *Overloading and Subsequent Lock Out of Electrical Buses During Accident Conditions,* January 30, 1992.

NRC Information Notice 92-40, *Inadequate Testing of Emergency Bus Under-voltage Logic Circuitry,* May 27, 1992.

NRC Information Notice 93-28, *Failure to Consider Loss of DC Bus in the Emergency Core Cooling system Evaluation May Lead to Non-conservative Analysis,* April 9, 1993.

NRC Information Notice 93-95, *Storm-Related Loss of Offsite Power Events Due to Salt Buildup on Switchyard Insulators,* December 13, 1993.

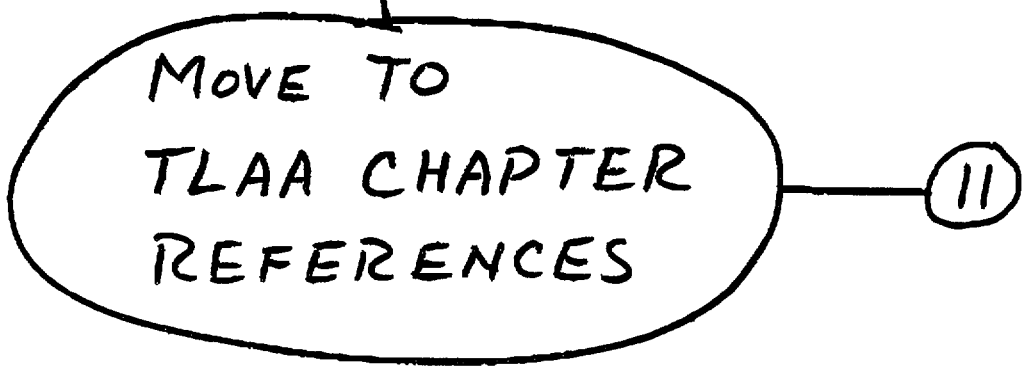
DELETE 3

NUREG-1705,...
NUREG-1723,...
NUREG/CR-5643,...
SAND 96-0344,...
EPRI TR-109619,...

ADD REFERENCES 7

NRC Regulatory Guide 1.89, *Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants, June 1984.*

NUREG-0588, *Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment,* December 1979.



NEI COMMENTS ON GALL REPORT — CHAPTER VI — ELECTRICAL COMPONENTS

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
1	Major Electrical Components	A	VI A-0 VI A-1 Page Headers	Electric Cables is too broad a term since, by its name, it does not distinguish it from grounding system conductors and transmission conductors. The critical distinguishing factor for electric cables is whether they are insulated or uninsulated. It makes sense to review all insulated cables together since they have similar functions to maintain related to the insulating materials. The term "insulated cables" would also distinguish it from other, non-electric cables since non-electric cables (e.g., crane cables) are not insulated. **Recommendation:** Change "Electric Cables" to "Insulated Cables".
2	Major Electrical Components	A	VI A-0 VI A-1 Page Headers	Industry reviews of cables and connections have found it advantageous not to split them into separate reviews. One such review is contained in SAND96-0344, *Aging Management Guideline for Commercial Nuclear Power Plants – Electrical Cable and Terminations*, September 1996, prepared by Sandia National Laboratories for the U.S. Department of Energy. Many NRC staff express the view that plant cabling should be reviewed as a system — which for cabling is the cable and its required terminations. The license renewal rule itself recognizes cables and connections as a single commodity in § 54.21(a)(1)(i) as it uses the term "electrical cables and connections" in its list of components. Treating cables and connections as two separate components in the GALL report goes against common practice and adds no value to the review. **Recommendation:** Combine insulated cables and connections (i.e., splices, mechanical connectors and terminal blocks) into a common review.
3	Major Electrical Components		VI A-0	No aging management program is credited by a license renewal applicant and approved by the NRC staff for managing electrical penetration assembly, electrical bus, electrical insulator, transmission conductor and ground conductor aging effects for license renewal. Subsequent GALL sections identify hypothetical programs and activities for managing the effects of aging on these components. Theorizing on what an aging management program might look like before there is a real plant example of aging effects that need managing is somewhat meaningless and could end up being way off the mark; like trying to do a root cause corrective active without any event data. Also, inclusion of hypothetical or made-up programs and activities is inconsistent with the staff's February 3, 2000 letter to NEI. SECY-99-148, CREDIT FOR EXISTING PROGRAMS FOR LICENSE RENEWAL, for The Commissioners, from William M. Travers, Executive Director of Operations, June 3, 1999, states under OPTION 3, "*The staff is engaged in an effort called 'Generic Aging Lessons Learned (GALL),' which evaluates existing programs generically to document the basis for determining when existing programs are adequate and when existing programs should be augmented for license renewal.*" The staff recommended that the Commission approve the use of Option 3 to provide credit for existing programs for license renewal and the Commission approved the staff's recommendation to use Option 3 in SRM August 27, 1999. The key term used in Option 3 is "existing" programs. The GALL report should reflect only "existing" programs that are credited by an applicant and approved by the staff for managing aging effects for license renewal. **Recommendation:** Delete the following commodity sections for which there are no staff-approved programs for license renewal: Section C, Electrical Penetration Assemblies Section D, Electrical Busses Section E, Electrical Insulators Section F, Transmission Conductors Section G, Ground Conductors

NEI COMMENTS ON GALL REPORT — CHAPTER VI — ELECTRICAL COMPONENTS

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
4	Electric Cables	A	VI A-1	No aging management program is credited by a license renewal applicant and approved by the NRC staff for managing aging effects associated with the cable or connection conductors, shield wires, jackets, seals, lugs, pins or block assemblies. As stated in a previous comment, the GALL report should reflect only "existing" programs that are credited by an applicant and approved by the staff for managing aging effects for license renewal. By the same rationale, the GALL report should reflect only those aging effects that have been found to require management, for which an existing program is credited by an applicant and approved by the staff. This page should reflect the Components and Regions Of Interest for which existing programs are credited and approved for managing aging effects for license renewal. **Recommendation:** This recommendation is in two parts: 1) Delete the following cable piece-parts since the aging effects have not been found to need aging management: A.1.1 Conductor A.1.2 Shield Wire A.1.4 Jacket B.1.1 Jackets B.1.2 Seals B.2.1 Terminal lugs, compression fittings, fusion connectors, contact pins B.3.1 Block Assembly 2) Replace what was deleted by the following since these reflect the Components and Regions Of Interest for which existing programs are credited and approved for managing aging effects for license renewal: A.1 Accessible Insulated Cables and Connections A.1.1 Conductor Insulation A.2 Inaccessible Medium-Voltage (2 kV to 15 kV) Cables Installed In Conduit Or Direct Buried A.2.1 Conductor Insulation
5	Electric Cables	A	VI A-2	The following statements are made: "*The power cables addressed are low-voltage ... and medium voltage ... which have similar constructions to I&C cables. High voltage power cables ... have unique, specialized construction and must be evaluated on an application specific basis. Since the cable types addressed herein are very similar in construction and aging effects, they are grouped together in the table.*" Medium-voltage cables have a different construction than low-voltage and I&C cables so the last part of the second sentence should be dropped. The second and third sentences seem to contradict each other. Based on refocusing the GALL report back to its purpose of reflecting existing, approved programs and only aging effects found to require management, the description of how power cables are addressed and variations in construction are not as important. In addition, addressing each cable piece-part is no longer needed, and a statement should be made that insulated cables and connections are reviewed as a single commodity. **Recommendation:** Replace the Systems, Structures and Components paragraph with the following: This review table addresses insulated cables and connections installed in power and instrumentation and control (I&C) applications. The power cables addressed are low-voltage (<1000 V) and medium-voltage (2 kV to 15 kV). High voltage power cables (>15 kV) are not normally used at nuclear power plants, have unique, specialized constructions and must be evaluated on an application specific basis. Insulated cables and their required terminations (i.e., connections) are reviewed as a single commodity. The types of connections included in this review are splices, mechanical connectors, and terminal blocks. This common review is translated into program actions, which treat cables and

NEI COMMENTS ON GALL REPORT — CHAPTER VI — ELECTRICAL COMPONENTS

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				connections in the same manner.
6	Electric Cables	A	VI A-2	The last sentence on this page, "*Physical interfaces include routing in cable trays and conduits.*" does not identify some other physical interfaces that would make the statement more complete. **Recommendation:** Replace the last sentence with: *Insulated cables and connections also interface with and are supported by structural commodities (e.g., cable trays, conduit, cable trenches, cable troughs, duct banks, cable vaults and manholes) which are reviewed, as appropriate, in the Structures and Components Supports section.*
7	Electric Cables	A.1.1	VI A-11	Only NRC and IEEE documents are referenced. Other industry references such as SAND96-0344, *Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations*, and EPRI TR-109619, *Guideline or the Management of Adverse Localized Equipment Environments*, should be added. In addition, NUREG/CR-5643, *Insights Gained From Aging Research,* was omitted and should be added. If the intent is to include approved programs in the GALL, there should be a reference to the NUREGs for the Calvert Cliffs SER (NUREG-1705, *Safety Evaluation Report Related to the License Renewal of Calvert Cliffs Nuclear Power Plant, Units 1 and 2*, December 1999) and Oconee SER (NUREG-1723, *Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station, Units 1, 2 and 3*, February 2000). **Recommendation:** Add NUREG/CR-5643, SAND96-0344, EPRI TR-109619, NUREG-1705 and NUREG-1723 as references for the insulated cable and connection aging effects reviewed in the GALL report.
8	Electric Cables **EQ/TLAA**	A.1.1	VI A-4	See comment 11. **Recommendation:** Delete the text under Existing Aging Management Programs (AMP) and consistent with comment 11 insert the following text into new GALL Chapter X:: The Nuclear Regulatory Commission (NRC) has established nuclear station environmental qualification (EQ) requirements in 10 CFR 50 Appendix A, Criterion 4, and in 10 CFR 50.49. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in "harsh" plant environments (i.e., those areas of the plant that could be subject to the harsh environmental effects of a loss of coolant accident (LOCA), high energy line breaks (HELBs) or post-LOCA radiation) are qualified to perform their safety function in those harsh environments. All operating plants must meet the requirements of 10 CFR 50.49 (EQ Rule) for certain electrical equipment important-to-safety. The EQ rule defines the scope of equipment to be included, requires the preparation and maintenance of a list of in-scope equipment, and a qualification file that includes equipment performance specifications, electrical characteristics and environmental conditions. The aging provisions are contained in § 50.49(e)(5) which requires, in part, consideration of all significant types of aging degradation that can affect equipment functional capability. § 50.49(e) also requires equipment replacement or refurbishment prior to the end of designated life unless additional life is established through ongoing qualification. § 50.49(f) establishes four methods of demonstrating qualification for aging and accident conditions. § 50.49(k) and (l) permits different qualification criteria to apply based on plant and equipment vintage. Compliance with the EQ rule provides evidence that the equipment will perform its intended functions during accident conditions after considering the detrimental effects of aging.
9	Electric Cables **EQ/TLAA**	General		The GALL discusses EQ components in the context of TLAAs and as components requiring an aging management review. As we discuss in comment number 11, we do not believe GALL should address TLAAs and would prefer to see such discussions incorporated into the License Renewal Standard Review Plan. Alternatively, if the staff believes GALL should address TLAAs then we recommend creating a specific GALL chapter. As comment 11 notes, we have prepared a draft Chapter X which includes a discussion of the evaluation of EQ qualification analyses as a TLAA. We may supplement our comments with an evaluation of EQ as an aging management program.
10	Electric Cables **EQ/TLAA**	A.1.1	VI A-4 through VI A-10	The discussion under Evaluation and Technical Basis discusses EQ requirements and EQ TLAA as they relate to aging management programs. The discussion in this area should be centered on the evaluation of TLAA. It should be remembered that the demonstration required for a TLAA is mainly an analytical exercise, not the review of an aging management program. Demonstration method (i) is a documentation review only. Demonstration method (ii) is strictly an analytical exercise, performed in the same way that Part 50 reanalyzes are routinely performed outside of license renewal. Demonstration method

