Attachment

RES STAFF COMMENTS ON

DRAFT

GENERIC AGING LESSONS LEARNED

(GALL) REPORT



Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission

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General Comments

1. Organization of columns in tables

It is recommended that the columns labeled as "Aging Effect" and "Aging Mechanisms" be switched. The switch would make a logical progression from "Materials" to "Environment" to "Aging Mechanisms" to "Aging Effects."

2. References

References cited in columns do not correlate one-on-one, with the "Region of Interest'. For example, in Section VI on Electrical Components, Page A-3, the Region of Interest is "conductor". While all cited references basically pertain to environmental qualification (EQ) in general, and specifically to insulating materials. It is desirable that for "conductors" references pertaining only to "conductors" be provided.

Many of the references cited in column 8 on individual components and structures are not included in the overall Reference sections at the end of the individual chapter. For completeness it is desirable to provide cross references.

3. Headings

Headings for columns on "Existing Aging Management Program (AMP)," "Evaluation and Technical Basis," and "Further Evaluation" do not match their respective structure or component under evaluation. It is recommended that headings for columns be made consistent with the structure or component under evaluation.

4. Column for "Existing Aging Management Program (AMP)"

The program description in the column should focus on the specific component or structure under evaluation and should not describe the program in generality.

5. Standard Review Plan and the GALL report

It would be of interest to know how the GALL report will be referenced in the SRP. Specifically, the treatment of augmented (a) programs for aging management for renewed license period.

6. Standard Review Plan and the GALL report

For a given component and structure under aging evaluation and for giving credit(s) to existing program(s) for aging management, it would be desirable to cross reference columns in the GALL report to appropriate corresponding sub-sections of the Standard Review Plan (SRP).

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Specific Comments

CHAPTER I

INTRODUCTION

Background

By letter dated March 3, 1999, the Nuclear Energy Institute (NEI) documented the industry's views on how existing plant programs and activities should be credited for license renewal. The "credit" issue was: to what extent should the staff review existing programs relied on for license renewal, to conclude that an applicant has demonstrated reasonable assurance that such programs will be effective in managing effects of aging on the functionality of structures and components in the period of extended operation. In a staff paper, SECY-99-148, "Credit for Existing Programs for License Renewal," dated June 3, 1999, the staff described options and provided a recommendation for crediting existing programs to improve the efficiency of the license renewal process.

By staff requirements memorandum (SRM) dated August 27, 1999, the Commission approved the staff's recommendation and directed the staff to focus the staff review guidance in the standard review plan (SRP) for license renewal on areas where existing programs should be augmented for license renewal. The staff would develop a "Generic Aging Lessons Learned (GALL)" report which evaluates existing programs generically to document the basis for determining when existing programs are adequate without change and when existing programs should be augmented for license renewal. The GALL report would be referenced in the SRP as a basis for determining the adequate of existing programs.

GALL Report

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This report builds on a previous report, NUREG/CR-6490, "Nuclear Power Plant Generic Aging Lessons Learned (GALL)," which is a systematic compilation of plant aging information. NUREG/CR-6490 was based on information in over 500 documents: Nuclear Plant Aging Research (NPAR) program reports sponsored by the Office of Nuclear Regulatory Research, Nuclear Management and Resources Council (NUMARC, now NEI) industry reports addressing license renewal, licensee event reports (LERs), information notices, generic letters, and bulletins.

The current effort reviews the aging effects on components and structures, identifies the relevant existing programs, and evaluates program attributes to manage aging effects for license renewal. This report is prepared with the technical assistance of the Argonne National Laboratory and the Brookhaven National Laboratory. As directed in the SRM, this report has the benefit of the experience from the staff members who conducted the review of the initial license renewal applications. Also, as directed in the SRM, the staff is seeking stakeholders' participation in the development of this report.

The results of the GALL effort are presented in a table format. The table column headings are: Item, Structure and Component, Region of Interest, Material, Environment, Aging Effects, Aging Mechanism, References, Existing Aging Management Program, Evaluation and Technical Basis, and Further Evaluation. Program attributes are evaluated for their adequacy

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in managing certain aging effects for particular structures and components. The evaluation is based on the review of these 10 attributes: scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. If the evaluation determines that a program is adequate to manage certain aging effects for a particular structure and component without change, the "Further Evaluation" entry would indicate no further staff evaluation is recommended for license renewal. Otherwise, it would recommend area(s) where the staff should focus its review.

Application of GALL Report

The GALL report is a basis document to the SRP that provides staff guidance in reviewing a license renewal application. License renewal applicants would submit information on specific existing programs that are relied on to manage certain aging effects for particular structures and components and would reference the GALL report as basis for program adequacy. The staff would follow the guidance in the SRP to verify that the applicants have identified the appropriate existing programs. The main focus of the staff review would be on augmented programs for license renewal. The SRP incorporating the GALL report is to be developed.

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CHAPTER II

CONTAINMENT STRUCTURES

Major Containment Structures

- A. Pressurized Water Reactor (PWR) Containments
- B. Boiling Water Reactor (BWR) Containments

CHAPTER II A

PRESSURIZED WATER REACTOR (PWR) CONTAINMENTS

II. CONTAINMENT STRUCTURES

A. PWR Containments

/

A1. Concrete Containments (Reinforced and Prestressed) Existing Aging Management Program 4 Technical Racis .

| Existing Aging Management Program | Evaluation and Technical Basis | Evaluation | |
|--|--|------------------------|------------|
| (AMP) Same as A1.2, Corrosion Aging | This aging effect is not significant for the liner itself. See | No. | |
| Mechanism | Item A3.1. | | |
| Mechanism | | | |
| NUREG-1611 identifies stress corrosion | | | |
| cracking of the steel liner as non- | • | | |
| significant. | | | |
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| | | No. | 4 |
| Same as A1.1, Freeze/Thaw Aging | Same as A1.1, Freeze/Thaw Aging Mechanism | | |
| Mechanism | | 90 | |
| | will full plus in will | 11- | |
| Note: 10CFR50.55a and IWL do not apply | Add the following: IWL provides for monitoring the plates and anchoring component If the condition and environment address gallery may lead to degre | | |
| to bonded post-tensioning systems. | Hoo I a Ditte | bearing | |
| NUREG-1611 identifies | That are villes for monitoring th | | 4 |
| 10CFR50.55a/IWL for managing tendon | TWE STONIGES TOT | nte. | |
| and anchor corrosion. | plates and anchoring comporter | 10 mar + | inden |
| | I I the condition and environment | dt that | 114050 |
| | It is work have hered to deare | detion of | - there |
| | access gallery muy lead it | 6 | inponents. |
| NUREG-1522 and IN 99-10 describe | | | |
| conditions in tendon access galleries | access gallery (e.g., moisture and numarity) is a prudent | Plant- | |
| conducive to corrosion of tendon | I may to manage the degradation [LC., CORDSION] OF | specific considera- | |
| anchorage components | bearing plates and other vertical tendon anchorage | tion of the | |
| | components | tendon | |
| | | access | 1 |
| } | | gallery | |
| | • | should be | |
| | | evaluated. | |
| | | | |
| | | | |
| | | 1 | 1 |
| | | | |
| | | | |
| | | 1 | |
| | | | |

Further

Concrete Containments," April 13, 1999.

Aad

- NRC Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," July 1990.
- NRC Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program," September 1995.
- NRC Draft Regulatory Guide DG-1076, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," February 1999.
- NUREG-1522, "Assessment of Inservice Conditions of Safety-Related Nuclear Power Plant Structures," June 1995.
- NUREG-1611, "Aging Management of Nuclear Power Plant Containments for License Renewal," September 1997.

Nuclear Energy Institute, NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10CFR Part 50, Appendix J," Revision 0, July 26, 1995.

NRC Regulatory Guide 1.35, "Inservice Inspective of Ungrouted Tendons en Prestressed Concrete Containments," July 1990.

CHAPTER II B

BOILING WATER REACTOR (BWR) CONTAINMENTS

CHAPTER III

STRUCTURES AND COMPONENT SUPPORTS

CHAPTER III A

CLASS 1 STRUCTURES

III STRUCTURES AND COMPONENT SUPPORTS

| I STRUCTURES AND COMPORENT | actor building, PWR shield building, Control room, | Further |
|--|--|------------------|
| Existing Aging Management Program | | Further |
| Existing Aging Management Program | Evaluation and Technical Basis | Evaluation |
| IE Bulletin 80-11 | the IF Bulletin 80-11 and IN No. | NO. |
| | | Acceptable |
| IN No. 87-67: The IE Bulletin No.80-11 titled "Masonry | | · · · |
| Wall Design" was issued to address the | | for |
| concern with regard to the adequacy of | | managing |
| the design criteria used in the design of | L TAT A AC THE PROTECTION OF MADULAT TO AND THE | aging effec |
| masonry walls and the apparent lack of | and important to safety bill hot covered by the in | |
| iesign criteria coordination between the | | |
| structural and piping/equipment design | I water at non-safety-related system to safety- | |
| groups. It required all operating nuclear | I I I I I I I I I I I I I I I I I I I | |
| groups. It required an operating nuclear | a fate aloted cyclems in these cases, if the vormounder | |
| power plants to address this issue by 1) | have be established that the masoning walls were | |
| dentifying all masonry walls in close | i strated and mointained in accordance with the | |
| proximity or having attachments from | I manufactor and a of the TR Bulletin 80-11 and the historics | |
| safety-related piping or equipment, and 2) | have the IN No 87-57. The Subject waits should | |
| performing reevaluation of design | he treated as within the scope encourpassed by and the | |
| adequacy of the walls and the | Dullatin 90,11 and IN No. 87-67, [2] Preventive | |
| construction practices employed in the | A AT THE THE THE NO. 87-67 CALLED TOP & DETROLL | ł |
| construction of these walls. | the licensee to morning by the licensee to monitor any | |
| - THE Learner Motion (IN) No. 87- | and the senditions (e o moriar clacks) of masoning "out | |
| The NRC Information Notice (IN) No. 87- | to coortain that the level of structural aucquacy w | |
| 57 titled "Lessons Learned from Regional | -List ligenceas committed is maintailieu. It also | |
| nspection of Licensee Actions in | that the licence's periodic surveillance | |
| Response to IE Bulletin 80- 11"documented the inspection experience | the effects of clacking in manoring the effects of clacking in manoral | |
| 1ª documented the inspection experience | walls should include: 1) an analysis of the probable | |
| conducted by the NRC staff with respect | | |
| to plant-specific implementation and corrective actions in executing the IE | the renair efforts for these cracks of | |
| Sulletin 80-11 requirements. During the | i a standar of the structures succuded of the structures | |
| nspections performed at several plants, a | | |
| number of deficiencies having the | | |
| potential for affecting plant safety were | CTACKING III UIGALANY VIII | [|
| dentified. In each case of the identified | - Cate malated maganer Walls FRAL AIC HOLICHING | L |
| denuned. In each case of the Astronyce | TT | \sim |
| by the licensee. The IN No. 87-67 | man augrested by the IN No. 87-07. IV Crk 50.00(4) | |
| concluded that the recurring nature of | The second of the checkly clicks vi | |
| some of the observed cracks may justify | The second provide the assessed all ICHSL CYCLY LWO | |
| he need for a periodic surveillance | 2) Darameters Monttored/Inspected. Inc. It ite | |
| rogram to ensure that the level of | or criteretical creeks in masoniv wans, specially | |
| tructural adequacy to which licensees | in the formed molio or being the Drimary are-Iclause | 1 |
| committed is maintained. | to me detion mechanisms for masonry wall subcourse and | |
| ominiciel is maintained. | in Some and discussed the calculate | |
| pplicant should develop a program with | Lite and detradation inclusions imparts | a |
| rocedural controls requiring engineering | the state of the spicit state when the spicit state of the spicit | 2 |
| otification, reevaluation, and periodic | the ways have a thorner of by the ways, it the choose of | Z |
| aspections to ensure that the structural | | forced walls, |
| tegrity of these walls is maintained. IN | | x |
| o. 87-67 states that these programs | the second stated increasing Didding Norward and | |
| o. 87-67 states that the physical condition of the | TO Destingting 90-11 and IN NO. 8/-0/ Should provide | 3.1 |
| alls, such as lack of mortar cracking | | especially unrem |
| nd boundary conditions, remain as | malated definiencies (e.g. mortar cracks) unat count | 1 2 |
| nalyzed. Therefore, a periodic inspection | a stantially compromise a masonicy wan s with the | 1 3 |
| nd surveillance program instituted by | Annetions will be identified. (5) Constorting wrone | |
| he licensee in accordance with the | And Alexandrea IN No. 27-57 SUPPOSICUL DELIVOUS | |
| nsights provided in IN No. 87-67, | | 1 |
| onstitutes part of a aging management | manten analys) of masonity waus to aster tant that the | , š |
| rogram for masonry walls that were | Land of etractural addillacy to wilkin menses | 15 |
| covered by IE Bulletin 80-11. Such | and a second in the second sec | N @ |
| overed by it buildun ou-11. Such | a second a second to second the second to th | N. 1 |
| program, if properly managed, should | should be met with corresponding corresponding | |
| provide reasonable assurance that any recurrence of aged-related deficiencies | | |
| | action. The periodic inspection age-related degradation. | 1 · · · |
| could not on agoin that could not ontially | Dredictability of the catche of age and the catche of a | 1 |
| e.g. mortar cracks) that could potentially compromise masonry wall's intended | predictability of the extent of age | [|