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				(iii) can be satisfied by performing the same analytical exercise, but at sometime in the future. The fact that equipment for which a TLAA exists is also included in a plant program is not relevant for reviewing a reanalysis of the TLAA. An EQ component TLAA as an example shows that the 10 program criteria used in the GALL report do not fit TLAA. Criteria (2), (3), (4), (5), (6), (8) and (9) do not apply. Criteria (1) states the scope as required by §50.49. Criteria (7) just restates the requirement of §50.49 that an EQ component, in order to be considered functional, has to be qualified (i.e., be within its qualified life). If not, the component has to be replaced or the plant is in violation of §50.49. Criteria (10) provides in-depth information related to environmental qualification of electrical equipment, with the input required to review EQ component TLAAs hidden within the text on the last page of the write-up. An EQ component TLAA does not fit the 10 criteria and it is not helpful to the utility or the LRA reviewer to try to describe it by these criteria. The conclusion of the Evaluation and Technical Basis discussion for EQ cables leads back to GSI-168. Per the NRC letter dated June 2, 1998, all that an applicant need do currently is "*provide a technical rationale demonstrating that the current licensing basis for EQ, pursuant to 10 CFR 50.49 will be maintained in the period of extended operation.*" **Recommendation:** Delete the discussion under Evaluation and Technical Basis and consistent with comment 11, insert the following text into new GALL Chapter X: The EQ process manages component intended functions through the use of qualification analyses. As required by the EQ Rule, an installed EQ component must always be qualified. Before the qualification for a component expires, the qualification must be extended analytically or through refurbishment or additional qualification testing, or the component must be replaced. Analyses for EQ equipment which specify a qualification of at least 40 years are Time Limited Aging Analyses (TLAA) for license renewal. There are three demonstration methods provided in § 54.21(c)(1) that can be used for evaluating TLAA: (i) the analysis remains valid for the period of extended operation, (ii) the analysis is projected to the end of the period of extended operation, or (iii) the effects of aging on the intended functions will be adequately managed during the period of extended operation. For demonstration method (i), the qualification existing at the time of the renewal application extends through the period of extended operation and no further evaluation is necessary. For demonstration method (ii), a reanalysis was performed in order to extend the qualification of the component through the period of extended operation. For demonstration method (iii), since these components are regulated under § 50.49 which requires that a qualified component be installed to perform the intended functions, at some time in the future before the component's qualification expires, the component's qualification must be extended analytically or through refurbishment or additional qualification testing, or the component must be replaced. Generic safety issue (GSI) 168 is related to EQ components and is an open generic issue related to license renewal. Research is ongoing to provide information to resolve it. Specific issues being addressed in this research are presented in NUREG/CR-6384. Once this generic issue is resolved, guidance will be provided as to the impact on license renewal. In the interim, NRC letter dated June 2, 1998, "*Guidance on Addressing GSI-168 for License Renewal*," (C. Grimes, NRC to D. Walters, NEI) provides guidance on addressing GSI-168 in license renewal applications. It states that, until the generic issue is resolved, "*...an acceptable approach described in the SOC is to provide a technical rationale demonstrating that the current licensing basis for EQ, pursuant to 10 CFR 50.49 will be maintained in the period of extended operation.*" An acceptable approach found during license renewal applications is to examine the reanalysis method performed for demonstration methods (ii) and (iii). The technical rationale attributes applicable to reanalysis should include analytical methods, data collection and reduction methods, acceptance criteria and corrective actions (if acceptance criteria are not met), and underlying assumptions. The following attribute descriptions have been found acceptable and should be used as a review guide.

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				REANALYSIS OF A QUALIFICATION The reanalysis is performed for a specific application to extend the qualification if excess conservatism exists in the original analysis. The qualification may be limited by thermal, radiation, or cyclical aging; the vast majority of qualification values are based on thermal limits. Conservatisms may exist in parameters such as the assumed ambient temperature of the equipment, an unrealistically low activation energy, or in the application of equipment (de-energized versus energized). The reanalysis is documented according to the plant's Quality Assurance program requirements, which require the verification of assumptions and conclusions. Specific attributes of a reanalysis are discussed below. ***Analytical Methods:*** The Arrhenius methodology is an acceptable thermal model used to perform a thermal reanalysis. Other models may be justified on a case-by-case basis. EQ equipment is typically sealed and cable insulation is protected from the occasional inadvertent spray. Exposure to moisture due to leaks is investigated on a case by case basis. The analytical method used for radiation reanalysis is to demonstrate qualification for the total integrated dose (normal radiation dose for 60 years plus accident radiation dose). ***Data Collection & Reduction Methods:*** Reducing excess conservatisms in the equipment service conditions (e.g., temperature) used in existing analyses is the chief method used for reanalysis. Temperature data used in a reanalysis shall be conservatively based on actual temperature measurements in the area around the equipment being reanalyzed. Temperature measurements can be obtained in several ways, examples of which are through monitors used for Technical Specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are mathematically reduced to arrive at a temperature used in a reanalysis. Temperatures may be used in several ways in a reanalysis such as (a) using the actual calculated temperature, or (b) using the calculated temperature to validate or show conservatism when using a design temperature for a reanalysis. For radiation, one acceptable method of establishing the 60 year aging radiation dose is to multiply the 40 year dose applicable to the equipment by the ratio of the evaluation period and divide by 40 years (e.g., for license renewal 60 years/40 years = 1.5). This value is added to the applicable accident radiation dose to obtain the total integrated dose for the equipment. For cyclical aging a similar approach may be used. Other methods of establishing radiation and cyclical aging parameters, including parameters conservatively based on operational data, may also be used when justified. ***Acceptance Criteria & Corrective Actions:*** The reanalysis shall extend the equipment's qualification through the renewal period. If the qualification cannot be extended, the equipment is replaced prior to the expiration of the existing qualification. ***Underlying Assumptions:*** Conservatisms in the EQ equipment qualification analyses are sufficient to account for environmental changes occurring due to plant modifications and events. Plant environmental zones are identified in the EQ documentation. The EQ documentation identifies the harsh environmental areas of the plant for loss of coolant accidents (LOCAs), high energy line breaks (HELBs) and radiation. The EQ documentation is a Quality Assurance controlled document. Changes in environmental parameters are reviewed by the EQ responsible engineer to address affected EQ equipment on a generic basis. If the changes cannot be dispositioned on a generic basis, the station corrective action process would be initiated to resolve the specific equipment concerns. Adverse environmental changes are addressed on an ongoing basis. When a significant environmental change is identified, a review of the qualification of affected EQ equipment is performed and applicable changes are made to the equipment qualification. In addition, when a reanalysis is performed for the purposes of extending the qualification, the environmental parameters for the equipment are verified. When environmental data used in an equipment reanalysis is confirmed to be accurate, the EQ documentation, if appropriate, is revised to reflect the new operating conditions. Equipment reanalyses are performed under calculations whose assumptions and environmental data are reviewed periodically for continued validity.
11	Electric Cables **EQ/TLAA**	A.1.1	VI A-4	Having an EQ/TLAA sections for each aging effect in cables, connections and penetrations does not make sense. The reanalysis of an EQ TLAA does not discuss each of the separate aging effects that could affect component function. A reanalysis of an existing qualification calculation (in this case a TLAA) looks only at what factors are reviewed in the existing calculation.

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				Qualification analyses for insulated cables and connections are only a small percentage of the total population of EQ TLAAs. The following electrical component commodities are included in a plant's EQ program and have associated qualification analyses that are TLAAs for license renewal, but are not represented in the GALL report: Accelerometers Actuators Motors RTDs Solenoid Valves Switches Transmitters If it is the intent to have all components associated with a TLAA represented in the GALL report, each of these additional components commodities should be added as additional sections in the electrical components chapter. As an alternative, since TLAA don't seem to "fit" well embedded in the aging effects tables, a separate TLAA chapter could be generated that would include a discussion of and lessons learned from the review of all TLAAs. All EQ components are replacement items under §54.21(a)(1)(ii) and no EQ components are required to be included in the aging management review. Components in the EQ program have a qualified life and the component is replaced at the end of that qualified life. The qualified life may be extended by refurbishment of specific parts or by reanalyzing the qualified life evaluation, but the plant is required to replace the component when its qualified life has expired. This makes all EQ components replacement items under §54.21(a)(1)(ii) and no EQ components are required to be included in the IPA. EQ components whose qualified life is 40 years or more are TLAA for every plant. Moving TLAA to a separate chapter would remove all EQ components from the GALL aging effects tables in the Electrical Components chapter and eliminate the need to create new sections for these active componants. **Recommendation:** There are two parts to this recommendation: 1) Move the EQ/TLAA discussion to a separate TLAA chapter along with the applicable references. 2) Add the following paragraph under *Systems, Structures and Components* on page VI A-2 indicating other specific cables and connections not covered in the section (similar the the statement regarding high-voltage power cables): Insulated cables and connections that are in the plant's environmental qualification (EQ) program are not included in this section. Components in the EQ program have a qualified life and the component is replaced at the end of that qualified life. The qualified life may be extended by refurbishment of specific parts or by reanalyzing the qualified life evaluation, but the plant is required to replace the component when its qualified life has expired. This makes all EQ components replacement items under §54.21(a)(1)(ii) and no EQ components are required to be included in the aging management review. Compliance with the EQ regulation (10 CFR 50.49) is adequate to ensure maintenance of the intended functions of the insulated cable and connections included in the plant's EQ program.
12	Electric Cables **EQ/TLAA**	A.1.1	VI A-4	***NOTE: This comment would be resolved by adopting the resolution for Comment 10.*** The paragraph for case (ii) states "*..., and the period of time prior to the end of qualified life when the reanalysis will be completed.*" Case (ii) are those TLAAs that "have been" projected. The reanalyses have already been performed at the time of application. This language was probably meant for case (iii). **Recommendation:** Remove this statement from the case (ii) discussion.
13	Electric Cables **EQ/TLAA**	A.1.1	VI A-6	***NOTE: This comment would be resolved by adopting the resolution for Comment 10.*** Under Evaluation and Technical Basis, second paragraph, second sentence, the statement is made: "*Only 87 LERs related to cables were considered attributable to aging and the failures were categorized as follows:....*" This is a slight misquote from the EPRI document. The 87 LERs were related to cables but not all were attributable to aging as stated.