| Existing Aging Management Program | actor building with steel superstructure) | Further Evaluatio |
|---|--|---|
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Same as |
| Same as A1.1, Settlement Aging Mechanism | Same as A1.1, Settlement Aging Mechanism | A1.1, Settlemen Aging |
| | | Mechanis |
| | | |
| | | |
| ame as A1.1, Erosion of Porous Concrete subfoundation Aging Mechanism | Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism | Same as A1. 1, Erosion of Porous Concrete Subfoundu tion Aging Mechanist |
| | , grating, | |
| ame as A1.2, Corrosion Aging lechanism | Same as A1.2, Corrosion Aging Mechanism <u>Note:</u> Fer NUREG-1557, aging management of the metal siding and roofing for loss of material due to corrosion is an unresolved issue. | Same as A1.2, Corrosion Aging Mechanist |
| | | |
| | | Same as |
| ame as A1.3, Cracking due to Restraint; winkage; Creep; Aggressive Environment | Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment | A1.3, Cracking due to Restraint; Shrinkage Creep; |
| - | | Aggressiv Environ- ment |
| | · | |

III STRUCTURES AND COMPONENT SUPPORTS

فسنعد

CHAPTER III B

COMPONENT SUPPORTS

III. STRUCTURES AND COMPONENT SUPPORTS

B2 Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and

| B2 Supports for Cable Trays, Condui Components | | Further |
|---|---|---|
| Existing Aging Management Program | t much sized Regis | Evaluation |
| (AMP) | Evaluation and Technical Basis | No, if within |
| Maintenance Rule | An applicant for License Renewal may reference its | the scope of |
| (10CFR50.65) | Structures Monitoring Program developed to meet the | the |
| -Structures monitoring | requirements of the Maintenance Rule (10CFR50.65), as | applicant's |
| , | further defined and clarified by NUMARC 93-01, Revision | MR |
| The "Maintenance Rule" is intended to | 2 and Regulatory Guide 1.160, Revision 2. The | Structures |
| monitor the effectiveness of maintenance | guidelines contained in these documents provide an | Monitoring |
| activities in nuclear power plants. It | adequate foundation for formulating licensee-specific MR | Program. |
| focuses on the adequacy of preventive | Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures | Otherwise, |
| and corrective maintenance activities. | License Renewal should commin that its interfects of Monitoring "rogram adequately manages the effects of | justification |
| | Monitoring "rogram anequately manages the three and aging so that the intended functions of structures and | for non- |
| 10CFR50.65 requires each licensee to | aging so that the internet initiaties of selected with component supports will be maintained, consistent with | applicability |
| develop and implement a program to | the current licensing basis, for the period of extended | or details of |
| verify that the current licensing basis | operation. The applicant should assess its MR | plant- |
| (CLB) is maintained through periodic | Structures Monitoring Program against the attributes of | specific |
| testing and inspection of critical plant | an acceptable aging management program. Evaluation | program |
| structures, systems, and components. | of MR Structures Monitoring against the ten (10) criteria | need to be |
| The nuclear power industry, through the | for an acceptable aging management program lonows: | evaluated. |
| Nuclear Energy Institute (NEI), has | (1) Scope of Program: The MR Structures Monitoring | |
| developed guidance for the development of | Brown scone is defined by the licensee; it may or may | |
| such programs. Rev. 2 to NUMARC 93-01 | not encompass all structures and structural components | |
| was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in | which must be reviewed for License Renewal. The | 2 21 |
| March 1997, identifies this document as | applicant should clearly identify the structure/aging | structural elements galvanizad cuatings |
| an acceptable approach to meeting the | offect (aging mechanism combinations which are | r a |
| objectives of 10CFR50.65. | managed by the MR Structures Monitoring Program. For | 33 |
| UDJECTIVES OF TOOL TOOL TOOL TOOL TOOL | notential structure/aging effect/aging mechanism | 10 |
| Revision 2 to NUMARC 93-01 added | combinations not covered by the MR Structures | 38 |
| Section 10.2.3, "Monitoring the Condition | Monitoring Program, the applicant should justify that it | 2.6 |
| of Structures." It emphasizes the | is not significant for the applicant's plant, or identity the | 12 12 |
| importance of monitoring the condition of | applicable aging management program. | Nº 2 |
| plant structures. Quoting from this | (2) Preventive Actions: Inspection and maintenance of | 88 |
| report. "Monitoring the condition of | (2) Interest coatings which inhibit corrosion of steel | 1 2 |
| structures, like systems and components, | structural elements should be included as part of Structures Monitoring. No specific preventive actions | 2000 |
| should be predictive in nature and | are identified for other aging mechanisms. (3) | 1. 50 |
| provide early warning of degradation. The | are identified for other aging internations. (5) Parameters Monitored/Inspected: For MR Structures | カナ |
| haseline condition of plant structures | Monitoring Programs, specification of the parameters | 32 |
| should be established to facilitate | monitoring Programs, specification of the per- | t |
| condition monitoring activities." | licensee. For License Renewal, the specific parameters | 2.0 |
| the second protestanting of | monitored or inspected should be linked to degradation | 150 |
| Regulatory Position 1.5 "Monitoring of | of intended function(s) and should detect the presence | 5 3 |
| Structures" in RG1.160, Rev. 2, states | and extent of aging effects. The inspection scope should | nd unistrut or similar structural correctors of galvaniza |
| that the Maintenance Rule does not treat | include holt-tightness checks for concrete expansion | 2.5 |
| structures differently from systems and | anabare subjected to vibratory loads/ The applicant | alt |
| components. The attributes of an | should confirm that its specification of parameters to be | |
| acceptable structure monitoring program | monitored or inspected is consistent with meeting | |
| are discussed. | Criterion 3. | |
| Standard Manitoring Desgrame | (4) Detection of Aging Effects: Detection of aging | |
| Structures Monitoring Programs | effects before there is loss of intended function requires | |
| developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be | that periodic inspection be conducted, utilizing | |
| IUCEROU.OD (maintaine Rule) can be | appropriate inspection methods implemented by quanned | |
| credited for addressing aging management of structures and structural | inspectors. Under the Maintenance Rule, the inspection | |
| components to meet the requirements of | schedule, inspection methods and inspector | |
| componients of meet the requirements of | qualifications are defined by the individual licensees. An | × |
| 1000054 (License Denemal) License | | |
| 10CFR54 (License Renewal). License | applicant for License Renewal should confirm that these | |
| 10CFR54 (License Renewal). License | applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are | |
| 10CFR54 (License Renewal). License | applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4. | |

Draft December 6, 1999

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III. STRUCTURES AND COMPONENTS SUPPORTS B4. Supports for Miscellaneous Mechanical Equipment (e.g., Cranes, EDG, HVAC System Components)

| RA Supports for Miscellaneous Mechan | nical Equipment (e.g., Cranes, EDG, HVAC System compo- | Dundhan |
|---|---|---|
| B4 Supports for miscenarious meeting Existing Aging Management Program | 1 | Further Evaluation |
| (AMP) | Evaluation and Technical Basis | No, if within |
| Maintenance Rule | An applicant for License Renewal may reference its | the scope of |
| (10CFR50.65) | Structures Monitoring Program developed to meet the | the |
| -Structures monitoring | and the Maintenance Rule (IUCFR00.00), as | applicant's |
| -OR ACTINGO MAINWARD | further defined and clarified by NUMARC 93-01, REVISION | MR |
| The "Maintenance Rule" is intended to | 2 and Regulatory Guide 1.160, Revision 2. The | Structures |
| monitor the effectiveness of maintenance | midelines contained in these documents provide an | Monitoring |
| activities in nuclear power plants. It | adequate foundation for formulating licensee-specific MR | Program. |
| focuses on the adequacy of preventive | Structures Monitoring Programs. An applicant for | Otherwise, |
| and corrective maintenance activities. | Licence Renewal should confirm that its MR Structures | justification |
| and corrective manifestation country | Manitaring Program adequately manages the effects of | for non- |
| 10CFR50.65 requires each licensee to | aging so that the intended functions of structures and | applicability |
| develop and implement a program to | appropriet supports will be maintained, consistent with | or details of |
| verify that the current licensing basis | the current licensing basis, for the period of externicu | |
| (CLB) is maintained through periodic | appropriate The applicant should assess its MK | plant- |
| testing and inspection of critical plant | Structures Monitoring Program against the attributes of | specific program |
| structures, systems, and components. | an acceptable aging management program. Evaluation | need to be |
| The nuclear power industry, through the | of MP Structures Monitoring against the ten (10) chiefia | evaluated. |
| Nuclear Energy Institute (NEI), has | for an accentable aging management program follows. | evaluated. |
| developed guidance for the development of | (1) Seene of Program: The MR Structures Monitoring | |
| such programs. Rev. 2 to NUMARC 93-01 | Brown scope is defined by the licensee; it may of may | |
| was issued in April 1996. USNRC | not encompass all structures and structural components | 12 : |
| Regulatory Guide 1.160, Rev. 2, issued in | which must be reviewed for License Renewal. The | 2.6 |
| March 1997, identifies this document as | applicant should clearly identify the structure/aging | i similar structural elements base of galvanized coatrigs. |
| an acceptable approach to meeting the | effect (aging mechanism combinations which are | a e |
| objectives of 10CFR50.65. | managed by the MR Structures Monitoring Program. For | 00 |
| ODICCUACE OF TOOL TOOL TOOL OO | notential structure/aging effect/aging mechanism | 2-2 |
| Revision 2 to NUMARC 93-01 added | combinations not covered by the MR Structures | tà ét |
| Section 10.2.3, "Monitoring the Condition | Monitoring Program, the applicant should justify that it | 10 2 |
| of Structures." It emphasizes the | is not significant for the applicant's plant, or identity the | 12 8 |
| importance of monitoring the condition of | applicable aging management program. | 10 2 |
| plant structures. Quoting from this | (2) Preventive Actions: Inspection and maintenance of | 30 |
| report, "Monitoring the condition of | protective coatings which inhibit correston of steel | 1 is a |
| structures, like systems and components, | structural elements should be included as part of | To 3. |
| should be predictive in nature and | Structures Monitoring. No specific preventive actions | 24 |
| provide early warning of degradation. The | are identified for other aging mechanisms. | 20 |
| baseline condition of plant structures | (2) Decemptors Monitored / Inspected: For MK | 1 8 |
| should be established to facilitate | Structures Monitoring Programs, Specification of the | 1 0 |
| condition monitoring activities.* | parameters monitored or inspected is the responsibility | 3. 21 |
| WEBRINGHT WANNESS | of the licensee For License Renewal, the specific | 5 8 |
| Regulatory Position 1.5 "Monitoring of | parameters monitored or inspected should be linked to | 23 |
| Structures" in RG1.160, Rev. 2, states | degradation of intended function(s) and should detect the | and unistratos |
| that the Maintenance Rule does not treat | presence and extent of aging effects. The inspection | 2 3 |
| structures differently from systems and | scope should include bolt-tightness checks for concrete | |
| components. The attributes of an | expansion anchors subjected to vibratory loads, The | 4 |
| acceptable structure monitoring program | applicant should confirm that its specification of | ł |
| arc discussed. | parameters to be monitored or inspected is consistent | 1 |
| | with meeting Criterion 3. | |
| Structures Monitoring Programs | (4) Detection of Aging Effects: Detection of aging | l |
| developed to meet the requirements of | effects before there is loss of intended function requires | l |
| 10CFR50.65 (Maintenance Rule) can be | that periodic inspection be conducted, utilizing | l |
| credited for addressing aging | communiate inspection methods implemented by quannet | |
| management of structures and structural | inspectors. Under the Maintenance Rule, the inspection | |
| components to meet the requirements of | schedule inspection methods and inspector | |
| 10CFR54 (License Renewal). License | qualifications are defined by the individual licensees. An | 1 |
| INCLUDE (FREEDE VOIE MOI). THE MAN | applicant for License Renewal should confirm that these | |
| | elements of its MR Structures Monitoring Program are | |
| | consistent with meeting Criterion 4. | la de la seconda |
| | | l |
| | i . | I |