NEI COMMENTS ON GALL REPORT — CHAPTER VI — ELECTRICAL COMPONENTS

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				Recommendation: Replace the statement with: Only 87 LERs were attributable to cables and the failures were categorized as follows: …
14	Electric Cables **EQ/TLAA**	A.1.1	VI A-8	***NOTE: This comment would be resolved by adopting the resolution for Comment 10.*** The reported events for cables, connections and EPAs under Evaluation and Technical Basis near the top of the page are in the discussion of EQ equipment. This failure data includes EQ and non-EQ equipment. The standards regarding manufacture, testing and installation of non-EQ equipment is much less stringent than that required for EQ equipment, yet the data for both is mixed in the reported events. **Recommendation:** Report events only relevant to EQ equipment or qualify the basis of the data.
15	Electric Cables **EQ/TLAA**	A.1.1	VI A-8	***NOTE: This comment would be resolved by adopting the resolution for Comment 10.*** Paragraph starting with "*Based on the results...*" This paragraph is drawing conclusions based on data that comes from failures of a mix of EQ and non-EQ equipment. It is inappropriate to draw conclusions about EQ equipment reliability based on failure data that includes non-EQ equipment. This paragraph may be correct for the data presented, but this should not be reported as representing EQ equipment reliability. **Recommendation:** Report conclusions based on events related only to EQ equipment.
16	(not used)			(not used)
17	Electric Cables **EQ/TLAA**	A.1.1	VI A-8	***NOTE: This comment would be resolved by adopting the resolution for Comment 10.*** Paragraph starting with "As discussd in SECY-93-049…" This paragraph does not reflect the on-going resolution of GSI-168 in which DOR/NUREG-0588 Category II were found to be satisfactory through the LR period. **Recommendation:** Incorporate this information in the write-up.
18	Electric Cables **EQ/TLAA**	A.1.1	VI A-10	***NOTE: This comment would be resolved by adopting the resolution for Comment 10.*** Paragraph starting "*It should be noted that, currently, there are no acceptable non-destructive CM techniques to measure the integrity of electric cables in situ.*" It may be true that there are no non-destructive CM techniques accepted by the NRC. There are, however, a number of promising techniques being used in the industry today such as the indenter, oxidation induction time and temperature testing using micro-samples. **Recommendation:** Incorporate this information in the write-up stating that there are no "NRC" accepted techniques, or delete the noted misleading statement.
19	Electric Cables	A.1.1	VI A-10	It has not been shown that the "Instrument Calibration Program" would yield any real aging management results. Has instrument signal drifts ever been correlated to cable degradation? How certain is it that a highly degraded cable (for all applications) will show up as a signal drift? You will certainly know when the cable fails, but how much warning does this technique really provide? Can it actually detect and trend degradation prior to failure? Instrument calibration is basically an I&C trouble-shooting methodology and should is not known for providing reliable cable degradation information. **Recommendation:** Delete the "Instrument Calibration Program" paragraph. If the Instrument Calibration Program is not deleted, insert the following program suggestion which follows along the same lines: **Normal Operation and Periodic Test Program** Normal operation and periodic test program, including technical specification surveillance, may be used to provide an indirect indication of the condition of various electrical components. Performance anomalies could be an indication that aging degradation is affecting the electrical circuit. Further investigation could then be initiated to determine the nature of the degradation and the component affected.
20	Electric Cables	A.1.3	VI A-11	It was discussed that the Aging Mechanism column be deleted since the focus should be on Aging Effects. When a specific aging mechanism is important, it

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				can be included in the aging effect by language such as, "*<aging effect>* caused by *<aging mechanism>*". **Recommendation:** Remove the Aging Mechanism column and incorporate relevant mechanisms into the aging effects column.
21	Electric Cables	A.1.3	VI A-11	The information on this page should be changed to match the information reviewed and approved by the staff as needing aging management. **Recommendation:** Replace information in the table with the following: ***Structure and Component:*** Inaccessible Medium-Voltage (2 kV to 15 kV) Cables Installed In Conduit Or Direct Buried ***Region of Interest:*** Conductor insulation ***Material:*** Various organic polymers (e.g., EPR, SR, EPDM, XLPE) ***Environment:*** Exposure to significant moisture and significant voltage ***Aging Effects:*** Formation of water trees, localized damage, leading to electrical failure (breakdown of insulation), caused by moisture intrusion, water trees
22	Electric Cables	A.1.3	VI A-12	In place of the generic program write-up for non-EQ cable provided on page VI A-10, this should be replaced by a discussion specific to this aging effect and the program that has been credited and approved for its management. **Recommendation:** Replace the existing references with the following text: ***Existing Aging Management Program (AMP)*** **Aging Management Program For Inaccessible Medium-Voltage Cables Exposed to Adverse Localized Environments caused by Moisture and Voltage Exposure** Most insulated cables in nuclear power plants are located in dry environments. However, some cables may be exposed to condensation and wetting in inaccessible locations such as conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations. When an energized cable is exposed to but not designed for these conditions, water treeing or a decrease in the dielectric strength of the conductor insulation can occur, which can lead to electrical failure. The purpose of this aging management program is to provide reasonable assurance that the intended functions of inaccessible medium-voltage cables exposed to adverse localized environments caused by moisture and voltage exposure will be maintained consistent with the current licensing basis through the period of extended operation. ***Evaluation and Technical Basis*** ***(1) Scope:*** The program includes inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture and significant voltage. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. The moisture and voltage exposures described as significant in these definitions are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization is not significant for submarine cables). ***(2) Preventive Actions:*** No actions are taken as part of this program to prevent or mitigate aging degradation. ***(3) Parameters Monitored/Inspected:*** In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to each test. ***(4) Detection:*** In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested at least once every 10 years, which is an adequate period to preclude failures of the conductor insulation. ***(5) Monitoring and Trending:*** No actions are taken as part of this program to trend the test results. ***(6) Acceptance Criteria:*** The acceptance criteria for each test is defined by the specific type of test performed and the specific cable tested. ***(7) Corrective Actions:*** Further investigation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the insulated cables and connections will be maintained consistent with the current licensing basis. Specific corrective actions are implemented in accordance with the station's corrective action program. When an unacceptable condition or situation is identified, a determination is made as to

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				whether the same condition or situation is applicable to other inaccessible, in-scope, medium-voltage. ***(8 & 9) Confirmatory Process & Administrative Control:*** Confirmatory actions, as needed, are implemented as part of the station's corrective action program. The implementation of this program is controlled by plant procedures. ***(10) Operating Experience:*** Operating experience has shown that XLPE or high molecular weight polyethlene (HMWPE) insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Treeing is much less prevalent in 4-kV cables than those operated at 13 or 33 kV. Due to the low dielectric stress, water trees do not occur in low-voltage cables.
23	Electric Cables	A.1.3	VI A-13	The information on this page should be changed to match the information reviewed and approved by the staff as needing aging management. **Recommendation:** Replace information in the table with the following: ***Structure and Component:*** Accessible Insulated Cables and Connections ***Region of Interest:*** Conductor insulation ***Material:*** Various organic polymers (e.g., EPR, SR, EPDM, XLPE) ***Environment:*** Adverse localized environment caused by heat or radiation in the presence of oxygen. ***Aging Effects:*** Embrittlement, cracking, melting, discoloration, leading to reduced insulation resistance, electrical failure, caused by thermal/thermoxidative degradation of organics, radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation
24	Electric Cables	A.1.3	VI A-14	In place of the generic program write-up for non-EQ cable provided on page VI A-10, this should be replaced by a discussion specific to this aging effect and the program that has been credited and approved for its management. The note for non-EQ cables states that "*..., the aging effects noted would be probable when cables with cracks are exposed to moisture, such as in a design basis event.*" Non-EQ cables are either not exposed to a harsh DBE environment or are not required to remain function during or after being exposed a harsh environment. Therefore, this statement is not applicable to non-EQ cables. Only if there is significant moisture in the normal cable environment would this be of concern. Normal humidity levels (20-90%) were dismissed as an aging stressor in the NRC TAP. **Recommendation:** Replace the existing references with the following text: ***Existing Aging Management Program (AMP)*** **Aging Management Program for Insulated Cables and Connections Exposed to Adverse Localized Environments caused by Heat or Radiation** In most areas within a nuclear power plant, the actual ambient environments are less severe than the design basis environments. However, in a limited number of localized areas, the actual environments may be more severe than the design basis environments. Conductor insulation materials used in cables and connections may degrade more rapidly than expected in these adverse localized environments. The purpose of this aging management program is to provide reasonable assurance that the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat or radiation will be maintained consistent with the current licensing basis through the period of extended operation. As stated in NUREG/CR-5643, "*The major concern with cables, is the performance of aged cable when it is exposed to accident conditions.*" The statement of considerations for the final license renewal rule (60FR22477) states, "*The major concern is that failures of deteriorated cable systems (cables, connections, and penetrations) might be induced during accident conditions.*" The insulated cables and connections covered by this aging management program, being non-EQ, are either not exposed to harsh accident conditions or are not required to remain functional during or following an accident to which they are exposed. Although the insulated cables and connections included in this program are important to overall plant safety, their capability to perform their intended functions during or following a design basis event is not a major concern. ***Evaluation and Technical Basis*** ***(1) Scope:*** The inspection program includes accessible insulated cables and connections within the scope of license renewal that are installed in adverse localized environments caused by heat or radiation in the presence of oxygen. An adverse localized environment is a condition in a limited plant area

NO.	TITLE	ITEM NO.	SECT. PAGE	COMMENTS
				that is significantly more severe than the specified service condition for the insulated cable or connection. ***(2) Preventive Actions:*** No actions are taken as part of this program to prevent or mitigate aging degradation. ***(3) Parameters Monitored/Inspected:*** Accessible insulated cables and connections installed in adverse localized environments are visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. ***(4) Detection:*** Cable and connection jacket surface anomalies are precursor indications of conductor insulation aging degradation from heat or radiation in the presence of oxygen. Accessible insulated cables and connections installed in adverse localized environments are visually inspected at least once every 10 years, which is an adequate period to preclude failures of the conductor insulation. ***(5) Monitoring and Trending:*** No actions are taken as part of this program to trend inspection results. ***(6) Acceptance Criteria:*** No unacceptable, visual indications of cable and connection jacket surface anomalies, which suggest that conductor insulation degradation exists, as determined by engineering evaluation. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the intended function. ***(7) Corrective Actions:*** Further investigation is performed on insulated cables and connections when the acceptance criteria are not met in order to ensure that the intended functions will be maintained consistent with the current licensing basis. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, relocation or replacement of the affected cable or connection. Specific corrective actions are implemented in accordance with the station's corrective action program. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections. ***(8 & 9) Confirmatory Process & Administrative Control:*** Confirmatory actions, as needed, are implemented as part of the station's corrective action program. The implementation of this program is controlled by plant procedures. ***(10) Operating Experience:*** Operating experience has shown that adverse localized environments caused by heat or radiation for insulated cables and connections may exist next to or above (within three feet of) steam generators, pressurizers, or hot process pipes such as feedwater lines.
25	Electrical Components	R	VI R-1 VI R-2	The references to IEEE standards includes a year and two separate references are made to IEEE Std. 323 for separate year editions. Different plants may reference different revisions of a standard. Unless there is some compelling reason to list all the different year editions, the year of a standard should be eliminated. This is also a conforming change for the references. **Recommendation:** Delete the year edition for the IEEE standards and make the following conforming changes to the references: 1) Move the references specific to EQ/TLAA to the TLAA chapter (per Comment 11). 2) Delete the references specific to Electrical Penetration Assemblies, Electrical Busses, Electrical Insulators, Transmission Conductors and Ground Conductors (per Comment 3). 3) Include the following references in the Electrical Components chapter (per Comment 7). NUREG-1705, *Safety Evaluation Report Related to the License Renewal of Calvert Cliffs Nuclear Power Plant, Units 1 and 2*, December 1999 NUREG-1723, *Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station, Units 1, 2 and 3*, February 2000 NUREG/CR-5643, *Insights Gained From Aging Research*, March 1992 IEEE Std. 1205, *IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations.* SAND96-0344, *Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations*, September 1996, prepared by Sandia National Laboratories for the U.S. Department of Energy. EPRI TR-109619, *Guideline or the Management of Adverse Localized Equipment Environments*, June 1999

CHAPTER VI

ELECTRICAL COMPONENTS

Major Electrical Components

A. Insulated Cables and Connections

A. Insulated Cables and Connections

A.1 Accessible Insulated Cables and Connections
A.1.1 Conductor Insulation

A.2 Inaccessible Medium-Voltage (2 kV to 15 kV) Cables Installed In Conduit Or Direct Buried
A.2.1 Conductor Insulation

Systems, Structures and Components

This review table addresses insulated cables and connections installed in power and instrumentation and control (I&C) applications. The power cables addressed are low-voltage (<1000 V) and medium-voltage (2 kV to 15 kV). High voltage power cables (>15 kV) are not normally used at nuclear power plants, have unique, specialized constructions and must be evaluated on an application specific basis.