CHAPTER IV (12/06/99)

REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

Major Plant Sections

- A1. Reactor Vessel (Boiling Water Reactor)
- A2. Reactor Vessel (Pressurized Water Reactor)
- B1. Reactor Vessel Internals (Boiling Water Reactor)
- B2. Reactor Vessel Internals (PWR) Westinghouse
- B3. Reactor Vessel Internals (PWR) Combustion Engineering)
- B4. Reactor Vessel Internals (PWR) Babcock & Wilcox
- C1. Reactor Coolant Pressure Boundary (Boiling Water Reactor)
- C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)
- D1. Steam Generator (Recirculating)
- D2. Steam Generator (Once-Through)

A1. Reactor Vessel (Boiling Water Reactor)

- A1.1 Top Head Enclosure
 - A1.1.1 Top Head
 - A1.1.2 Nozzles (Vent, Top Head Spray or RCIC, and Spare)
 - A1.1.3 Head Flange
 - A1.1.4 Closure Studs and Nuts
 - A1.1.5 Vessel Flange Leak Detection Line
- A1.2 Vessel Shell
 - A1.2.1 Vessel Flange
 - A1.2.2 Upper Shell
 - A1.2.3 Intermediate (Nozzle) Shell
 - A1.2.4 Intermediate (Beltline) Shell
 - A1.2.5 Lower Shell
 - A1.2.6 Beltline Welds
 - A1.2.7 Attachment Welds
- A1.3 Nozzles
 - A1.3.1 Main Steam
 - A1.3.2 Feedwater
 - A1.3.3 High Pressure Coolant Injection (HPCI)
 - A1.3.4 High Pressure Core Spray (HPCS)
 - A1.3.5 Low Pressure Core Spray (LPCS)
 - A1.3.6 CRD Return Line
 - A1.3.7 Recirculating Water (Inlet & Outlet)
 - A1.3.8 Low Pressure Coolant Injection (LPCI) or RHR Injection Mode

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A1.3.9 Isolation Condenser Supply

A1.4 Nozzles Safe Ends

- A1.4.1 High Pressure Core Spray (HPCS)
- A1.4.2 Low Pressure Core Spray (LPCS)
- A1.4.3 CRD Return Line
- A1.4.4 Recirculating Water (Inlet & Outlet)
- A1.4.5 Low Pressure Coolant Injection (LPCI) or RHR Injection Mode

A1.5 Penetrations

- A1.5.1 CRD Stub Tubes
- A1.5.2 Instrumentation
- A1.5.3 Jet Pump Instrument
- A1.5.4 Standby Liquid Control
- A1.5.5 Flux Monitor
- A1.5.6 Drain Line
- A1.6 Bottom Head
- A1.7 Control Rod Drive Mechanism

A1.7.1 Housing

A1.8 Support Skirt and Attachment Welds

A2. Reactor Vessel (Pressurized Water Reactor)

- A2.1 Closure Head
 - A2.1.1 Dome
 - A2.1.2 Head Flange
 - A2.1.3 Stud Assembly
 - A2.1.4 Vessel Flange Leak Detection Line
- A2.2 Control Rod Drive Mechanism
 - A2.2.1 Pressure Housing
- A2.3 Nozzles
 - A2.3.1 Inlet
 - A2.3.2 Outlet
 - A2.3.3 Safety Injection (on some)
- A2.4 Nozzle Safe Ends
 - A2.4.1 Inlet
 - A2.4.2 Outlet
 - A2.4.3 Safety Injection (on some)
- A2.5 Shell
 - A2.5.1 Upper (Nozzle) Shell
 - A2.5.2 Intermediate & Lower Shell
 - A2.5.3 Vessel Flange
- A2.6 Core Support Pads

A2.7 Bottom Head

A2.7.1 Dome

A2.8 Penetrations

- A2.8.1 CRD Mechanism
- A2.8.2 Instrumentation
- A2.8.3 Leakage Monitoring Tubes
- A2.9 Pressure Vessel Support
 - A2.9.1 Skirt Support
 - A2.9.2 Cantilever/Column Support
 - A2.9.3 Neutron Shield Tank

B1. Reactor Vessel Internals (Boiling Water Reactor)

- B1.1 Core Shroud, Shroud Head, and Core Plate
 - B1.1.1 Core Shroud Head Bolts
 - B1.1.2 Core Shroud (Upper, Central, Lower)
 - B1.1.3 Core Plate
 - B1.1.4 Core Plate Bolts
 - B1.1.5 Access Hole Cover
 - B1.1.6 Shroud Support Structure
 - B1.1.7 Standby Liquid Control Line
 - B1.1.8 LPCI Coupling
- B1.2 Top Guide
- B1.3 Feedwater Spargers
 - B1.3.1 Thermal Sleeve
 - B1.3.2 Distribution Header
 - B1.3.3 Discharge Nozzles
- B1.4 Core Spray Lines and Spargers
 - B1.4.1 Core Spray Lines (Headers)
 - B1.4.2 Spray Ring
 - B1.4.3 Spray Nozzles
 - B1.4.4 Thermal Sleeve
- B1.5 Jet Pump Assemblies
 - B1.5.1 Thermal Sleeve
 - B1.5.2 Inlet Header
 - B1.5.3 Riser Brace Arm

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- B1.5.4 Holddown Beams
- B1.5.5 Inlet Elbow
- B1.5.6 Mixing Assembly
- B1.5.7 Diffuser
- B1.5.8 Castings
- B1.6 Fuel Supports & CRD Assemblies
 - B1.6.1 Orificed Fuel Support

B1.7 Instrument Housings

- B1.7.1 Intermediate Range Monitor (IRM) Dry Tubes
- B1.7.2 Low Power Range Monitor (LPRM) Dry Tubes
- B1.7.3 Source Range Monitor (SRM) Dry Tubes

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

| | | VESSEL INTERI | | Environ | nging | Aging | | |
|-------|-----------------------------|--------------------------------|---------------------------------------|--------------------------------|-----------------------------------|-----------|--|-----|
| | Structure and | Region of | Material | ment | Effect | Mechanism | References | |
| tem | Component | Interest | Wateriai | ment | ····· | | | |
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| | | | | | | | | TAS |
| | | | | | | | | |
| | | | | | <u> </u> | SCC | ASME Section XI, | |
| .1.5 | Core Shroud, Shroud Head | Access Hole Cover | Alloy 600. Alloy 82 & 182 welds | 288°C. High-Purity Water | Crack Initiation and Growth | Suc | 1989 Edition. GE SIL 462 Sup. 3. | |
| | and Core Plate | | 162 weids | | | | BWRVIP-29. EPRI TR-103515. ASME Section XI. | |
| 1.1.6 | Core Shroud, Shroud Head | Shroud Support | | 288°C, High-Purity | Crack Initiation | SCC | ASME Section A. 1989 Edition. GE SIL 462 Sup. 3. | |
| | and Core Plate | Structure (Shroud | 182 welds | Water | and Growth | | GE 311 402 04p. 0.1 BWRVIP-29. EPRI TR-103515. | |
| | | Support Cylinder, Shroud | | | | | BWRVIP-38. BWRVIP-52. | |
| | | Support Plate, Shroud | | | | | Supporting BWRVIP: | |
| | | Support Legs) | | | | | BWRVIP-03. BWRVIP-06. | |
| | | | | | | • | BWRVIP-14. BWRVIP-44. | |
| | | | | | | | BWRVIP-45. BWRVIP-59. BWRVIP-60. | |
| | | | | | | | BWRVIP-62. | |
| | | | | | | | Operating Experience NRC IN 88-03. | |
| | | | | | | | NRC IN 92-57. | |
| | | | | | | | | |
| | | | | | | | | |
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| IV | REAC | TOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM |
|----|-------------|---|
| | B1 . | REACTOR VESSEL INTERNALS (Boiling Water Reactor) |

| Existing | Evaluation and Technical Basis | Further Evaluation |
|---|---|--|
| Aging Management Program (AMP) Same as for the effect of Stress Corrosion Cracking on Item B1.1.6 shroud support structure. | Same as for the effect of Stress Corrosion Cracking on Item B1.1.6 shroud support structure. | Yes, BWRVIP Guideline |
| Visual inspection (VT-3) is performed according to ASME Section XI, IWB- 2500, category B-N-2. Guidance for enhanced VT-1 inspections and UT inspections in plant specific programs. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in TR-103515 and BWRVIP-29 to minimize the potential of crack initiation and growth. Plant programs also may include water chemistry measures such as strict controls on conductivity, hydrogen addition, and use of noble metal additions to reduce electrochemical potential. BWRVIP guideline is under staff review. | (1) Scope of Program: The program includes preventive measures to mitigate SCC. inservice inspection [IS] to monitor the effects of SCC on the intended function of the components. and repair and/or replacement as needed to maintain the capability to perform the intended function. (2) Preventive Actions: Maintaining high water purify (many BWRs now operate at <0.15 µS/cm²) reduces susceptibility to SCC. Hydrogen additions are effective in reducing electrochemical potentials in the recirculation piping system, but are less effective in the core region. Noble metal additions through a catalytic action appear to increase the effectiveness of hydrogen additions in the core region. but only limited date are available at present to domentate their effectivenese. (3) Parameters Monitored/Inspected: Inspection and flaw evaluation are to be performed in accordance with referenced BWRVIP guideline, as approved by the NRC staff. (4) Detection of Aging Effects: Degradation due to SCC can not occur without crack initiation and growth. (5) Monitoring and Trending: Inspection schedule in accordance with applicable, approved BWRVIP guideline is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with applicable, approved BWRVIP guideline. (7) Corrective Actions: The corrective action proposed by the BWRVIP is under staff review. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be acquate for the period of license renewal. (10) Operating Experience: Cracking has occurred in a number of vessel internal components. Weld regions are most susceptible, although ti s not clear whether this is due to sensitization and/or imputites associated with the welds or the high residual stresses in the weld regions. | Yes, BWRVIP Guideline Yes. BWRVIP Guideline |
| Visual inspection (VT-3) is performed according to ASME Section XI, IWB- 2500, category B-N-2. Guidance for enhanced VT-1 inspections and UT nspections in plant specific programs. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in TR-103515 and BWRVIP-29 to minimize the potential of crack initiation and growth. Plant | (1) Scope of Program: The program includes preventive measures to mitigate SCC, inservice inspection (ISI) to monitor the effects of SCC on the intended function of the components, and repair and/or replacement as needed to maintain the capability to perform the intended function. (2) Preventive Actions: Maintaining high water purity (many BWRs now operate at <0.15 μ S/cm ²) reduces susceptibility to SCC. Hydrogen additions are effective in reducing electrochemical potentials in the recirculation piping system, but are less effective in the core region. | Yes, BWRVIP Guideline |

B2. Reactor Vessel Internals (PWR) - Westinghouse

- B2.1 Upper Internals Assembly
 - B2.1.1 Upper Support Plate
 - B2.1.2 Upper Support Column
 - B2.1.3 Upper Support Column Bolts
 - B2.1.4 Upper Core Plate
 - B2.1.5 Upper Core Plate Alignment Pins
 - B2.1.6 Fuel Pins
 - B2.1.7 Hold-Down Spring
- B2.2 RCCA Guide Tube Assemblies
 - B2.2.1 RCCA Guide Tubes
 - B2.2.2 RCCA Guide Tube Bolts
 - B2.2.3 RCCA Guide Tube Support Pins
- B2.3 Core Barrel
 - B2.3.1 Core Barrel
 - B2.3.2 Upper Core Barrel Flange
 - B2.3.3 Core Barrel Nozzles
 - B2.3.4 Thermal Shield
- B2.4 Baffle/Former Assembly
 - B2.4.1 Baffle/Former Plates
 - B2.4.2 Baffle/Former Bolts
- B2.5 Lower Internal Assembly
 - B2.5.1 Lower Core Plate
 - B2.5.2 Fuel Pins

- B2.5.3 Lower Support Plate
- B2.5.4 Lower Support Plate Column
- B2.5.5 Lower Support Plate Column Bolts
- B2.5.6 Radial Keys and Clevis Inserts
- B2.5.7 Clevis Insert Bolts
- B2.6 Instrumentation Support Structure
 - B2.6.1 Flux Thimble Guide Tubes
 - B2.6.2 Flux Thimbles

REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM IV REACTOR VESSEL INTERNALS (PWR) - Westinghouse ----

| B2. REACTOR VESSEL INTERI | NALS (PWR) - Westinghouse | Further |
|---------------------------------------|---|------------|
| Existing | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) | (1) Scope of Program: The program includes preventive | Yes |
| Visual inspection (VT-3) is performed | (1) Scope of Program. The program includes provide measures to mitigate SCC of SS components, inservice | Element 4 |
| according to Category B-N-3 of | measures to mitigate Sec of SS components, and the | should be |
| Subsection IWB, ASME Section XI | inspection (ISI) to monitor the effects of SCC on the | further |
| (edition specified in 10 CFR 50.55a). | intended function of the components, and repair and/or | evaluated |
| Primary water chemistry is monitored | replacement as needed to maintain the capability to | crainer- |
| and maintained in accordance with | perform the intended function. (2) Preventive Actions: | |
| EPRI guidelines in TR-105714 to | PWR operating chemistry limits the halogens. sulfates. | |
| minimize the potential of crack | and oxygen in the primary water to less than 0.05, 0.05. | |
| initiation and growth. | and 0.005 ppm. respectively, during operation. However, | |
| | introduction of oxygen can occur during shutdown and | |
| - | potential exists for the formation of more aggressive | |
| | chemistry conditions by radiolysis in creviced regions or | |
| | in low-flow stagnant regions. The AMP must rely upon | |
| | inservice inspection (ISI) in accordance with ASME | |
| | Section XI to detect possible degradation. (3) Parameters | |
| | Monitored/ Inspected: The AMP monitors the effects of | |
| | SCC on the intended function by detection and sizing of | |
| | cracks by ISI Table IWB-2500, category B-N-3 specifies | |
| | visual VT-3 examination of all accessible surfaces of | |
| | reactor internals. (4) Detection of Aging Effects: | |
| | Degradation due to SCC can not occur without crack | |
| | initiation and growth. VT-3 may not be adequate to detect | |
| | tight cracks. Creviced and other inaccessible regions are | |
| | difficult to inspect visually and supplementary UT or | |
| | other nondestructive examinations may be needed. | |
| | (5) Monitoring and Trending: Inspection schedule in | |
| | accordance with IWB-2400 is adequate for timely detection | |
| | of cracks (6) Acceptance Criteria: Any degradation is | |
| | evaluated in accordance with IWB-3520. (7) Corrective | |
| | Actions: Repair and replacement are in conformance with | |
| | TWB-3140. (8 & 9) Confirmation Process and | |
| | Administrative Controls: Site QA procedures, review and | |
| | approval processes, and administrative controls are | |
| | implemented in accordance with requirements of | |
| | Appendix B to 10 CFR Part 50 and will continue to be | |
| | adequate for the period of license renewal. (10) Operating | |
| | Experience: Although stainless steel components in PWRS | |
| | have generally not been found to be affected by SCC | |
| | because of low dissolved oxygen levels and control of | |
| | primary water chemistry, potential for SCC exists from | |
| | inadvertent introduction of contaminants into the | |
| | primary coolant system (IN 84-18), from the introduction | |
| | of relatively high levels of dissolved oxygen during | |
| | shutdown or from aggressive chemistries that may | |
| · · | develop in arriving regions, Cracking has occurred in 55 | |
| | boffle former holts in a number of foreign plants (in 90-11) | |
| | and has now been observed in US plants. The mechanism | |
| | of this particular cracking has not yet been resolved. | |
| time biogenetics (FT 2) is performed | (1) Scone of Program. The program includes preventive | Yes |
| Visual inspection (VT-3) is performed | measures to mitigate SCC of SS components, inservice | Element 4 |
| according to Category B-N-3 of | inspection (ISI) to monitor the effects of SCC on the | should be |
| Subsection IWB, ASME Section XI | intended function of the components, and repair and/or | further |
| edition specified in 10 CFR 50.55a). | replacement as needed to maintain the capability to | evaluated |
| Primary water chemistry is monitored | perform the intended function. (2) Preventive Actions: | 1 |
| and maintained in accordance with | PWR operating chemistry limits the halogens, sulfates. | |
| EPRI guidelines in TR-105714 to | and oxygen in the primary water to less than 0.05, 0.05, | 1 |
| minimize the potential of crack | and 0.005 ppm, respectively, during operation, which | |
| initiation and growth. | and 0.000 ppm, respectively, during optimities | |

IV B2-5 DRAFT - 12/06/99 IASCE een occur even in good water chemistry for high radiation damage levels.

| B2. REACTOR VESSEL INTERNA | ALS (PWR) - Westinghouse | Further |
|--|--|-----------|
| Existing | | Evaluatio |
| Aging Management Program (AMP) | Evaluation and Technical Basis | |
| | (continued from previous page) greatly reduces susceptibility to IASCC. However, | |
| 1 | introduction of oxygen can occur during shutdown and | |
| 1 | potential exists for the formation of more aggressive | |
| | shemistry conditions by radiolysis in creviced regions of | |
| | n low-flow stagnant regions. Also for sufficiently high | |
| | human levels IASCC can occur even in low oxygen | |
| | environments. The AMP must rely upon ISI in accordance | |
| | with ASME Section XI to detect possible degradation. | |
| 1 | (3) Parameters Monitored/Inspected: The AMP monitors | |
| -1. | the effects of SCC on the intended function by delection | |
| 8 | and sizing of cracks by inservice inspection (ISI). Table | |
| · Ir | WB-2500 category B-N-3 specifies visual v1-3 | |
| e e e e e e e e e e e e e e e e e e e | examination of all accessible surfaces of reactor | |
| ļi | internals. (4) Detection of Aging Effects: Degradation due | |
| ļt | to IASCC can not occur without crack initiation and growth. VT-3 may not be adequate to detect tight cracks. | |
| <u></u> | growth. VI-3 may not be adequate to detect again of the second se | |
|] | detecting the features of interest (crack appearance and | |
| | size) in assuring the integrity of the component, should be | |
| | specified For example, enhancement of the visual visit | |
| | examination to achieve a 1/2-mil (0.0005 in.) resolution, | |
| 1. | with the conditions (lighting and surface cleanness) for | |
| | the ISI bounded by those used to demonstrate the | |
| Ι. | resolution of the inspection technique. Creviceu regions | |
| | are difficult to inspect visually and supplementary 01 of | |
| | other nondestructive examinations may be needed. As an | |
| 4 | alternate to enhanced inspection, perform a component- | |
| | specific evaluation including a mechanical loading | |
| | assessment to determine the maximum tensile loading on the component during ASME Code Level A. B. C. and D | |
| 1 | conditions. (5) Monitoring and Trending: Inspection | |
| | schedule in accordance with IWB-2400 is adequate for | |
| 1 | timely detection of cracks. (6) Acceptance Criteria: Any | |
| | degradation is evaluated in accordance with IWB-3520. | |
| | (7) Corrective Actions: Repair and replacement are in | |
| | conformance with IWB-3140. (8 82 9) Confirmation | |
| | Process and Administrative Controls: Site GA procedures. | |
| | review and approval processes, and administrative | |
| | controls are implemented in accordance with | |
| | requirements of Annendix B to 10 CFR Part 50 and will | |
| | continue to be adequate for the period of license renewal. | |
| | (10) Operating Experience: Although the only cracking presently directly attributable to IASCC in PWRs occurred | |
| | in SS fuel cladding used in early reactors, susceptibility to | |
| | this degradation will increase as plant operating unic and | 1 |
| | hence accumulated fluence levels increase. The fole that | |
| | IASOC has played in the more recent cracking that has | |
| | occurred in SS haffle/former bolts in U.S. plants as well as | |
| | foreign plants (IN 98-11) in not yet universally agreed | 1 |
| | upon. | ↓ |
| the second or and management | Plant specific aging management program is to be | Yes |
| Plant specific aging management program. Based on EPRI TR-107521. | evaluated. The applicant must provide the basis ion | TLAA |
| estimates of void swelling vary from | concluding that void swelling is not an issue for the | |
| 14% for baffle-former assemblies over a | component or must provide an AMP. The applicant | 1; + |
| 40-y plant life to less than 3% for the | should address earbridge many 100, open | T |
| THE REAL PROPERTY AND A REAL PROPERTY A REAL PROPERTY AND A REAL P | | 1. |
| most highly irradiated sections of the | associated with swelling. | 1 |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2 REACTOR VESSEL INTERNALS (PWR) - Westinghouse

 $\underbrace{\checkmark}$

| Existing | | Further Evaluatio |
|--|---|----------------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluatio |
| Tiging managements | (continued from previous page) | |
| | internale (A) Detection of Aging Effects: Degradation due | |
| | to SCC can not occur without crack initiation and growin. | |
| | Historically the VT-3 visual examinations have not | |
| | identified bolt cracking because cracking occurs at the | |
| | juncture of the bolt head and shank, which is not | |
| | accessible for visual inspection. Creviced and other | |
| | inaccessible regions are difficult to inspect visually. | |
| | Supplementary UT examinations may be needed. | |
| | (5) Monitoring and Trending: Inspection schedule in | |
| | accordance with IWB-2400 is adequate for timely detection | |
| | of cracks. (6) Acceptance Criteria: Any degradation is | |
| | evaluated in accordance with IWB-3520. (7) Corrective | |
| | Actions: Repair and replacement are in conformance with | |
| | IWB-3140. (8 & 9) Confirmation Process and | |
| | Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are | |
| | implemented in accordance with requirements of | |
| | Appendix B to 10 CFR Part 50 and will continue to be | |
| | adequate for the period of license renewal. (10) Operating | |
| | Experience: Although stainless steel components in PWRs | |
| | have generally not been found to be affected by SUC | |
| | because of low dissolved oxygen levels and control of | |
| | primary water chemistry, potential for SCC exists from | |
| | inadvertent introduction of contaminants into the | |
| | primary coolant system (IN 84-18), from the introduction | |
| | of relatively high levels of dissolved oxygen during | |
| | shutdown or from aggressive chemistries that may | |
| | develop in creviced regions. Cracking has occurred in SS | |
| | baffle former bolts in a number of foreign plants (IN 90-11) | |
| | and has now been observed in US plants. The mechanism | |
| | of this particular cracking has not yet been resorved. SCC | |
| | has also been observed in Ni alloy (Alloy X-750) control | |
| | rod drive guide tube support pins (IN 82-29). Replacement | |
| | components with a different heat treatment appear to be | |
| | less susceptible to cracking. | |
| ame as for the effect of Stress | Same as for the effect of Stress Corrosion Cracking on | Yes |
| prosion Cracking on Items B2.1.3 | Items B2.1.3 upper support column bolts. B2.1.5 upper core | Element 4 |
| oper support column bolts, B2.1.5 | plate alignment pins, and B2.1.6 fuel pins. | should be |
| oper core plate alignment pins, and | | further |
| 2.1.6 fuel pins. | | evaluated |
| a. r. o June parte | | |
| : | | Vac |
| ant specific aging management | Plant specific aging management program is to be | Yes TLAA |
| rogram. Based on EPRI TR-107521. | are lusted. The applicant must provide the basis ion | ILAA |
| stimates of void swelling vary from | l concluding that void swelling is not an issue for the | |
| 4% for baffle-former assemblies over a | I among an must provide an AMP. The GIDLIGAN T | b / |
| 0-y plant life to less than 3% for the | change coderes contructed and 105 of averti | F 1 |
| ost highly irradiated sections of the | associated with swelling. | 1 |
| nternals at 60 y. | associater with swelling. | |
| isual inspection (VT-3) is performed | Same as the effect of Stress Relaxation on Item B2.1.7, | Yes |
| ccording to Category B-N-3 of | hold-down spring. | Elements |
| ubsection IWB, ASME Section XI. | | and 4 |
| UDSCUUIT IND, HOME OCCUPTIE. | | should b |
| | | 1 |
| | | evaluate |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2 BEACTOR VESSEL INTERNALS (PWR) - Westinghouse