Insulated cables and their required terminations (i.e., connections) are reviewed as a single commodity. The types of connections included in this review are splices, mechanical connectors, and terminal blocks. This common review is translated into program actions, which treat cables and connections in the same manner.

Insulated cables and connections that are in the plant's environmental qualification (EQ) program are not included in this section. Components in the EQ program have a qualified life and the component is replaced at the end of that qualified life. The qualified life may be extended by refurbishment of specific parts or by reanalyzing the qualified life evaluation, but the plant is required by the EQ regulation (10 CFR 50.49) to replace the component when its qualified life has expired. This makes all EQ components replacement items under § 54.21(a)(1)(ii) and no EQ components are required to be included in the aging management review. Compliance with § 50.49 is adequate to ensure maintenance of the intended functions of the insulated cable and connections included in the plant's EQ program.

System Interfaces

Insulated cables and connections functionally interface with all plant systems that rely on electric power and/or instrumentation and control. Insulated cables and connections also interface with and are supported by structural commodities (e.g., cable trays, conduit, cable trenches, cable troughs, duct banks, cable vaults and manholes) which are reviewed, as appropriate, in the Structures and Components Supports section.

VI. ELECTRICAL COMPONENTS
A. Insulated Cables and Connections

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	References
A.1.1	Accessible Insulated Cables and Connections	Conductor insulation	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by heat or radiation in the presence of oxygen	Embrittlement, cracking, melting, discoloration, leading to reduced insulation resistance, electrical failure, caused by thermal/ thermoxidative degradation of organics, radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation	NUREG-1705 NUREG-1723 NUREG/CR-5643 IEEE Std. 1205 SAND96-0344 EPRI TR-109619

VI. ELECTRICAL COMPONENTS
A. Insulated Cables and Connections

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Aging Management Program for Insulated Cables and Connections Exposed to Adverse Localized Environments caused by Heat or Radiation In most areas within a nuclear power plant, the actual ambient environments are less severe than the design basis environments. However, in a limited number of localized areas, the actual environments may be more severe than the design basis environments. Conductor insulation materials used in cables and connections may degrade more rapidly than expected in these adverse localized environments. The purpose of this aging management program is to provide reasonable assurance that the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat or radiation will be maintained consistent with the current licensing basis through the period of extended operation. As stated in NUREG/CR-5643, "*The major concern with cables, is the performance of aged cable when it is exposed to accident conditions.*" The statement of considerations for the final license renewal rule (60FR22477) states, "*The major concern is that failures of deteriorated cable systems (cables, connections, and penetrations) might be induced during accident conditions.*" The insulated cables and connections covered by this aging management program, being non-EQ, are either not exposed to harsh accident conditions or are not required to remain functional during or following an accident to which they are exposed. Although the insulated cables and connections included in this program are important to overall plant safety, their capability to perform their intended functions during or following a design basis event is not a major concern.	***(1) Scope:*** The inspection program includes accessible insulated cables and connections within the scope of license renewal that are installed in adverse localized environments caused by heat or radiation in the presence of oxygen. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service condition for the insulated cable or connection. ***(2) Preventive Actions:*** No actions are taken as part of this program to prevent or mitigate aging degradation. ***(3) Parameters Monitored/Inspected:*** Accessible insulated cables and connections installed in adverse localized environments are visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. ***(4) Detection:*** Cable and connection jacket surface anomalies are precursor indications of conductor insulation aging degradation from heat or radiation in the presence of oxygen. Accessible insulated cables and connections installed in adverse localized environments are visually inspected at least once every 10 years, which is an adequate period to preclude failures of the conductor insulation. ***(5) Monitoring and Trending:*** No actions are taken as part of this program to trend inspection results. ***(6) Acceptance Criteria:*** No unacceptable, visual indications of cable and connection jacket surface anomalies, which suggest that conductor insulation degradation exists, as determined by engineering evaluation. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the intended function. ***(7) Corrective Actions:*** Further investigation is performed on insulated cables and connections when the acceptance criteria are not met in order to ensure that the intended functions will be maintained consistent with the current licensing basis. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, relocation or replacement of the affected cable or connection. Specific corrective actions are implemented in accordance with the station's corrective action program. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections. ***(8 & 9) Confirmatory Process & Administrative Control:*** Confirmatory actions, as needed, are implemented as part of the station's corrective action program. The implementation of this program is controlled by plant procedures. ***(10) Operating Experience:*** Operating experience has shown that adverse localized environments caused by heat or radiation for insulated cables and connections may exist next to or above (within three feet of) steam generators, pressurizers, or hot process pipes such as feedwater lines.	No

VI. ELECTRICAL COMPONENTS
A. Insulated Cables and Connections

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	References
A.2.1	Inaccessible Medium-Voltage (2 kV to 15 kV) Cables Installed In Conduit Or Direct Buried	Conductor insulation	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by exposure to moisture and voltage	Formation of water trees, localized damage, leading to electrical failure (breakdown of insulation), caused by moisture intrusion, water trees	NUREG-1705 NUREG-1723 IEEE Std. 1205 SAND96-0344 EPRI TR-109619

VI. ELECTRICAL COMPONENTS
A. Insulated Cables and Connections

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Aging Management Program For Inaccessible Medium-Voltage Cables Exposed to Adverse Localized Environments caused by Moisture and Voltage Exposure Most insulated cables in nuclear power plants are located in dry environments. However, some cables may be exposed to condensation and wetting in inaccessible locations such as conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations. When an energized cable is exposed to but not designed for these conditions, water treeing or a decrease in the dielectric strength of the conductor insulation can occur, which can lead to electrical failure. The purpose of this aging management program is to provide reasonable assurance that the intended functions of inaccessible medium-voltage cables exposed to adverse localized environments caused by moisture and voltage exposure will be maintained consistent with the current licensing basis through the period of extended operation.	***(1) Scope:*** The program includes inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture and significant voltage. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. The moisture and voltage exposures described as significant in these definitions are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization is not significant for submarine cables). ***(2) Preventive Actions:*** No actions are taken as part of this program to prevent or mitigate aging degradation. ***(3) Parameters Monitored/Inspected:*** In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to each test. ***(4) Detection:*** In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested at least once every 10 years, which is an adequate period to preclude failures of the conductor insulation. ***(5) Monitoring and Trending:*** No actions are taken as part of this program to trend the test results. ***(6) Acceptance Criteria:*** The acceptance criteria for each test is defined by the specific type of test performed and the specific cable tested. ***(7) Corrective Actions:*** Further investigation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the insulated cables and connections will be maintained consistent with the current licensing basis. Specific corrective actions are implemented in accordance with the station's corrective action program. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other inaccessible, in-scope, medium-voltage cables. ***(8 & 9) Confirmatory Process & Administrative Control:*** Confirmatory actions, as needed, are implemented as part of the station's corrective action program. The implementation of this program is controlled by plant procedures. ***(10) Operating Experience:*** Operating experience has shown that XLPE or high molecular weight polyethlene (HMWPE) insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Treeing is much less prevalent in 4-kV cables than those operated at 13 or 33 kV. Due to the low dielectric stress, water trees do not occur in low-voltage cables.	No

References

NUREG-1705, *Safety Evaluation Report Related to the License Renewal of Calvert Cliffs Nuclear Power Plant, Units 1 and 2*, December 1999

NUREG-1723, *Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station, Units 1, 2 and 3*, February 2000

NUREG/CR-5643, *Insights Gained From Aging Research*, March 1992

IEEE Std. 1205, *IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations.*

SAND96-0344, *Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations*, September 1996, prepared by Sandia National Laboratories for the U.S. Department of Energy.

EPRI TR-109619, *Guideline or the Management of Adverse Localized Equipment Environments*, June 1999

CHAPTER X

TIME-LIMITED AGING ANALYSES

A. Electrical Component TLAA

A.1 Qualified Life Analyses for Electrical Components Included in the Plant's Environmental Qualification (EQ) Program

The Nuclear Regulatory Commission (NRC) has established nuclear station environmental qualification (EQ) requirements in 10 CFR 50 Appendix A, Criterion 4, and in 10 CFR 50.49. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in "harsh" plant environments (i.e., those areas of the plant that could be subject to the harsh environmental effects of a loss of coolant accident (LOCA), high energy line breaks (HELBs) or post-LOCA radiation) are qualified to perform their safety function in those harsh environments after the effects of inservice aging. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of qualification.

All operating plants must meet the requirements of 10 CFR 50.49 (EQ Rule) for certain electrical equipment important-to-safety. The EQ rule defines the scope of equipment to be included, requires the preparation and maintenance of a list of in-scope equipment, and a qualification file that includes equipment performance specifications, electrical characteristics and environmental conditions. The aging provisions are contained in § 50.49(e)(5) which requires, in part, consideration of all significant types of aging degradation that can affect equipment functional capability. § 50.49(e) also requires equipment replacement or refurbishment prior to the end of designated life unless additional life is established through ongoing qualification. § 50.49(f) establishes four methods of demonstrating qualification for aging and accident conditions. § 50.49(k) and (l) permits different qualification criteria to apply based on plant and equipment vintage. Compliance with the EQ rule provides evidence that the equipment will perform its intended functions during accident conditions after considering the detrimental effects of aging.

The EQ process manages component intended functions through the use of qualification analyses. As required by the EQ Rule, an installed EQ component must always be qualified. Before the qualification for a component expires, the qualification must be extended analytically or through refurbishment or additional qualification testing, or the component must be replaced. Analyses for EQ equipment which specify a qualification of at least 40 years are Time Limited Aging Analyses (TLAA) for license renewal. There are three demonstration methods provided in § 54.21(c)(1) that can be used for evaluating TLAA:

(i) the analysis remains valid for the period of extended operation,
(ii) the analysis is projected to the end of the period of extended operation, or
(iii) the effects of aging on the intended functions will be adequately managed during the period of extended operation.

For demonstration method (i), the qualification existing at the time of the renewal application extends through the period of extended operation and no further evaluation is necessary. For

demonstration method (ii), a reanalysis was performed in order to extend the qualification of the component through the period of extended operation. For demonstration method (iii), since these components are regulated under § 50.49 which requires that a qualified component be installed to perform the intended functions, at some time in the future before the component's qualification expires, the component's qualification must be extended analytically or through refurbishment or additional qualification testing, or the component must be replaced.

Generic safety issue (GSI) 168 is related to EQ components and is an open generic issue related to license renewal. Research is ongoing to provide information to resolve it. Specific issues being addressed in this research are presented in NUREG/CR-6384. Once this generic issue is resolved, guidance will be provided as to the impact on license renewal. In the interim, NRC letter dated June 2, 1998, "*Guidance on Addressing GSI-168 for License Renewal*," (C. Grimes, NRC to D. Walters, NEI) provides guidance on addressing GSI-168 in license renewal applications. It states that, until the generic issue is resolved, "*...an acceptable approach described in the SOC is to provide a technical rationale demonstrating that the current licensing basis for EQ, pursuant to 10 CFR 50.49 will be maintained in the period of extended operation.*"

An acceptable approach found during license renewal applications is to examine the reanalysis method performed for demonstration methods (ii) and (iii). The technical rationale attributes applicable to reanalysis should include analytical methods, data collection and reduction methods, acceptance criteria and corrective actions (if acceptance criteria are not met), and underlying assumptions. The following attribute descriptions have been found acceptable and should be used as a review guide.