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2. REACTOR VESSEL INTERNALS (PWR) - Westinghouse

| B2. REACTOR VESSEL INTERN Existing | | Further Evaluation |
|--|--|-----------------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Yes |
| Plant specific aging management program. Based on EPRI TR-107521. estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. The applicant should address loss gold at the applicant with swelling | TLAA |
| internals at 60 y. | (1) Scope of Program: The program includes inservice | Yes |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | (1) Scope of Program: The plogram includes how and repair and/or replacement as needed to maintain the capability to perform the intended function. (2) Preventive Actions: No practical preventative actions are possible. Stainless steels are susceptible to embrittlement under neutron irradiation. Fracture toughness will depend strongly on the fluence on a particular component. Components can be screened out if the maximum tensile loading on the component under ASME Code Level A. B. C. and D conditions is sufficiently low. (3) Parameters Monitored/ Inspected: The AMP monitors the effects of neutron irradiation embrittlement on the intended function of the component by detection and sizing of cracks by inservice inspection (ISI). Table IWB-2500, category B-N-3 specifies visual VT-3 examination of all accessible surfaces of reactor internals. (4) Detection of Aging Effects: Lass of finatumetics is expected to initiate at the surface and should be detectable by ISI except for some crevice regions. VT-3 may not be adequate to detect tight cracks. Also, creviced regions are difficult to inspect visually and supplementary UT or other nondestructive examinations may be needed. (5) Monitoring and Trending: Inspection schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: No instances of internals degradation have been recorded that have been definitely attributed to | |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | irradiation embrittlement. Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Wear on Items B2.1.5 upper core plate alignment pins and B2.1.6 fuel pins. | No |

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| B2. REACTOR VESSEL INTER | NALS (PWR) - Westinghouse | Further |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Same as for the effect of Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Same as for the effect of Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1, upper support plate. B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1, upper support plate. B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant should address loss of ductility associated with Void swelling. | Yes TLAA |
| Plant-specific aging management program. Historically the VT-3 visual examinations have not identified baffle/former bolt cracking because cracking occurs at the juncture of the bolt head and shank, which is not accessible for visual inspection. However, recent UT examinations of the baffle/former bolt have identified cracking in several plants. The industry is currently addressing the issue of baffle bolt cracking in the PWR Materials Reliability Project, Issues Task Group (ITG) activities to determine, develop, and implement the necessary steps and plans to manage the applicable aging effects on a plant | Plant-specific aging management program is to be evaluated. | Yes No AMP |
| specific basis. Same as for the effect of Stress Corrosion Cracking on Item B2.4.2 baffle/former bolts. | Same as for the effect of Stress Corrosion Cracking on Item B2.4.2 baffle/former bolts. | Yes No AMP |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. | Yes TLAA |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2. REACTOR VESSEL INTERNALS (PWR) - Westinghouse

| B2. REACTOR VESSEL INTER | NALS (PWR) - Westinghouse | Further |
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| Existing | Durther and Technical Basis | Evaluation |
| Aging Management Program (AMP) Visual inspection (VT-3) is performed | Evaluation and Technical Basis Same as for the effect of Neutron Irradiation | Yes |
| according to Category B-N-3 of Subsection IWB, ASME Section XI. | Embrittlement on Items B2.3.1 thru B2.3.3 core barrel, upper core barrel flange, core barrel nozzles. | Elements 3 and 4 should be further evaluated |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Stress Relaxation on Item B2.1.7 hold-down spring. | Yes Elements 3 ano 4 should be further evaluated |
| Same as for the effect of Stress Corrosion Cracking on Items B2.1.1. upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Same as for the effect of Stress Corrosion Cracking on Items B2.1.1. upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant should address lags get chilit associated with Void Swelling | Yes TLAA |
| internals at 60 y. Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B2.3.1 thru B2.3.3 core barrel, upper core barrel flange, core barrel nozzles. | Yes Elements 3 and 4 should be further evaluated |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| 50.55a), Subsection NG. Same as for the effect of Stress Corrosion Cracking on Items B2.1.3 upper support column bolts. B2.1.5 upper core plate alignment pins. and B2.1.6 fuel pins. | Same as for the effect of Stress Corrosion Cracking on Items B2.1.3 upper support column bolts, B2.1.5 upper core plate alignment pins, and B2.1.6 fuel pins. | Yes Element 4 should be further evaluated |

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2 REACTOR VESSEL INTERNALS (PWR) - Westinghouse

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| B2. REACTOR VESSEL INTER | NALS (PWR) - Westinghouse | Further |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Same as for the effect of Stress Corrosion Cracking on Items B2.1.3 upper support column bolts. B2.1.5 upper core plate alignment pins. and B2.1.6 fuel pins. | Same as for the effect of Stress Corrosion Cracking on Items B2.1.3 upper support column bolts, B2.1.5 upper core plate alignment pins, and B2.1.6 fuel pins. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant should address loss gole chilit associated with void Swelling | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B2.3.1 thru B2.3.3 core barrel, upper core barrel flange, core barrel nozzles. | Yes Elements 3 and 4 should be further evaluated |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Stress Relaxation on Item B2.1.7 hold-down spring. | Yes Elements 3 and 4 should be further evaluated |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Wear on Items B2.1.5 upper core plate alignment pins and B2.1.6 fuel pins. | Νο |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Source Source Stress Same as for the effect of Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Same as for the effect of Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1. upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| Plang. Plang. Plang specific aging management program. Based on EPRI TR-107521. estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant should address loss of dectility associated with Void swelling | Yes TLAA |

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| B2. REACTOR VESSEL INTER | NALS (PWR) - Westinghouse | Further |
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| Existing | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) Same as for the effect of Thermal Aging and Neutron Irradiation Embrittlement on Item B2.1.2, upper support column constructed of CASS. | Same as for the effect of Thermal Aging and Neutron Irradiation Embrittlement on Item B2.1.2, upper support column constructed of CASS. | No |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Wear on Items B2.1.5 upper core plate alignment pins and B2.1.6 fuel pins. | No |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Same as for the effect of Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Same as for the effect of Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B2.1.1, upper support plate, B2.1.4 upper core plate, and B2.1.7 hold-down spring. | Yes Element 4 should be further evaluated |
| spring. Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. A piplicant shuld address loss glactilith associated with Void Swelling | Yes TLAA No |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Wear on Items B2.1.5 upper core plate alignment pins and B2.1.6 fuel pins. | 140 |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2 REACTOR VESSEL INTERNALS (PWR) - Westinghouse

B3. Reactor Vessel Internals (PWR) - Combustion Engineering

- B3.1 Upper Internals Assembly
 - B3.1.1 Upper Guide Structure Support Plate
 - B3.1.2 Fuel Alignment Plate
 - B3.1.3 Fuel Alignment Plate Guide Lugs
 - B3.1.4 Hold-Down Rings
- B3.2 CEA Shroud Assemblies
 - B3.2.1 CEA Shrouds
 - B3.2.2 CEA Shrouds Bolts
 - B3.2.3 CEA Shrouds Extension Shaft Guides
- B3.3 Core Support Barrel
 - B3.3.1 Core Support Barrel
 - B3.3.2 Core Support Barrel Upper Flange
 - B3.3.3 Core Support Barrel Alignment Keys
- B3.4 Core Shroud Assembly
 - B3.4.1 Core Shroud Assembly
 - B3.4.2 Core Shroud Assembly Bolts
 - B3.4.3 Core Shroud Tie Rods
- B3.5 Lower Internal Assembly
 - B3.5.1 Core Support Plate
 - B3.5.2 Fuel Alignment Pins
 - B3.5.3 Lower Support Structure Beam Assemblies
 - B3.5.4 Core Support Column
 - B3.5.5 Core Support Column Bolts

B3.5.6 Core Support Barrel Snubber Assemblies

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

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| Existing | | Further |
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| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) | Evaluation and Technical Basis (continued from previous page) inaccessible regions are difficult to inspect visually. Supplementary UT examinations may be needed. (5) Monitoring and Trending: Inspection schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: Although stainless steel components in PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels and control of primary water chemistry, potential for SCC exists from inadvertent introduction of contaminants into the primary coolant system (IN 84–18). from the introduction of relatively high levels of dissolved oxygen during shutdown, or from aggressive chemistries that may develop in creviced regions. Cracking has occurred in SS baffle former bolts in a number of foreign plants (IN 98-11) and has now been observed in US plants. The mechanism of this particular cracking has not yet been resolved. SCC has also been observed in Ni alloy (Alloy X-750) control rod drive guide tube support pins (IN 82-29). Replacement components with a different heat treatment appear to be less susceptible to cracking. | Evaluatio |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on tems B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate puide lugs. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Element 4 should be further evaluated |
| ame as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA hroud bolts. | | Yes Element 4 should be further evaluated Yes |
| lant specific aging management rogram. Based on EPRI TR-107521. stimates of void swelling vary from 4% for baffle-former assemblies over a 0-y plant life to less than 3% for the nost highly irradiated sections of the internals at 60 y. | evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. A pplicant ; hult address loss y ductility associated with Void Swelling. | TLAA |
| isual inspection (VT-3) is performed ccording to Category B-N-3 of ubsection IWB, ASME Section XI. | Same as for the effect of Wear on Items B3.1.1 upper guide structure support plate, B3.1.3 fuel alignment plate guide lugs., and B3.1.4 hold-down ring. | No |

| Existing | Evaluation and Technical Basis | Further Evaluatior |
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| Aging Management Program (AMP) | (continued from previous page) Inspection schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: There are no reports of stress relaxation producing damage in reactor vessel internals. | |
| Same as for the effect of Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate. B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Same as for the effect of Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate. B3.1.2 fuel alignment plate. and B3.1.3 fuel alignment plate guide lugs. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicand should address loss of dechility associated with Void Swelling, | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B–N-3 of Subsection IWB, ASME Section XI. | (1) Scope of Program: The program includes inservice inspection (ISI) to detect cracking and/or failure, and repair and/or replacement as needed to maintain the capability to perform the intended function. (2) Preventive Actions: No practical preventative actions are possible. Stainless steels are susceptible to embrittlement under neutron irradiation. Fracture toughness will depend strongly on the fluence on a particular component. Components can be screened out if the maximum tensile loading on the component under ASME Code Level A. B. C. and D conditions is sufficiently low. (3) Parameters Monitored/Inspected: The AMP monitors the effects of neutron irradiation embrittlement on the intended function of the component by detection and sizing of cracks by inservice inspection [ISI]. Table IWB-2500, category B-N-3 specifies visual VT-3 examination of all accessible surfaces of reactor internals. (4) Detection of Aging Effects: Loss of fracture toughness is of consequence only if cracks exist. Cracking is expected to initiate at the surface and should be detectable by ISI except for some crevice regions. VT-3 may not be adequate to detect tight cracks. Also, creviced regions are difficult to inspect visually and supplementary UT or other nondestructive examinations may be needed. (5) Monitoring and Trending: Inspection schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is | Yes Elements 3 and 4 should be further evaluated |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B3 BEACTOR VESSEL INTERNALS (PWR) - ABB/Combustion Engineering

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| B3. REACTOR VESSEL INTER | NALS (PWR) - ABB/Combustion Engineering | |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Further Evaluation |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR | (continued from previous page) evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: No instances of internals degradation recorded have been definitely attributed to irradiation embrittlement. Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| 50.55a), Subsection NG. Visual inspection (VT-3) is performed according to Category B–N–3 of Subsection IWB, ASME Section XI. | Same as for the effect of Wear on Items B3.1.1 upper guide structure support plate, B3.1.3 fuel alignment plate guide lugs., and B3.1.4 hold-down ring. | No |
| Same as for the effect of Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Same as for the effect of Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the nternals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant shald address loss y ductified assuciated with void swelling. | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B3.3.1 core support barrel and B3.3.2 core support barrel upper flange. | Yes Elements 3 and 4 should be further evaluated |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B3. REACTOR VESSEL INTERNALS (PWR) - ABB/Combustion Engineering

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| | NALS (PWR) - ABB/Combustion Engineering | Further |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (Autr) Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Same as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA shroud bolts. | Same as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA shroud bolts. | Yes Element 4 should be further evaluated |
| Same as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA shroud bolts. | Same as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA shroud bolts. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant should endress lass of each lift associated with Vaid Swelling. | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B3.3.1 core support barrel and B3.3.2 core support barrel upper flange. | Yes Elements 3 and 4 should be further evaluated |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Stress Relaxation on Item B3.2.2 CEA shroud bolts. | Yes Elements 3 and 4 should be further evaluated |
| Same as for the effect of Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Same as for the effect of Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Yes Element 4 should be further evaluated |
| | Same as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA shroud bolts. | Yes Element 4 should be further evaluated |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B3. REACTOR VESSEL INTERNALS (PWR) - ABB/Combustion Engineering

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| B3. REACTOR VESSEL INTER | NALS (PWR) - ABB/Combustion Engineering | |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Further Evaluation |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Items B3.1.1 upper guide structure support plate, B3.1.2 fuel alignment plate, and B3.1.3 fuel alignment plate guide lugs. | Yes Element 4 should be further evaluated |
| Same as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA shroud bolts. | Same as for the effect of Stress Corrosion Cracking on Item B3.2.2 CEA shroud bolts. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. <i>poplicant</i> <i>Shuld address lass geneticat</i> <i>associated with void swelling</i> . | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB. ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B3.3.1 core support barrel and B3.3.2 core support barrel upper flange. | Yes Elements 3 and 4 should be further evaluated |
| Visual Inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Stress Relaxation on Item B3.2.2 CEA shroud bolts. | Yes Elements 3 and 4 should be further evaluated |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B3. REACTOR VESSEL INTERNALS (PWR) - ABB/Combustion Engineering

B4 Reactor Vessel Internals (PWR) - Babcock & Wilcox

- B4.1 Plenum Cover and Plenum Cylinder
- B4.2 CRA Guide Tube Assemblies
 - B4.2.1 Tubes
 - B4.2.2 Spacer Casting
 - B4.2.3 Spider Casting
 - B4.2.4 Bolts
- B4.3 Upper Grid Assembly
 - B4.3.1 Upper Grid Rib Section
 - B4.3.2 Upper Grid Assembly Bolts
 - B4.3.3 Plenum Rib Pads
- B4.4 Core Support Assembly
 - B4.4.1 Core Support Shield
 - B4.4.2 Core Support Shield Flange
 - B4.4.3 Core Support Shield to Core Barrel Bolts
- B4.5 Vent Valve Assembly
- B4.6 Core Barrel Assembly
 - B4.6.1 Core Barrel
 - B4.6.2 Core Barrel Bolts
 - B4.6.3 Core Barrel to Thermal Shield Bolts
- B4.7 Lower Grid Assembly (LGA)
 - B4.7.1 Upper Grid
 - B4.7.2 Fuel Guide Pads
 - B4.7.3 Lower Grid

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- B4.7.4 Support Columns
- B4.7.5 Cylinder Guide Blocks
- B4.7.6 LGA Bolts
- B4.7.7 Core Barrel Bolts
- B4.7.8 Flow Distributor Bolts
- B4.7.9 Thermal Shield Bolts
- B4.8 Flow Distributor
- B4.9 Thermal Shield

| Existing Aging Management Program (AMP)Evaluation and Technical BasisEvaluation(continued from previous page) greatly reduces susceptibility to IASCC. However, introduction of oxygen can occur during shutdown and potential exists for the formation of more aggressive chemistry conditions by radiolysis in creviced regions or in low-flow stagnant regions. Also for sufficiently high fluence levels, IASCC can occur even in low oxygen environments. The AMP must rely upon ISI in accordance with ASME Section XI to detect possible degradation. (3) Parameters Monitored/Inspected: The AMP monitors the effects of SCC on the intended function by detection and sizing of cracks by inservice inspection (ISI). Table IWB-2500, category B-N-3 specifies visual VT-3 examination of all accessible surfaces of reactor intermals. (4) Detection of Aging Effects: Degradation due to IASCC can not occur without crack initiation and growth. VT-3 may not be adequate to detect tight cracks. The inspection technique, including the reliability in detecting the features of interest (crack appearance and size) in assuring the integrity of the component, should be specified. For example, enhancement of the visual VT-1 | B4. REACTOR VESSEL INTER | NALS (PWR) - Babcock & Wilcox | Further |
|---|--|--|-----------------------|
| Aging Management (vers) (continued from previous page) greatly reduces susceptibility to IASCC. However, introduction of oxygen can occur during shutdown and potential exists for the formation of more aggressive chemistry conditions by radiolysis in creviced regions or in low-flow stagnant regions. Also for sufficiently high fluence levels, IASCC can occur even in low oxygen environments. The AMP must rely upon ISI in accordance with ASME Section XI to detect possible degradation. (3) Parameters Monitored/Inspected: The AMP monitors the effects of SCC on the intended function by detection and sizing of cracks by inservice inspection (ISI). Table IWB-2500, category B-N-3 specifies visual VT-3 examination of all accessible surfaces of reactor internals. (4) Detection of Aging Effects: Degradation due to IASCC can not occur without crack initiation and growth. VT-3 may not be adequate to detect tight cracks. The inspection technique, including the reliability in detecting the features of interest (crack appearance and size) in assuring the integrity of the component, should be specified. For example, enhancement of the visual VT-1 | | Evaluation and Technical Basis | |
| with the conditions (lighting and surface cleanness) for the ISI bounded by those used to demonstrate the resolution of the inspection technique. Creviced regions are difficult to inspect visually and supplementary UT or other nondestructive examinations may be needed. As an alternate to enhanced inspection, perform a component- specific evaluation including a mechanical loading assessment to determine the maximum tensile loading on the component during ASME Code Level A, B, C, and D conditions. (5) Monitoring and Trending: Inspection | Existing | Evaluation and Technical Basis (continued from previous page) greatly reduces susceptibility to IASCC. However, introduction of oxygen can occur during shutdown and potential exists for the formation of more aggressive chemistry conditions by radiolysis in creviced regions or in low-flow stagnant regions. Also for sufficiently high fluence levels, IASCC can occur even in low oxygen environments. The AMP must rely upon ISI in accordance with ASME Section XI to detect possible degradation. (3) Parameters Monitored/Inspected: The AMP monitors the effects of SCC on the intended function by detection and sizing of cracks by inservice inspection (ISI). Table IWB-2500, category B-N-3 specifies visual VT-3 examination of all accessible surfaces of reactor internals. (4) Detection of Aging Effects: Degradation due to IASCC can not occur without crack initiation and growth. VT-3 may not be adequate to detect tight cracks. The inspection technique, including the reliability in detecting the features of interest (crack appearance and size) in assuring the integrity of the component, should be specified. For example, enhancement of the visual VT-1 examination to achieve a 1/2-mil (0.0005 in.) resolution, with the conditions (lighting and surface cleanness) for the ISI bounded by those used to demonstrate the resolution of the inspection technique. Creviced regions are difficult to inspect visually and supplementary UT or other nondestructive examinations may be needed. As an alternate to enhanced inspection, perform a component- specific evaluation including a mechanical loading assessment to determine the maximum tensile loading on the component during ASME Code Level A, B, C, and D conditions. (5) Monitoring and Trending: Inspection schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation | Further Evaluation |
| | | schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. | |
| schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures. review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. | | (10) Operating Experience: Although the only cracking presently directly attributable to IASCC in PWRs occurred in SS fuel cladding used in early reactors, susceptibility to this degradation will increase as plant operating time and hence accumulated fluence levels increase. The role of IASCC in the more recent cracking that has occurred in SS baffle/former bolts in U.S. plants as well as foreign plants (IN 98-11) has not yet been universally agreed upon. | Vac |
| schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures. review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: Although the only cracking presently directly attributable to IASCC in PWRs occurred in SS fuel cladding used in early reactors, susceptibility to this degradation will increase as plant operating time and hence accumulated fluence levels increase. The role of IASCC in the more recent cracking that has occurred in SS baffle/former bolts in U.S. plants as well as foreign plants (IN 98-11) has not yet been universally agreed upon. | Plant specific aging management program. Based on EPRI TR-107521, estimates of vold swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. In Applicant Shishle address loss goartility associated with Void swelling. | Yes TLAA |

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| B4. REACTOR VESSEL INTER | RNALS (PWR) - Babcock & Wilcox | |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Further Evaluation |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Same as for the effect of Stress Corrosion Cracking on Item B4.1. plenum cover and plenum cylinder. | Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | should eddress loss of ductility associated with void swelling. | Yes TLAA No |
| Determination of the susceptibility of CASS components to thermal aging embrittlement based on casting method. Mo content, and percent ferrite. For "potentially susceptible" components, based on the neutron fluence of the component, implement either a supplemental examination of the affected components as part of the applicant's 10-year inservice inspection ISI) program during the license renewal erm or a component-specific evaluation to determine the susceptibility to loss of fracture oughness. | (1) Scope of Program: The program includes determination of the susceptibility of CASS components to thermal aging based on casting method, Mo content, and percent ferrite, and for "potentially susceptible" components, to account for the synergistic loss of fracture toughness due to neutron embrittlement and thermal aging embrittlement, implement either a supplemental examination of the affected components as part of a 10- year inservice inspection (ISI) program during the license renewal term or a component-specific evaluation to determine the susceptibility to loss of fracture toughness. (2) Preventive Actions: The program provides no guidance on methods to mitigate thermal aging or neutron embrittlement. (3) Parameters Monitored/ Inspected: The program specifics depend on the neutron fluence and ferrite content of the component. The criteria in EPRI TR- 106092, with some modifications approved by the NRC staff, can be used to determine whether CASS components are potentially susceptibility to thermal aging embrittlement based on the casting method, Mo content, and ferrite content. For low-Mo content (0.5 wt.% max.) steels, only static-cast steels with >20% ferrite are potentially susceptible to thermal embrittlement, all centrifugal-cast and static-cast steels with ≤20% ferrite are not susceptible. For high-Mo content (2.0 to 3.0 wt.%) steels, static-cast steels with >14% ferrite and centrifugal- cast steels with >20% ferrite are not susceptible. For high-Mo content (2.0 to 3.0 wt.%) ferrite and centrifugal-cast steels with $\leq 14\%$ ferrite are not susceptible. For high-Mo content (2.0 to 3.0 wt.%) steels, static-cast steels with $\leq 14\%$ ferrite and centrifugal-cast steels with $\leq 14\%$ ferrite are not susceptible. For high-Mo content (2.0 to 3.0 wt.%) steels, static-cast steels with $\leq 14\%$ ferrite are contrifugal-cast steels with $\leq 14\%$ ferrite are not susceptible. For high-Mo content (2.0 to 3.0 wt.%) steels, static-cast steels with $\leq 14\%$ ferrite and centrifugal-cast steels with $\leq 14\%$ ferrite are not | |

| IV | REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM | |
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| | B4. REACTOR VESSEL INTERNALS (PWR) - Babcock & Wilcox | |

| B4. REACTOR VESSEL INTER | NALS (PWR) - Babcock & Wilcox | Further |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Further Evaluation |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Stress Corrosion Cracking on Item B4.1. plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Appl: conf shall convers loss of d-child associated with Void swelling. | Yes TLAA |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| | (1) Scope of Program: The program includes inservice inspection (ISI) to detect cracking and/or failure, and repair and/or replacement as needed to maintain the capability to perform the intended function. (2) Preventive Actions: No practical preventative actions are possible. Stainless steels are susceptible to embrittlement under neutron irradiation. Fracture toughness will depend strongly on the fluence on a particular component. Components can be screened out if the maximum tensile loading on the component under ASME Code Level A, B, C, and D conditions is sufficiently low. (3) Parameters Monitored/ Inspected: The AMP monitors the effects of neutron irradiation embrittlement on the intended function of the component by detection and sizing of cracks by inservice inspection (ISI). Table IWB-2500, category B-N-3 specifies visual VT-3 examination of all accessible surfaces of reactor internals. (4) Detection of Aging Effects: Loss of fracture toughness is of consequence only if cracks exist. Cracking is expected to initiate at the surface and should be detectable by ISI except for some crevice regions. VT-3 may not be adequate to detect tight cracks. Also, creviced regions are difficult to inspect visually and supplementary UT or other nondestructive examinations may be needed. (5) Monitoring and Trending: Inspection schedule in accordance with IWB-2400 is adequate for timely detection of cracks. (6) Acceptance Criteria: Any degradation is evaluated in accordance with IWB-3520. | Yes Elements 3 and 4 should be further evaluated |