REANALYSIS OF A QUALIFICATION

The reanalysis is performed for a specific application to extend the qualification if excess conservatism exists in the original analysis. The qualified life may be limited by thermal, radiation, or cyclical aging; the vast majority of qualified life values are based on thermal limits. Conservatisms may exist in parameters such as the assumed ambient temperature of the equipment, an unrealistically low activation energy, or in the application of equipment (de-energized versus energized). The reanalysis is documented according to the plant's Quality Assurance program requirements, which require the verification of assumptions and conclusions. Specific attributes of a reanalysis are discussed below.

Analytical Methods: The Arrhenius methodology is an acceptable thermal model used to perform a thermal reanalysis. Other models may be justified on a case-by-case basis. EQ equipment is typically sealed and cable insulation is protected from the occasional inadvertent spray. Exposure to moisture due to leaks is investigated on a case by case basis. The analytical method used for radiation reanalysis is to demonstrate qualification for the total integrated dose (normal radiation dose for 60 years plus accident radiation dose).

Data Collection & Reduction Methods: Reducing excess conservatisms in the equipment service conditions (e.g., temperature) used in existing analyses is the chief method used for

reanalysis. Temperature data used in a reanalysis shall be conservatively based on actual temperature measurements in the area around the equipment being reanalyzed. Temperature measurements can be obtained in several ways, examples of which are through monitors used for Technical Specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are mathematically reduced to arrive at a temperature used in a reanalysis. Temperatures may be used in several ways in a reanalysis such as (a) using the actual calculated temperature, or (b) using the calculated temperature to validate or show conservatism when using a design temperature for a reanalysis. For radiation, one acceptable method of establishing the 60 year aging radiation dose is to multiply the 40 year dose applicable to the equipment by the ratio of the evaluation period and divide by 40 years (e.g., for license renewal 60 years/40 years = 1.5). This value is added to the applicable accident radiation dose to obtain the total integrated dose for the equipment. For cyclical aging a similar approach may be used. Other methods of establishing radiation and cyclical aging parameters, including parameters conservatively based on operational data, may also be used when justified.

Acceptance Criteria & Corrective Actions: The reanalysis shall extend the equipment's qualification through the renewal period. If the qualification cannot be extended, the equipment is replaced prior to the expiration of the existing qualification.

Underlying Assumptions: Conservatisms in the EQ equipment qualification analyses are sufficient to account for environmental changes occurring due to plant modifications and events. Plant environmental zones are identified in the EQ documentation. The EQ documentation identifies the harsh environmental areas of the plant for loss of coolant accidents (LOCAs), high energy line breaks (HELBs) and radiation. The EQ documentation is a Quality Assurance controlled document.

Changes in environmental parameters are reviewed by the EQ responsible engineer to address affected EQ equipment on a generic basis. If the changes cannot be dispositioned on a generic basis, the station corrective action process would be initiated to resolve the specific equipment concerns. Adverse environmental changes are addressed on an ongoing basis.

When a significant environmental change is identified, a review of the qualification of affected EQ equipment is performed and applicable changes are made to the equipment qualification. In addition, when a reanalysis is performed for the purposes of extending the qualification, the environmental parameters for the equipment are verified. When environmental data used in an equipment reanalysis is confirmed to be accurate, the EQ documentation, if appropriate, is revised to reflect the new operating conditions. Equipment reanalyses are performed under calculations whose assumptions and environmental data are reviewed periodically for continued validity.

References

Code of Federal Regulations, Title 10, Part 50, Section 49, *Environmental Qualification of electric Equipment Important to Safety for Nuclear Power Plants.*

NRC Bulletin 79-01B, *Environmental Qualification of Class 1E Equipment, January 14, 1980.*

NRC Regulatory Guide 1.89, *Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants*, June 1984.

NUREG-0588, *Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment,* December 1979.

IEEE Std. 317, *IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations.*

IEEE Std. 323, *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.*

IEEE Std. 383, *IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.*

IEEE Std. 1205, *IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations.*

ENCLOSURE 3

B1. Light Load Handling Systems (Related to Refueling)

B1.1 ~~Bridge (for cranes that fall within the scope of 10 CFR 54)~~ Cranes

B1.1.1 Structural Girders

B1.2 ~~Rail System~~ Cranes and Hoists

B1.2.1 ~~Frame Cut Holes~~ Structural Girders and Rails

B1.2.2 ~~Rail~~ Flame Cut Holes

B.1.2.3 Rails

151

B1. Light Load Handling Systems (Related to Refueling)

152 Delete wording and replace with language noted in comment.

System, Structures, and Components

Most commercial nuclear facilities have between fifty and one-hundred cranes. Many of these cranes are industrial grade cranes that do not fall within the scope of 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and therefore are not required to be part of the integrated plant assessment (IPA). Normally less than ten cranes fall within the scope of 10 CFR 54. The IPA must demonstrate that these cranes are all capable of supporting their rated loads. In addition, a subset of this group must remain fully operational before, during, and after a safe shutdown earthquake. Typically only one or two facility cranes have this functional requirement.

Cranes that are within the scope of 10 CFR 54 also fall within the scope of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The most accurate method of determining which systems and components fall within the scope of these two sections of the CFR is to use the plant probabilistic risk assessment and perform a risk ranking. All of the cranes within the scope of 10 CFR 54 that must be included in the IPA are also included in the 10 CFR 50.65 "Maintenance Rule" and they are therefore monitored quite closely. Dynamic items such as cables, hooks, drums, gear boxes, brakes, relays and bearings are typical components that are the primary focus for the 10 CFR 50.65 inspection and maintenance programs. The main focus of 10 CFR 54, however, is on passive items that are less likely to be inspected under the normal monitoring and maintenance programs. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the light load handling systems are classified as Group C Quality Standards.

System Interfaces

No other systems contained in this report interface with the light load handling system.

153 Delete and reword as noted in the comment.

VII AUXILIARY SYSTEMS
B1. LIGHT LOAD HANDLING SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B1.1.1	~~Bridge and Trolley (for cranes that fall within the scope of 10 CFR 54)~~ Cranes	Structural Girders	Structural Steel A-36, A-7 or A-285	Air at ~~70%~~ 100 Relative Humidity and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA. Specification #70, ~~ASME NOG-1.~~
B1.2.1	~~Bridge and Trolley (for cranes that fall within the scope of 10 CFR 54)~~ Cranes and Hoists	Structural Girders and Rails	Structural Steel A-36, A-7 or A-285	Air at ~~20%~~ 100% RH and 49°C (120°F)	Loss of Material	General Corrosion, ~~Coating Degradation~~	10 CFR 50.65. ~~ASME B30.2. ASME Section XI, 1989 Edition.~~ ASME B30.16
B1.2.1	~~Rail System~~ Cranes and Hoists	~~Frame~~ Flame Cut Holes	A-759	Air at ~~20%~~ 100% RH and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA. Specification #70, ASME NOG-1. IN 96-26

VII AUXILIARY SYSTEMS
B1. LIGHT LOAD HANDLING SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Although the number of load cycles for nuclear power plant cranes is usually less than 20,000, components may have been designed or evaluated for a forty (40) year life or they may have been designed to a specific Service Class as defined in CMAA Specification #70 or ASME NOG-1. However, due to their age, some cranes may have been designed by their manufacturers using a fatigue analysis that employed a cumulative usage factor (CUF). It must be demonstrated that the analysis that was originally done is still applicable for the period of license renewal.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal.	Yes ~~TLAA~~
Structures, systems and components that fall within the Scope of 10 CFR 54.4, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, also fall within the Scope of 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. An acceptable monitoring program will meet all of the requirements of the ASME B30.2 specification for Overhead and Gantry Cranes and include plant system walkdowns, following the guidance provided by the ASME Code Section XI for VT-3, which require visual inspection of paint and coatings during each outage and reporting the walkdown results. When coating degradation is found, plant maintenance procedures require a review and evaluation of the findings. Corrective actions are initiated as necessary. Crane Inspection Program	**(1) Scope of Program:** The program is focused on managing the effects of general corrosion on the structural reliability of the component. ***(2) Preventive Actions:*** Paint or coating prevents or mitigates corrosion on the external portions of the girders. Internal surfaces may or may not be painted or coated. ***(3) Parameters Monitored/Inspected:*** The existing AMP only controls and monitors the loss of material from the external surfaces of the girders. ***(4) Detection of Aging Effects:*** Inspection and confirmation that the paint or coating is intact is an effective method of ensuring that the effects of corrosion on the external surfaces of the girders is minimized. Because it is difficult, if not impossible, to inspect and repair internal surfaces, other methods such as ultrasonic inspection should be used to monitor for loss of material from the internal surfaces of the girder. ***(5) Monitoring and Trending:*** Based upon the annual loss of material determined from the inspection program, an estimate can be made of the annual loss of material from the girder. Based on this rate, an estimate of the thickness of the material at the end of license renewal can be made. ***(6) Acceptance Criteria:*** The original crane manufacture/designer or other responsible organization should be consulted to determine if the crane will be capable of meeting its structural and functional requirements at the end of license renewal. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** There has been no history in the nuclear industry of corrosion related degradation that has impaired crane girders from meeting their structural and functional requirements.	Yes ~~Elements 2 thru 6 should be further evaluated~~ No
Same as for the effects of Fatigue on Items B1.1.1 and B1.1.2, Bridge and Trolley.	~~Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal.~~	Yes TLAA

158 Delete text and insert last sentence from wording in comment.

VII AUXILIARY SYSTEMS

B1. LIGHT LOAD HANDLING SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B1.2.2 3	~~Rail System.~~ Cranes and Hoists → 171	Rail	A-759	Air at ~~70%~~ 10% RH and 49°C (120°F)	~~Attrition.~~ Loss of Material	Wear	10 CFR 54.4. 10 CFR 50.65. ~~ASME Section XI, 1989 Edition.~~ ASME B30.2 ASME B30.16 → 173

156 172

VII AUXILIARY SYSTEMS

B1. LIGHT LOAD HANDLING SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Structures, systems and components~~ that fall within the Scope of 10 CFR 54.4, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, also fall within the Scope of 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. Acceptable monitoring programs include visual inspections, following the guidance provided by the ASME Code Section XI for VT-3, of the crane rails, along with maintenance programs that initiate appropriate ~~corrective actions if necessary~~. Crane Inspection Program 174	~~(1) Scope of Program:~~ The program is focused on managing the effects of both normal and abnormal wear on the functional reliability of the components. ***(2) Preventive Actions:*** Monitoring and maintenance are the primary methods of minimizing wear. ***(3) Parameters Monitored/Inspected:*** Unusual wear patterns such as mushrooming, coining, spalling, surface cracks or wear on the side of the rails are all indications of abnormal operating conditions such as overloading or misalignment. Misalignment is often caused by loose bolts on clips, fasteners, splices and expansion joints. ***(4) Detection of Aging Effects:*** Excessive wear should be easily detectable through visual inspections. As a precaution, a sampling of bolts should be checked to ensure that vibrations have not caused them to lose their proper torque. ***(5) Monitoring and Trending:*** Based upon the results of the visual inspection and the check of the bolt torque, a recommendation should be made for future monitoring and maintenance. ***(6) Acceptance Criteria:*** The wear of the rails will normally not affect the ability of the structure to support its rated load. It may, however, prevent the crane from being able to operate as required. If the wear of the rail system is such that there is any question as to whether or not the crane will operate properly, the crane manufacture or a firm with equivalent expertise should be contacted to evaluate the situation and recommend corrective measures. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** In an isolated case, cracks were found in crane rails due to field modifications during installation. These cracks were arrested and have not effected the structural or functional performance of the crane. This is considered an isolated incidence. More frequently, bolts have been found that ~~have loosened due to vibrations.~~ 175	Yes Elements 2 thru 6 should be further evaluated

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
151	Light Load Handling Systems	B1	VII B1-1	Item B1 should be structured as follows: B1.1 Cranes B1.1.1 Structural Girders B1.2 Cranes and Hoists B1.2.1 Structural Girders and rails B1.2.2 Flame Cut Holes B1.2.2 Rails These subsections titles are more generic that those presently in GALL
152	Light Load Handling Systems	B1	VII B1-3	Introductory section should be rewritten so that it is comparable to other sections. The system, structures, and components included in this table comprise the overhead heavy load handling systems or cranes. Dynamic items of the cranes such as cables, hooks, drums, gear boxes, brakes, relays and bearings are typical components that are the primary focus for 10 CFR 50.65, "Requirements for monitoring the Effectiveness of Maintenance at Nuclear Power Plants." As dynamic items, they are outside the scope of license renewal. The focus of 10 CFR 54 are the passive items such as the crane rails and girders. The crane rails and girders are constructed of structural steel and exposed to internal building environments.
153	Light Load Handling	B1	VII B1-3	System Interfaces should be changed as follows:

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
	Systems			Physical interfaces exist with the supporting structure. The direct interface is at the structural connection of the crane girders to the structure.
154	Light Load Handling Systems	B1.1.1	VII B1-4	Item B1.1.1 Structure and Component should be identified as "Cranes". Delete text in second column of Item B1.1.1 and add "Cranes".
156	Light Load Handling Systems	B1.1.1, B1.2.1, B1.2.1 and B1.2.2	VII B1-4	Environment for the cranes should be Air at 100% relative humidity and 49°C (120°F). Change 70% relative humidity to 100% relative humidity.
160	Light Load Handling Systems		VII B1-4	Second item listed as B1.1.1 should be identified as B1.2.1.
161	Light Load Handling Systems	B1.2.1	VII B1-4	Item B1.2.1 Structure and Component should be identified as "Cranes and Hoists."
162	Light Load Handling Systems	B1.2.1	VII B1-4	Item B1.2.1 Region of Interest should be identified as "Structural Girders and Rails"
167	Light Load Handling Systems	B1.2.1	VII B1-4	Item B1.2.1, Replace Rail System under the Structure and Component column with "Cranes and Hoists".
168	Light Load Handling Systems	B.1.2.1	VII B1-4	Change Frame to Flame
169	Light Load Handling Systems	B1.2.1	VII B1-4	Information Notice 96-26, *Recent Programs with Overhead Cranes*, should be included as a reference.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
163	Light Load Handling Systems	B1.2.1	VII B1-4	Item B1.2.1, Do not include ASME Section XI, 1989 Edition as a reference. Crane inspections are not performed in accordance with ASME. Also delete reference to ASME B30.2 since it is not applicable to most plants. Include ASME B30.16 for hoists as a reference
187	Light Load Handling Systems	B1.2.1	VII B1-4	Item B1.2.1 Aging Mechanism column: Coating Degradation is not an aging mechanism. Degradation of the coating in and of itself does not result in loss of material. Delete Coating degradation as an aging mechanism.
300	Light Load Handling Systems	B1.1.1	VII B1-4	Delete reference to ASME NOG-1, it is not a utility applied reference
164	Light Load Handling Systems	B1.2.1	VII B1-5	Item B1.2.1, Existing Aging Management Program (AMP) column: the licensee's crane inspection program may be implemented as part of 10 CFR 50.65, NUREG-0612, or some other initiative. To ensure that it is not confusing, the program should simply be identified as the "Crane Inspection Program". Delete text and add "Crane Inspection Program" Also, add the OSHA required crane inspection to the reference and credit the program as an effective aging management program. The OSHA crane inspection requires periodic load testing and girder deflection measurement. Any undetected corrosion which results in loss of material of the load carrying structure will be detected by a change in

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				the girder deflection. Reference 29CFR Chapter XVII, 1910.179. Also, NUREG-0612 provides guidance on operational control and maintenance for heavy loads cranes
157	Light Load Handling Systems	B1.1.1	VII B1-5	Item B1.1.1, Existing Aging Management Program (AMP) column: Delete information and rewrite as follows since the purpose of the column is to identify the program. Crane Manufacturers Association of America (CMAA) Specification #70, "Specification for Electric Overhead Traveling Cranes"
158	Light Load Handling Systems	B1.1.1	VII B1-5	Item B1.1.1, Evaluation and Technical Basis column: rewrite as follows. Although the number of load cycles for nuclear power plant cranes is usually well below the threshold addressed in CMAA #70, components may have been designed or evaluated for a forty (40) year life or they may have been designed to a specific Service Class as defined in CMAA #70. If it is determined that fatigue of cranes is a time-limited aging analysis for the period of extended operation, an evaluation must be performed in accordance with §54.21(c)(1).
159	Light Load Handling Systems	B1.1.1	VII B1-5	Item B1.1.1, Further Evaluation column: delete TLAA and replace with "if fatigue of crane girders is determined to be a TLAA."

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
166	Light Load Handling Systems	B1.2.1	VII B1-5	Item B1.2.1, Further Evaluation: Yes should be changed to No. The aging management program is not implemented as part of NUREG-0612 and addresses more than cranes under NUREG-0612. All cranes are covered by the regulation of 29 CFR CH XVII.
165	Light Load Handling Systems	B1.2.1	VII B1-5	Item B1.2.1, Evaluation and Technical Basis column: Add discussion as provided below. The regulatory basis for inspecting the rails and girders of cranes and hoists is found in 29 CFR Ch XVII, §1910.179. An acceptable Crane Inspection Program will meet the requirements of the ASME B30.2 specification for Overhead and Gantry Cranes. Evaluation of the Crane Inspection Program against the ten (10) criteria for an acceptable aging management program follows: (1) Scope of Program: The scope of the program includes the rails and girders of cranes and hoists within license renewal. (2) Preventive Actions: No preventive actions are specified and the staff has found this acceptable (See ONS SER). (3) Parameters Monitored/Inspected: The steel surfaces of the rails and girders are monitored for loss of material due to corrosion and wear of the rails. (4) Detection of Aging Effects: The rails and girders are visually inspected for degradation and functional tests are also performed to

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				ensure the their integrity. (5) Monitoring and Trending: Monitoring and trending are not identified for this program and the staff has found this acceptable (See ONS SER). (6) Acceptance Criteria: The acceptance criteria is no unacceptable visual indication of loss of material due to corrosion or wear. (7) Corrective Actions: Site corrective actions are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (8) Confirmation Process: The confirmation process is included as part of the corrective actions which are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (9) Administrative Controls: Administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (10) Operating Experience: Industry experience has not identified any instances of loss of material of rails and girders that has resulted in loss of intended functions. In an isolated case, cracks were found in crane rails due to field modifications during installation. The cracks were arrested and have not effected the structural or functional performance of the crane. This is considered an isolated incidence.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				The program has been shown to detect and correct any degradation such that the intended functions of the rails and girders will be maintained consistent with the CLB for the period of extended operation.
158	Light Load Handling Systems		VII B1-5	B1.1.1, Evaluation and Technical Basis Column: rewrite as below. Although the number of load cycles for nuclear power plant cranes is usually well below the threshold addressed in CMAA #70, components may have been designed or evaluated for a forty (40) year life or they may have been designed to a specific Service Class as defined in CMAA #70 or ASME NOG-1. If it is determined that fatigue of cranes is a time-limited aging analysis for the period of extended operation, an evaluation must be performed in accordance with §54.21(c)(1).
171	Light Load Handling Systems		VII B1-6	Structure and component should be identified as "Cranes and hoists".
172	Light Load Handling Systems		VII B1-6	B1.2.2, Aging Effect is "Loss of Material" not attrition.
173	Light Load Handling Systems		VII B1-6	References should be to 10 CFR 54.4, 10 CFR 50.65, ASME B30.2 and B30.16. Do not reference ASME Section XI, 1989 Edition; crane inspections are not performed in accordance with ASME Code requirements.
174	Light Load Handling		VII B1-7	B1.2.2, AMP Column: the licensee's crane inspection program may be implemented as part of

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B1

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
	Systems			10 CFR 50.65, NUREG-0612, or some other initiative. To ensure that it is not confusing, the program should simply be identified as the "Crane Inspection Program". Delete text and add "Crane Inspection Program"
175	Light Load Handling Systems		VII B1-7	B1.2.2, evaluation and technical basis, delete information and state: Same as B1.2.1, Loss of Material for Cranes and Hoists.

B1. Light Load Handling Systems (Related to Refueling)

B1.1 Cranes

B1.1.1 Structural Girders

B1.2 Cranes and Hoists

B1.2.1 Structural Girders and Rails

B1.2.2 Flame-Cut Holes

B1.2.3 Rails

B1. Light Load Handling Systems (Related to Refueling)

System, Structures, and Components

The systems, structures, and components included in this table comprise the overhead light-load handling systems or cranes. Dynamic items of the cranes, such as cables, hooks, drums, gear boxes, brakes, relays, and bearings are typical components that are the primary focus for 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." As dynamic items, they are outside the scope of license renewal. The focus of 10 CFR 54 is the passive items such as the crane rails and girders. The crane rails and girders are constructed of structural steel and exposed to internal building environments.

System Interfaces

Physical interfaces exist with the supporting structure. The direct interface is at the structural connections of the crane girders to the structure.

VII AUXILIARY SYSTEMS

B1. LIGHT LOAD HANDLING SYSTEMS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B1.1.1	Cranes	Structural Girders	Structural Steel A-36, A-7, or A-285	Air at 100% Relative Humidity and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA Specification #70.
B1.2.1	Cranes and Hoists	Structural Girders and Rails	Structural Steel A-36, A-7, or A-285	Air at 100% HR and 49°C (120°F)	Loss of Material	General Corrosion	10 CFR 50.65 ASME B30.16
B1.2.1	Cranes and Hoists	Flame Cut Holes	A-759	Air at 100% HR and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA Specification # 70. IN 96-26 Recent Programs with Overhead Cranes
B1.2.3	Cranes and Hoists	Rail	A-759	Air at 100% HR and 49°C (120°F)	Loss of Material	Wear	10 CFR 54.4 10 CFR 50.65 ASME B 30.2 ASME B 30.16

VII AUXILIARY SYSTEMS

B1. LIGHT LOAD HANDLING SYSTEMS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Crane Manufacturers Association of America (CMSS) Specification # 70, "Specification for Electric Overhead Traveling Cranes."	Although a number of load cycles for nuclear power plant cranes is usually well below the threshold addressed in CMAA # 70, components may have been designed or evaluated for a forty (40) year life, or they may have been designed to a specific Service Class, as defined in CMAA #70. If it is determined that fatigue of cranes is a time-limited aging analysis for the period of extended operation, an evaluation must be performed in accordance with §54.21(c)(1).	Yes, if fatigue of crane girders is determined to be a TLAA.
Crane Inspection Program or Maintenance Rule Structures Monitoring Program performed in accordance with OSHA requirements.	The regulatory basis for inspecting the rails and girders of cranes and hoists is found in 29 CFR Ch XVII, §1910.179. An acceptable Crane Inspection Program will meet the requirements of ASME B30.2 specification for Overhead and Gantry Cranes. Evaluation of the Crane Inspection Program against the ten (10) criteria for an acceptable aging management program follows: (1) **Scope of Program**: The scope of the program includes the rails and girders of cranes and hoists within license renewal. (2) **Preventive Actions:** No preventive actions are specified and the staff has found this acceptable. (3) **Parameters Monitored/Inspected:** The steel surfaces of the rails and girders are monitored for loss of material due to corrosion and wear of the rails. (4) **Detection of Aging Effects:** The rails and girders are visually inspected for degradation and functional tests are also performed to ensure their integrity. (5) **Monitoring and Trending:** Monitoring and trending are not identified for this program and the staff has found this acceptable. (6) **Acceptance Criteria:** The acceptance criteria is no unacceptable visual indication of loss of material due to corrosion or wear. (7) **Corrective Actions:** Site corrective actions are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (8) **Confirmation Process:** The confirmation process is included as part of the corrective actions that are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (9) **Administrative Controls:** Administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (10) **Operating Experience:** Industry experience has not identified any instances of loss of material of rails and girders that has resulted in loss of intended functions. In an isolated case, cracks were found in crane rails due to field modifications during installation. The cracks were arrested and have not effected the structural or functional performance of the crane. This is considered an isolated incidence. The program has been shown to detect and correct any degradation such that the intended functions of the rails and girders will be maintained consistent with the CLB for the period of extended operation.	No
	If it is determined that fatigue of cranes involves Time-Limited Aging Analysis (TLAA) for the period of extended operation, an elevation must be performed in accordance with §54.21(c)(1).	Yes, if fatigue of flame-cut holes is determined to involve a TLAA.
Crane Inspection Program or Maintenance Rule Structures Monitoring Program performed in accordance with OSHA requirements.	*Same as B1.2.1, Loss of Material for Cranes and Hoists*	No