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| Existing | | Further |
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| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) (7) Corrective Actions: Repair and replacement are in conformance with IWB-3140. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: No instances of internals degradation recorded have been definitely attributed to irradiation embrittlement. | |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Wear on Item B4.2.1 CRA guide tubes. | No |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Stress Relaxation on Item B4.2.2 CRA guide tubes bolts. | Yes Elements 3 and 4 should be further evaluated |
| Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant. should address loss g ductility associated with Void swelling. | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B4.2.1-B4.2.3 upper grid assembly rib section, bolts, and plenum rib pads. | Yes Elements 3 and 4 should be further evaluated |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a), Subsection NG. | performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of | Same as the effect of Wear on Item B4.2.1, CRA guide tubes | No |

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| B4. REACTOR VESSEL INTER | NALS (PWR) - Babcock & Wilcox | Further |
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| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant shuld address loss y ductility associated high Void swelling. | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B4.2.1-B4.2.3 upper grid assembly rib section. bolts, and plenum rib pads. | Yes Elements 3 and 4 should be further evaluated |
| Same as for the effect of Thermal Aging and Neutron Embrittlement on Items B4.2.1- B1.2.3 CRA guide tubes, spacer casting, and spider casting. | Same as for the effect of Thermal Aging and Neutron Embrittlement on Items B4.2.1- B1.2.3 CRA guide tubes, spacer casting, and spider casting. | Νο |
| Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the internals at 60 y. | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Applicant Should address loss g buchility associated with Void swelling | Yes TLAA |
| Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B4.2.1-B4.2.3 upper grid assembly rib section, bolts, and plenum rib pads. | Yes Elements 3 and 4 should be further evaluated |

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| • | B4. REACTOR VESSEL INTERNALS (PWR) - Babcock & Wilcox |

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| | Evaluation and Technical Basis | Further Evaluation |
| een designed or for a 40 y design e requirements of g criteria or ASME pecified in 10 CFR | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| ry B-N-3 of | Same as for the effect of Stress Relaxation on Item B4.2.2 CRA guide tubes bolts. | Yes Elements 3 and 4 should be further evaluated |
| on Item B4.1, | Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
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| osion Cracking on | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| PRI TR-107521. Elling vary from assemblies over a than 3% for the | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Appl:conf shull deddress luss of duct. I.t. assuciated with void swelling. | Yes TLAA |
| | ICK VESSEL INTEX iting int Program (AMP) en designed or for a 40 y design e requirements of ag criteria or ASME pecified in 10 CFR NG. T-3) is performed ty B-N-3 of ME Section XI. t of Stress on Item B4.1, tenum cylinder. ct of Irradiation osion Cracking on over and plenum nanagement PRI TR-107521, elling vary from - assemblies over a than 3% for the d sections of the | net Program (AMP) Evaluation and Technical Basis sen designed or for a 40 y design erequirements of g criteria or ASME performed for the period of license renewal, and Generic Safety Issue (CSI)-190 is to be addressed. Same as for the effect of Stress Relaxation on Item B4.2.2 CRA guide tubes bolts. T-3) is performed ry B-N-3 of ME Section XI. Same as for the effect of Stress Relaxation on Item B4.2.2 CRA guide tubes bolts. st of Stress on Item B4.1, lenum cylinder. Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. ct of Itradiation osion Cracking on wer and plenum Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on plenum cylinder. Plant specific aging management PRI TR 107521, essemblies over a Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. A <i>nol</i> : Ccrl ¹ |

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| IV REACTOR VESSEL, INTERNALS, A | VALS (PWR) - Babcock & Wilcox | |
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| | | Further |
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation Yes |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. Appl: cut should address loss y ductality associated with Void swelling. | TLAA |
| internals at 60 y. Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B4.2.1-B4.2.3 upper grid assembly rib section, bolts, and plenum rib pads. | Yes Elements 3 and 4 should be further evaluated |
| Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Same as for the effect of Irradiation Assisted Stress Corrosion Cracking on Item B4.1, plenum cover and plenum cylinder. | Yes Element 4 should be further evaluated |
| Plant specific aging management program. Based on EPRI TR-107521, estimates of void swelling vary from 14% for baffle-former assemblies over a 40-y plant life to less than 3% for the most highly irradiated sections of the | Plant specific aging management program is to be evaluated. The applicant must provide the basis for concluding that void swelling is not an issue for the component or must provide an AMP. | Yes TLAA |
| internals at 60 y. Visual inspection (VT-3) is performed according to Category B-N-3 of Subsection IWB, ASME Section XI. | Same as for the effect of Neutron Irradiation Embrittlement on Items B4.2.1-B4.2.3 upper grid assembly rib section, bolts, and plenum rib pads. | Yes Elements 3 and 4 should be further evaluated |

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C1. Reactor Coolant Pressure Boundary (Boiling Water Reactor)

- C1.1 Piping & Fittings
 - C1.1.1 Main Steam
 - C1.1.2 Feedwater
 - C1.1.3 High Pressure Coolant Injection (HPCI) System
 - C1.1.4 Reactor Core Isolation Cooling (RCIC) System
 - C1.1.5 Recirculation
 - C1.1.6 Residual Heat Removal (RHR) System
 - C1.1.7 Low Pressure Coolant Injection (LPCI) System
 - C1.1.8 Low Pressure Core Spray (LPCS) System
 - C1.1.9 High Pressure Core Spray (HPCS) System
 - C1.1.10 Isolation Condenser
 - C1.1.11 Lines to Reactor Water Cleanup (RWC) and Standby Liquid Control (SLC) Systems
 - C1.1.12 Steam Line to HPCI and RCIC Pump Turbine
- C1.2 Recirculation Pump
 - C1.2.1 Bowl / Casing
 - C1.2.2 Cover
 - C1.2.3 Seal Flange
 - C1.2.4 Closure Bolting
- C1.3 Safety & Relief Valves
 - C1.3.1 Valve Body
 - C1.3.2 Bonnet
 - C1.3.3 Seal Flange
 - C1.3.4 Closure Bolting

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C1.4 Isolation Condenser

- C1.4.2 Tubesheet
- C1.4.3 Channel Head
- C1.4.4 Shell

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM C1. REACTOR COOLANT PRESSURE BOUNDARY (Boiling Water Reactor)

| Existing | | Further |
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| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Program delineated in NUREG-0313, | (1) Scope of Program: The program is focused on managing | Yes, |
| Rev. 2 and NRC Generic letter (GL) 88-01 | and implementing the counter measures to mitigate IGSCC | BWRVIP |
| and its Supplement 1, and inservice | and inservice inspection (ISI) to monitor IGSCC and its | Guideline |
| nspection in conformance with ASME | effects on the intended function of austenitic stainless | |
| Section XI (edition specified in 10 CFR | steel (SS) piping 4 in. or larger in diameter, and reactor | |
| 50.55a), Subsection IWB, Table IWB | vessel attachments and appurtenances. NUREG-0313 and | |
| 2500-1, examination categories B-J for | GL 88-01, respectively, describe the technical basis and | |
| pressure retaining welds in piping and | staff guidance regarding mitigating IGSCC in BWRs. | |
| B-F for pressure retaining dissimilar | (2) Preventive Actions: Mitigation of IGSCC is by selection | |
| metal welds, and testing category B-P | of material considered resistant to sensitization and | |
| for system leakage. BWRVIP guideline is | IGSCC, e.g., low-carbon grades of austenitic SSs and weld | |
| under staff review. Coolant water | metal, with a maximum carbon of 0.035% and minimum | |
| chemistry is monitored and maintained | 7.5% ferrite in weld metal, and by special processing such | |
| in accordance with EPRI guidelines in | as solution heat treatment, heat sink welding, and | - |
| FR-103515 and BWRVIP-29 to minimize | induction heating or mechanical stress improvement (SI). | |
| the potential of crack initiation and | Coolant water chemistry is monitored and maintained in | |
| growth. | accordance with EPRI guidelines in TR-103515 and | |
| - | BWRVIP-29 to minimize the potential of crack initiation | |
| | and growth. Also, hydrogen water chemistry and | |
| | stringent control of conductivity is used to inhibit IGSCC. | |
| | (3) Parameters Monitored/Inspected: Inspection and flaw | |
| | evaluation are to be performed in accordance with | |
| | referenced BWRVIP guideline, as approved by the NRC | |
| | staff. (4) Detection of Aging Effects: Aging degradation of | |
| | the piping can not occur without crack initiation and | |
| | growth; extent and schedule of inspection as delineated in | |
| | GL 88-01 and updated in BWRVIP-75 is adequate and will | |
| | assure timely detection of cracks before the loss of | |
| ^ | intended function of austenitic SS piping and fittings. | |
| Has the staff accepted the -> BWRVIP document? | (5) Monitoring and Trending: Inspection schedule in | |
| rias the staff | accordance with applicable approved BWRVIP guideline. | |
| Que It I II | (6) Acceptance Criteria: Any IGSCC degradation is evaluated in accordance with applicable approved BWRVIP | - |
| accepted The -> | guideline. (7) Corrective Actions: The corrective action | |
| DUNDULD Dat 19 | proposed by the BWRVIP is under staff review. (8 & 9) | · · |
| BLOKVIF aloument | Confirmation Process and Administrative Controls: Site | |
| TP non +1 N | QA procedures, review and approval processes, and | |
| 19 ges, wen et | administrative controls are implemented in accordance | |
| el of be | with requirements of Appendix B to 10 CFR Part 50 and | |
| should be | will continue to be adequate for the period of license | |
| selement about | renewal. (10) Operating Experience: IGSCC has occurred in | |
| if the services | small- and large-diameter BWR piping made of austenitic | |
| If yes, then it should be referenced approp- rictely. | SSs. Significant cracking has occurred in RHR system and | |
| V | reactor water cleanup system piping welds. | 1 |
| Determined and the supervised bilities of | (1) Scope of Program: The program includes | No |
| Determination of the susceptibility of | determination of the susceptibility of CASS components | |
| CASS piping to thermal aging | to thermal aging based on casting method. Mo content. | |
| embrittlement based on casting method. | and percent ferrite, and for potentially susceptible | |
| Mo content, and percent ferrite. For | components aging management is accomplished either | |
| "potentially susceptible" piping, aging | through volumetric examination or plant/component- | . . |
| management is accomplished either | specific flaw tolerance evaluation. (2) Preventive Actions: | 1 |
| through enhanced volumetric | The program provides no guidance on methods to mitigate | 1 |
| examination or plant/component- | thermal aging. (3) Parameters Monitored/ Inspected: | 1 |
| specific flaw tolerance evaluation. | Based on the criteria in EPRI TR-106092, with some | 1 |
| Additional inspection or evaluations | modifications, the susceptibility to thermal aging | |
| are not required for "not susceptible" | embrittlement of CASS piping is determined in terms of | 1 |
| piping to demonstrate that the material | casting method, Mo content, and ferrite content. For low- | |
| has adequate fracture toughness. For | Mo content (0.5 wt.% max.) steels, only static-cast steels | 1 |
| pump casings and valve bodies. | and connected for a start many starter of y | |

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| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|------|----------------------------|-----------------------|----------|------------------|-----------------|--------------------|------------|
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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM C1. REACTOR COOLANT PRESSURE BOUNDARY (Boiling Water Reactor)