ENCLOSURE 4

B2. Overhead Heavy Load Handling System

Cranes

B2.1 ~~Bridge (for cranes that fall within the scope of 10 CFR 54)~~

B2.1.1 Structural Girders

B2.2 ~~Rail System~~ Cranes and Hoists

Flame

B2.2.1 ~~Frame~~ Cut Holes

B2.2.2 Rails

B2.2.1 Structural Girders and Rails

176

B2. Overhead Heavy Load Handling Systems

177 Delete wording and insert language from Comment

System, Structures, and Components

Most commercial nuclear facilities have between fifty and one-hundred cranes. Many of these cranes are industrial grade cranes that do not fall within the scope of 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and therefore are not required to be part of the integrated plant assessment (IPA). Normally less than ten cranes fall within the scope of 10 CFR 54. The IPA must demonstrate that these cranes are all capable of supporting their rated loads. In addition, a subset of this group must remain fully operational before, during, and after a safe shutdown earthquake. Typically only one or two facility cranes have this functional requirement.

Cranes that are within the scope of 10 CFR 54 also fall within the scope of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The most accurate method of determining which systems and components fall within the scope of these two sections of the CFR is to use the plant probabilistic risk assessment and perform a risk ranking. All of the cranes within the scope of 10 CFR 54 that must be included in the IPA are also included in the 10 CFR 50.65 "Maintenance Rule" and they are therefore monitored quite closely. Dynamic items such as cables, hooks, drums, gear boxes, brakes, relays and bearings are typical components that are the primary focus for the 10 CFR 50.65 inspection and maintenance programs. The main focus of 10 CFR 54, however, is passive items that are less likely to be inspected under the normal monitoring and maintenance programs. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the overhead load handling systems are classified as Group C Quality Standards.

System Interfaces

No other systems contained in this report interface with the overhead heavy load handling system.

178 Delete wording and insert language from comment.

VII AUXILIARY SYSTEMS

B2. OVERHEAD HEAVY LOAD HANDLING SYSTEMS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B2.1.1	~~Bridge and Trolley (for cranes that fall within the scope of 10 CFR 54)~~ Cranes	Structural Girders	Structural Steel A-36, A-7, or A-285	Air at ~~70%~~ Relative Humidity and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA. Specification #70, ~~ASME NOG-1.~~
B2.1.1	~~Bridge and Trolley (for cranes that fall within the scope of 10 CFR 54)~~ Cranes and Hoists	Structural Girders and Rails	Structural Steel A-36, A-7, or A-285	Air at ~~70%~~ relative humidity and 49°C (120°F)	Loss of Material	General Corrosion, ~~Coating Degradation~~	10 CFR 50.65. ASME B30.2. ~~ASME Section XI, 1989 Edition.~~ NUREG-0612. ANSI N14.6. ASME B30.16
B2.2.1	~~Rail System~~ Cranes and Hoists	~~Frame~~ Cut Holes	A-759	Air at ~~70%~~ Relative Humidity and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA. Specification #70, ~~ASME NOG-1.~~ IN 96-26

181 Delete text and insert language noted in Comment.

VII AUXILIARY SYSTEMS
B2. OVERHEAD HEAVY LOAD HANDLING SYSTEMS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Although the number of load cycles for~~ nuclear power plant cranes is usually less than 20,000, components may have been designed or evaluated for a forty (40) year life or they may have been designed to a specific Service Class as defined in CMAA Specification #70 or ASME NOG-1. However, due to their age, some cranes may have been designed by their manufacture using a fatigue analysis that employed a cumulative usage factor (CUF). It must be demonstrated that the analysis that was originally done is still applicable for ~~the~~ period of license renewal.	~~Fatigue is a time limited aging analysis (TLAA) to be performed for the period of license renewal.~~ 182 Delete and insert language noted in Comment	~~Yes TLAA~~ If fatigue of crane girders is determined to be a TLAA 183
~~Structures, systems and components~~ that fall within the Scope of 10 CFR 54.4, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, also fall within the Scope of 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. An acceptable monitoring program will meet all of the requirements of the ASME B30.2 specification for Overhead and Gantry Cranes and include plant system walkdowns, following the guidance provided by the ASME Code Section XI for VT-3, which require visual inspection of paint and coatings during each outage and reporting the walkdown results. When coating degradation is found, plant maintenance procedures require a review and evaluation of the findings. Corrective actions are initiated as necessary. In addition, some of the cranes must comply with the requirements of NUREG-0612, Control of Heavy Loads at Nuclear Power Plants. NUREG-0612 requires compliance with ANSI N14.6 which calls for extensive load ~~testing and inspection~~. Crane Inspection Program 189	~~(1) Scope of Program:~~ The program is focused on ~~managing~~ the effects of general corrosion on the structural reliability of the component. ***(2) Preventive Actions:*** Paint or coating prevents or mitigates corrosion on the external portions of the girders. Internal surfaces may or may not be painted or coated. ***(3) Parameters Monitored/Inspected:*** The existing AMP for some cranes only controls and monitors the loss of material from the external surfaces of the girders. Cranes that are required to comply with NUREG-0612 are also load tested. ***(4) Detection of Aging Effects:*** Inspection and confirmation that the paint or coating is intact is an effective method of ensuring that the effects of corrosion on the external surfaces of the girders is minimized. Because it is difficult, if not impossible, to inspect and repair internal surfaces, other methods such as ultrasonic inspection should be used to monitor for loss of material from the internal surfaces of the girder. ***(5) Monitoring and Trending:*** Based upon the annual loss of material determined from the inspection program, an estimate can be made of the annual loss of material from the girder. Based on this rate, an estimate of the thickness of the material at the end of license renewal can be made. ***(6) Acceptance Criteria:*** The original crane manufacture/designer or other responsible organization should be consulted to determine if the crane will be capable of meeting its structural and functional requirements at the end of license renewal. NUREG-0612 provides acceptance criteria for cranes that fall under its jurisdiction. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** There has been no history in the nuclear industry of corrosion related degradation that has impaired crane girders from meeting their structural and functional requirements.	~~Yes, Elements 2 thru 6 should be further evaluated for cranes not covered by NUREG-0612.~~ No 191
Same as for the effects of Fatigue on Items B2.1.1 and B2.1.2, Bridge and Trolley.	~~Fatigue is a time-limited aging analysis (TLAA)~~ to be performed for the period of license renewal.	Yes TLAA 190 Delete text and replace with language noted in comment

VII AUXILIARY SYSTEMS
B2. OVERHEAD HEAVY LOAD HANDLING SYSTEMS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B2.2.2.3	~~Rail System~~ Cranes and Hoists	Rail	A-759	Air at ~~75%~~ Relative Humidity and 49°C (120°F)	~~Attrition~~ Loss of Material	Wear	10 CFR 54.4. 10 CFR 50.65. ~~ASME Section XI, 1989 Edition.~~ ASME B30.2 ASME B30.16

180
100%
197
198
199
200

VII AUXILIARY SYSTEMS

B2. OVERHEAD HEAVY LOAD HANDLING SYSTEMS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Structures, systems and components~~ that fall within the Scope of 10 CFR 54.4, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, also fall within the Scope of 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. Acceptable monitoring programs include visual inspections, following the guidance provided by the ASME Code Section XI for VT-3, of the crane rails, along with maintenance programs that initiate appropriate ~~corrective actions if necessary.~~ Crane Inspection Program	~~(1) Scope of Program:~~ The program is focused on managing the effects of both normal and abnormal wear on the functional reliability of the components. ***(2) Preventive Actions:*** Monitoring and maintenance are the primary methods of minimizing wear. ***(3) Parameters Monitored/Inspected:*** Unusual wear patterns such as mushrooming, coining, spalling, surface cracks or wear on the side of the rails are all indications of abnormal operating conditions such as overloading or misalignment. Misalignment is often caused by loose bolts on clips, fasteners, splices and expansion joints. ***(4) Detection of Aging Effects:*** Excessive wear should be easily detectable through visual inspections. As a precaution, a sampling of bolts should be checked to ensure that vibrations have not caused them to lose their proper torque. ***(5) Monitoring and Trending:*** Based upon the results of the visual inspection and the check of bolt torque, a recommendation should be made for future monitoring and maintenance. ***(6) Acceptance Criteria:*** The wear of the rails will normally not affect the ability of the structure to support its rated load. It may, however, prevent the crane from being able to operate as required. If the wear of the rail system is such that there is any question as to whether or not the crane will operate properly, the crane manufacture or a firm with equivalent expertise should be contacted to evaluate the situation and recommend corrective measures. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** In an isolated case, cracks were found in crane rails due to field modifications during installation. These cracks were arrested and have not effected the structural or functional performance of the crane. This is considered an isolated incidence. More frequently, bolts have been found that have loosened due to vibrations.	~~Yes~~ ~~Elements 2 thru 6 should be further evaluated~~ No → 191

201

202

Delete text and insert language from comment

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B2

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
300	Overhead Heavy Load Handling System	B2.1.1 and B2.2.2	VII B2-4	Delete reference to ASME NOG-1, it is not a utility applied reference
176	Overhead Heavy Load Handling System	B2	VII B2-1	Page should be revised to match the following subsections: B2.1 Cranes B2.1.1 Structural Girders B2.2 Cranes and hoists B2.2.1 Structural Girders and Rails B2.2.2 Flame Cut Holes B2.2.3 Rails These subsections titles are more generic that those presently in GALL.
177	Overhead Heavy Load Handling System	B2	VII B2-3	Introductory section should be rewritten so that it is comparable to other sections. The system, structures, and components included in this table comprise the overhead heavy load handling systems or cranes. Dynamic items of the cranes such as cables, hooks, drums, gear boxes, brakes, relays and bearings are typical components that are the primary focus for 10 CFR 50.65, "Requirements for monitoring the Effectiveness of Maintenance at Nuclear Power Plants." As dynamic items, they are outside the scope of license renewal. The focus of 10 CFR 54 is the passive items such as the crane rails and girders. The crane rails and girders are constructed of structural steel and exposed to internal building environments
178	Overhead Heavy Load Handling	B2	VII B2-3	System Interfaces should be changed as follows: Physical interfaces exist with the supporting structure. The

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B2

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
	System			direct interface is at the structural connection of the crane girders to the structure.
179	Overhead Heavy Load Handling System	B2.1.1	VII B2-4	Item B2.1.1 Structure and Component should be identified as "Cranes".
180	Overhead Heavy Load Handling System	B2.1.1, B2.2.1, and B2.2.2	VII B2-4	Environment for the cranes should be Air at 100% relative humidity and 49°C (120°F). Change 70% relative humidity to 100% relative humidity for
184	Overhead Heavy Load Handling System		VII B2-4	Second item listed as B2.1.1 should be identified as B2.2.1.
185	Overhead Heavy Load Handling System	B2.2.1	VII B2-4	Item B2.2.1 Structure and Component should be identified as "Cranes and Hoists."
186	Overhead Heavy Load Handling System	B2.2.1	VII B2-4	Item B2.1.2, Region of Interest should be identified as "Structural Girders and Rails".
187	Overhead Heavy Load Handling System	B2.2.1	VII B2-4	B2.1.2, Aging Mechanism Column: Coating Degradation is not an aging mechanism. Degradation of the coating in and of itself does not result in loss of material. Delete Coating Degradation as an aging mechanism.
188	Overhead Heavy Load Handling System	B2.2.1	VII B2-4	Do not include ASME Section XI, 1989 Edition as a reference. Crane inspections are not performed in accordance with ASME. Include ASME B30.16 for hoists as a reference.
192	Overhead		VII B2-4	Item number should be changed to B2.2.2.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B2

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
	Heavy Load Handling System			
193	Overhead Heavy Load Handling System	B2.2.2	VII B2-4	Item B2.2.2 Structure and Component should be identified as "Cranes and Hoists".
194	Overhead Heavy Load Handling System	B2.2.2	VII B2-4	Region of Interest – change Frame to Flame.
195	Overhead Heavy Load Handling System	B2.2.2	VII B2-4	Information Notice 96-26, *Recent Programs with Overhead Cranes,* should be included as a reference.
181	Overhead Heavy Load Handling System	B2.1.1	VII B2-5	Item B2.1.1, AMP Column: Delete information and rewrite as below since the purpose of the column is to identify the program. Crane Manufacturers Association of America (CMAA) Specification #70, "Specification for Electric Overhead Traveling Cranes"
182	Overhead Heavy Load Handling System	B2.1.1	VII B2-5	Item B2.1.1, Evaluation and Technical Basis column: rewrite as follows: Although the number of load cycles for nuclear power plant cranes is usually well below the threshold addressed in CMAA #70, components may have been designed or evaluated for a forty (40) year life or they may have been designed to a specific Service Class as defined in CMAA #70. If it is determined that fatigue of cranes is a time-limited aging analysis for the period of extended operation, an evaluation must be performed in accordance with

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B2

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				§54.21(c)(1).
183	Overhead Heavy Load Handling System	B2.1.1	VII B2-5	Item B2.1.1, Further Evaluation column: delete TLAA and add "if fatigue of crane girders is determined to involve a TLAA."
189	Overhead Heavy Load Handling System	B.2.2.1	VII B2-5	Item B2.2.1, Existing Aging Management Program (AMP) column: the licensee's crane inspection program may be implemented as part of 10 CFR 50.65, NUREG-0612, or some other initiative. To ensure that it is not confusing, the program should simply be identified as the "Crane Inspection Program". Delete text and add "Crane Inspection Program
190	Overhead Heavy Load Handling System	B2.2.1	VII B2-5	Item B2.2.1, Evaluation and Technical Basis column: Delete the existing text and insert the following: The regulatory basis for inspecting the rails and girders of cranes and hoists is found in 29 CFR Ch XVII, §1910.179. An acceptable Crane Inspection Program will meet the requirements of the ASME B30.2 specification for Overhead and Gantry Cranes. Evaluation of the Crane Inspection Program against the ten (10) criteria for an acceptable aging management program follows: (1) Scope of Program: The scope of the program includes the rails and girders of cranes and hoists within license renewal. (2) Preventive Actions: No preventive actions are specified and the staff has found this acceptable (See ONS SER). (3) Parameters Monitored/Inspected: The steel surfaces of the rails and girders are monitored for loss of material due to corrosion and wear of the rails. (4) Detection of Aging Effects: The rails and girders are visually inspected for degradation and functional tests are also performed to ensure the their integrity.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B2

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				(5) Monitoring and Trending: Monitoring and trending are not identified for this program and the staff has found this acceptable (See ONS SER). (6) Acceptance Criteria: The acceptance criteria is no unacceptable visual indication of loss of material due to corrosion or wear. (7) Corrective Actions: Site corrective actions are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (8) Confirmation Process: The confirmation process is included as part of the corrective actions which are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (9) Administrative Controls: Administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (10) Operating Experience: Industry experience has not identified any instances of loss of material of rails and girders that has resulted in loss of intended functions. In an isolated case, cracks were found in crane rails due to field modifications during installation. The cracks were arrested and have not effected the structural or functional performance of the crane. This is considered an isolated incidence. The program has been shown to detect and correct any degradation such that the intended functions of the rails and girders will be maintained consistent with the CLB for the period of extended operation.
191	Overhead Heavy Load Handling System	B2.2.1	VII B2-5	Item B2.2.1, Further Evaluation column: Yes should be changed to No. The aging management program is not implemented as part of NUREG-0612 and addresses more than cranes under NUREG-0612. All cranes are covered by the regulation of 29 CFR CH XVII.
197	Overhead		VII B2-6	Item number should be changed to B2.2.3.

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B2

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
	Heavy Load Handling System			
198	Overhead Heavy Load Handling System	B2.2.3	VII B2-6	Item B2.2.3, Structure and Component should be changed to "Cranes and Hoists".
199	Overhead Heavy Load Handling System	B2.2.3	VII B2-6	Item B2.2.3, Aging Effect is "Loss of Material" not Attrition.
200	Overhead Heavy Load Handling System	B2.2.3	VII B2-6	References should be to 10 CFR 54.4, 10 CFR 50.65, ASME B30.2 and B30.16. Do not reference ASME Section XI, 1989 Edition; crane inspections are not performed in accordance with ASME Code requirements.
201	Overhead Heavy Load Handling System	B2.2.3	VII B2-7	Item B2.2.3, Existing Aging management Program (AMP) column: the licensee's crane inspection program may be implemented as part of 10 CFR 50.65, NUREG-0612, or some other initiative. To ensure that it is not confusing, the program should simply be identified as the "Crane Inspection Program". Delete text and add "Crane Inspection Program". Delete text and add "Crane Inspection Program" Also, add the OSHA required crane inspection to the reference and credit the program as an effective aging management program. The OSHA crane inspection requires periodic load testing and girder deflection measurement. Any undetected corrosion which results in loss of material of the load carrying structure will be detected by a change in the girder deflection. Reference 29CFR Chapter XVII, 1910.179. Also, NUREG-0612 provides guidance on operational control and

GALL REPORT- CIVIL / STRUCTURAL DISCIPLINE COMMENTS
SECTION VII B2

COMMENT NUMBER	GALL SECTION	ITEM NO.	PAGE	COMMENT
				maintenance for heavy loads cranes
202	Overhead Heavy Load Handling System	B2.2.3	VII B2-7	Item B2.2.3, Evaluation and Technical Basis column delete information and state: Same as B2.2.1, Loss of Material for Cranes and Hoists

B2. Overhead Heavy Load Handling System

B2.1 Cranes

B2.1.1 Structural Girders

B2.2 Cranes and Hoists

B2.2.1 Structural Girders and Rails

B2.2.2 Flame-Cut Holes

B2.2.3 Rails

B2. Overhead Heavy Load Handling Systems

System, Structures, and Components

The system, structures, and components included in this table comprise the overhead heavy-load handling systems or cranes. Dynamic items of the cranes such as cables, hooks, drums, gear boxes, brakes, relays and bearings are typical components that are the primary focus for 10 CFR 50.65, "Requirements for monitoring the Effectiveness of Maintenance at Nuclear Power Plants." As dynamic items, they are outside the scope of license renewal. The focus of 10 CFR 54 is the passive items such as the crane rails and girders. The crane rails and girders are constructed of structural steel and exposed to internal building environments.

System Interfaces

Physical interfaces exist with the supporting structure. The direct interface is at the structural connection of the crane girders to the structure.

VII AUXILIARY SYSTEMS

B2. OVERHEAD HEAVY LOAD HANDLING SYSTEMS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B2.1.1	Cranes	Structural Girders	Structural Steel A-36, A-7, or A-285	Air at 100% Relative Humidity and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA Specification #70
B2.2.1	Cranes and Hoists	Structural Girders and Rails	Structural Steel A-36, A-7, or A-285	Air at 100% relative humidity and 49°C (120°F)	Loss of Material	General Corrosion	10 CFR 50.65 ASME B30.2 ASME B30-16 NUREG-0612 ANSI N14.6
B2.2.2	Cranes and Hoists	Flame Cut Holes	A-759	Air at 100% Relative Humidity and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA Specification # 70 IN 96-26 Recent Programs with Overhead Cranes
B2.2.3	Cranes and Hoists	Rail	A-759	Air at 100% Relative Humidity and 49°C (120°F)	Loss of Material	Wear	10 CFR 54.4 10 CFR 50.65 ASME B 30.2 ASME B 30.16

VII AUXILIARY SYSTEMS

B2. OVERHEAD HEAVY LOAD HANDLING SYSTEMS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Crane Manufacturers Association of America (CMAA) Specification #70, "Specification for Electric Overhead Traveling Cranes"	Although the number of load cycles for nuclear power plant cranes is usually well below the threshold addressed in CMAA #70, components may have been designed or evaluated for a forty (40) year life, or they may have been designed to a specific Service Class, as defined in CMAA #70. If it is determined that fatigue of cranes is a time-limited aging analysis for the period of extended operation, an evaluation must be performed in accordance with §54.21(c)(1).	Yes, if fatigue of crane girders is determined to involve a TLAA.
Crane Inspection Program	The regulatory basis for inspecting the rails and girders of cranes and hoists is found in 29 CFR Ch XVII, §1910.179. An acceptable Crane Inspection Program will meet the requirements of ASME B30.2 specification for Overhead and Gantry Cranes or NUREG-0612. Evaluation of the Crane Inspection Program against the ten (10) criteria for an acceptable aging management program follows: (1) **Scope of Program**: The scope of the program includes the rails and girders of cranes and hoists within license renewal. (2) **Preventive Actions:** No preventive actions are specified and the staff has found this acceptable. (3) **Parameters Monitored/Inspected:** The steel surfaces of the rails and girders are monitored for loss of material due to corrosion and wear of the rails. (4) **Detection of Aging Effects:** The rails and girders are visually inspected for degradation and functional tests are also performed to ensure their integrity. (5) **Monitoring and Trending:** Monitoring and trending are not identified for this program and the staff has found this acceptable. (6) **Acceptance Criteria:** The acceptance criteria is no unacceptable visual indication of loss of material due to corrosion or wear. (7) **Corrective Actions:** Site corrective actions are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (8) **Confirmation Process:** The confirmation process is included as part of the corrective actions that are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (9) **Administrative Controls:** Administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (10) **Operating Experience:** Industry experience has not identified any instances of loss of material of rails and girders that has resulted in loss of intended functions. In an isolated case, cracks were found in crane rails due to field modifications during installation. The cracks were arrested and have not effected the structural or functional performance of the crane. This is considered an isolated incidence. The program has been shown to detect and correct any degradation such that the intended functions of the rails and girders will be maintained consistent with the CLB for the period of extended operation.	No
	If it is determined that fatigue of cranes involves a Time-Limited Aging Analysis (TLAA) for the period of extended operation, an evaluation must be performed in accordance with §54.21(c)(1).	Yes, if fatigue of flame-cut holes is determined to involve a TLAA.
Crane Inspection Program or Maintenance Rule Structures Monitoring Program in accordance with OSHA requirements.	*Same as B2.2.1, Loss of Material for Cranes and Hoists*	No