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM C1 REACTOR COOLANT PRESSURE BOUNDARY (Boiling Water Reactor)

| | | C1. REACTOR COOLANT PRES | SURE BOUNDARY (Boiling Water Reactor) | | 1 |
|--------------|---------------|---|--|------------|-----|
| | 1 | Existing | | Further | |
| | | Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation | Į. |
| | | (continued from previous page) | (continued from previous page) | | |
| | | screening for susceptibility to thermal | with >20% ferrite are potentially susceptible to thermal | | |
| | | aging is not required. Also, the existing | embrittlement, all centrifugal-cast and static-cast steels | | ł |
| | | ASME Section XI inspection | with ≤20% ferrite are not susceptible. For high-Mo | | 1 |
| | | requirements, including the alternative | content (2.0 to 3.0 wt.%) steels, static-cast steels with | | |
| | | requirements of ASME Code Case N-481 | >14% ferrite and centrifugal-cast steels with >20% ferrite | | 1 |
| 2 | 、 、 | for pump casings, are considered | are potentially susceptible to thermal embrittlement. static-cast steels with $\leq 14\%$ ferrite and centrifugal-cast | | |
| (| \Rightarrow | adequate for all pump casings and valve | steels with ≤20% ferrite are not susceptible. Ferrite | | 1 |
| • | | bodies. | content will be calculated by the Hull's equivalent factors | | |
| | | | or a method producing an equivalent level of accuracy | | 1 |
| | | Pull calling and | $(\pm 6\%$ deviation between measured and calculated values). | L. P. | |
| | | Vemp casengs and | For pump casings and valve bodies, screening for | why | 9 |
| | | Value bodies are | susceptibility to thermal aging is not required. | mat | \$ |
| | | | (4) Detection of Aging Effects: For "not susceptible" piping, | 100 | 1. |
| | | Susceptible to | no additional inspection or evaluations are required to | | 1 |
| | | | demonstrate that the material has adequate fracture | | |
| - | - | thermal ceque and | toughness. For "potentially susceptible" piping, because | | 1 |
| | | | the base metal does not receive periodic inspection per | | |
| | | They are cerethin | ASME Section XI, volumetric examination should be | 1 | |
| | | The were | performed on the base metal, with the scope of the | .] | |
| | | the scope of the | inspection covering the portions determined to be limiting | 1 | |
| | | | from the standpoint of applied stress, operating time, and environmental considerations. Alternatively, a | | |
| | | license renewal. | plant/component- specific flaw tolerance evaluation, | | |
| | | A DENEWAS | using specific geometry and stress information, can be | | |
| | | Therefore, they | used to demonstrate that the thermally-embrittled | 1 | 1 |
| 1 | | The eport, may | material has adequate toughness. Current volumetric | | |
| | | 8 OD L. THAT A GO | examination methods are inadequate for reliable | | |
| | | panowa de evaluado | detection of cracks in CASS components; the performance | | |
| | | los bast of main | of the equipment and techniques when developed, should | | |
| | | - para of aling | be demonstrated through the program consistent with the | 1 | |
| | | | ASME Section XI, Appendix VIII. For all pump casings | | |
| | | Wandgement | and valve bodies, the existing ASME Section XI inspection | | |
| | | boug | requirements, including the alternative requirements of ASME Code Case N-481 for pump casings, are considered | | |
| | | poopan. | adequate. For valve bodies less than NPS 4, the adequacy | | |
| | | | of inservice inspection according to ASME Section XI has | | |
| | | | been demonstrated by a NRC performed bounding fracture | | |
| | | | analysis. (5) Monitoring and Trending: Inspection | | |
| | | | schedule in accordance with IWB-2400 should provide | | |
| | | | timely detection of cracks. (6) Acceptance Criteria: Flaws | | |
| | | | detected in CASS components are evaluated in accordance | | |
| | | | with the applicable procedures of IWB-3500. If aging | | |
| | | | management is accomplished through plant/component- specific flaw tolerance evaluation, e.g., for potentially | | |
| | | · · | susceptible piping, flaw evaluation for piping with <25% | | |
| | | | ferrite is performed according to the principles associated | | 1 · |
| | | · · · · · · · · · · · · · · · · · · · | with IWB-3640 procedures for submerged arc welds (SAW). | | |
| | | | disregarding the Code restriction of 20% ferrite in IWB- | 1 | |
| | | | 3641(b)(1). Flaw evaluation for piping with >25% territe is | 8 | |
| | | | performed on a case-by-case basis using fracture | | 1 |
| | | | toughness data provided by the applicant. (7) Corrective | 1 | |
| | | | Actions: Repair is in conformance with IWA-4000 and | | |
| | | | IWB-4000, and replacement according to IWA-7000 and | | |
| | | | IWB-7000. (8 & 9) Confirmation Process and | | |
| | | | Administrative Controls: Site QA procedures, review and | | 1 |
| | | | approval processes, and administrative controls are | | |
| | | | implemented in accordance with requirements of | | Ι. |
| \checkmark | | | Appendix B to 10 CFR | L | |
| | | | | | |

| C1. REACTOR COOLANT PRESSURE BOUNDARY (Boiling Water Reactor) | | | | | | | |
|---|----------------------------|--|----------------------------------|--|-----------------------------------|--|---|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| | | | | | | - | |
| C1.1.5. C1. 1.11 | Piping & Fittings | Recirculation, Lines to RWC and SLC Systems | SS | 288°C, Oxygenated Water | Cumulative Fatigue Damage | Fatigue | ASME Section III, 1989 Edition. ANSI B31.1. GSI-190. |
| C1.1.6 thru C1. 1.10 | Piping & Fittings | RHR, LPCI, LPCS, HPCS, IC | CS, SS | 288°C Oxygenated Water or Steam | Cumulative Fatigue Damage | Fatigue | ASME Section III, 1989 Edition. ANSI B31.1. GSI-190. |
| C1.2.1 thru C1.2.3 | Recirculation Pump | Bowl/Casing, Cover, Seal Flange | CASS, SS | 288°C, Oxygenated Water | Cumulative Fatigue Damage | Fatigue | ASME Section III, 1989 Edition. ANSI B31.1. GSI-190. |
| C1.2.1, C1.2.2 | Recirculation Pump | Bowl/Casing, Cover | CASS (SA351 CF-8 or CF-8M) | 288°C, Oxygenated Water | Loss of Fracture Toughness | Thermal Aging Embrittle- ment | EPRI TR-106092. ASME Section XI, 1989 Edition. |
| C1.2.1 | Recirculation Pump | Bowl/Casing | CASS, SS | 288°C, Oxygenated Water | Crack Initiation and Growth | SCC, IGSCC | ASME Section XI, 1989 Edition. NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S 1. BWRVIP-29. EPRI TR-103515. |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM C1. REACTOR COOLANT PRESSURE BOUNDARY (Boiling Water Reactor)

| TV | REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM |
|----|--|
| | C1 REACTOR COOLANT PRESSURE BOUNDARY (Boiling Water Reactor) |

| | SURE BOUNDARY (Boiling Water Reactor) | Further |
|---|--|------------|
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | Same as for the effect of Erosion/Corrosion on Item C1.1.1 | Yes, |
| ume as for the effect of osion/Corrosion on Item C1.1.1 main | main steam piping and fittings. | Element 1 |
| eam piping and fittings. | | should be |
| ean piping and failings. | • | further |
| | | evaluated |
| | Same as for the effect of Thermal Aging Embrittlement on | No |
| ame as for the effect of Thermal Aging | piping and fittings in various reactor coolant pressure | |
| mbrittlement on piping and fittings in | boundary systems Items C1.1.5 - C1.1.11. | |
| arious reactor coolant pressure | boundary systems reme errore that | |
| oundary systems Items C1.1.5 - | | · |
| 1.1.11. uidelines of NUREG-0313, Rev. 2 and | (1) Scope of Program: The program includes preventive | No |
| uidelines of NUREG-0313, Rev. 2 and | measures to mitigate stress corrosion cracking (SCC) and | |
| RC Generic letter (GL) 88-01 and its | inservice inspection (ISI) to monitor the effects of SCC on | |
| upplement 1; inservice inspection in | intended function of the valves. NUREG-0313 and GL 88- | |
| onformance with ASME Section XI | 01, respectively, describe the technical basis and staff | |
| dition specified in 10 CFR 50.55a), | guidance regarding the problem of IGSCC in BWRs. | |
| ubsection IWB, Table IWB 2500-1, | (2) Preventive Actions: Mitigation of IGSCC is by selection | 1 |
| camination categories B-M-1 for valve | of material considered resistant to sensitization and | 1 |
| bdy welds and B-M-2 for valve body. | IGSCC e.g. low-carbon grades of cast SSs and weld metal, | |
| nd testing category B-P for system | with a maximum carbon of 0.035% and minimum 7.5% | |
| akage. Coolant water chemistry is | ferrite Also, hydrogen water chemistry and stringent | l |
| onitored and maintained in | control of conductivity is used to inhibit IGSCC. | |
| cordance with EPRI guidelines in TR- 03515 and BWRVIP-29 to minimize the | High-carbon grades of cast SS, e.g., CF-8 and CF-8M | are |
| J3515 and BWRVIP-29 to minimize the | susceptible to SCC. The aging management program | |
| otential of crack initiation and | must therefore rely upon ISI in accordance with GL 88-01 | 1 |
| rowth. | to detect possible degradation. (3) Parameters | |
| | Monitored/Inspected: The AMP monitors the effects of | |
| | SCC on intended function of the valves by detection and | |
| | sizing of cracks by ISI. For welds NPS 4 or larger, the | |
| | inspection requirements follow those delineated in GL 88- | |
| | Inspection requirements of Table IWB 2500-1. | |
| | examination category B-M-2 specifies visual VI-3 | |
| | examination of internal surfaces of the valve. Inspection | |
| | requirements of testing category B-P conducted according | |
| | to IWA-5000 specify visual VT-2 (IWA-5240) examination | |
| | of all pressure retaining components during system | |
| | leakage test (IWB-5221) and system hydrostatic test (IWB- | |
| | 5222) Also, coolant water chemistry is monitored and | |
| | maintained in accordance with EPRI guidelines in TR- | |
| | 103515 and BWRVIP-29 to minimize the potential of crack | |
| | initiation and growth. (4) Detection of Aging Effects: | |
| | Degradation of the valves due to SCC can not occur without | t i |
| | arack initiation and growth: extent and schedule of | |
| | inspection as delineated in GL 88-01 will assure detection | 1 |
| | of cracks before the loss of the intended function of the | 1 |
| | valves. (5) Monitoring and Trending: Inspection schedule | |
| | in accordance with GL 88-01 should provide timely | |
| | detection of cracks. All welds are inspected each | |
| | inspection period from at least one valve in each group | |
| | performing similar functions in the system. Visual | 1 |
| | examination is required only when the valve is | |
| | disassembled for maintenance, repair, or volumetric | |
| | examination, but at least once during the period. System | |
| | leakage test is conducted prior to plant startup lollowing | |
| | each refueling outage, and hydrostatic test is conducted at | 1 |
| | or near the end of each inspection interval. (6) Acceptance | 2 |
| | I or near the end of each inspection interval. (0) according | |

| Item | C1. REACTOR Structure and Component | Region of Interest | Material | Environ- ment | Aging | Aging Mechanism | References |
|--------------------------|--|---|-----------------------|---|---------------------------------|-------------------------------------|---|
| | | | | | | ~ | |
| C1.3.3, C1.3.4 | Valves | Seal Flange, Closure Bolting | CS, SS Bolting: | Air, Leaking Oxygenated Water and/or Steam at 288°C | Attrition | Wear | NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. ASME Section XI, 1989 Edition. |
| C1.3.1 thru C1.3.3 | Valves (Check, Control, Hand, Motor- Operated, and Relief Valves) | Valve Body, Bonnet, Seal Flange | CASS, SS | 288°C, Oxygenated Water | Cumulative Fatigue Damage | Fatigue | ASME Section III, 1989 Edition. ANSI B31.1. GSI-190. |
| C1.3.4 | Valves | Closure Bolting | SA193 GrB7 | Air, Leaking Oxygenated Water and/or Steam at 288°C | Loss of Preload | Stress Relaxation | NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. ASME Section XI, 1989 Edition. |
| C1.3.4 | Valves | Closure Bolting | | Air, Leaking Oxygenated Water and/or Steam at 288°C | Cumulative Fatigue Damage | Fatigue | ASME Section III. 1989 Edition. ANSI B31.1. GSI-190. |
| C1.4.1 thru C1.4.4 | Isolation Condenser | Tubing, Tubesheet, Channel Head, Shell | Tubesheet: CS, SS; | Tube side: Steam; Shell side: demineraliz ed water | Loss of Material | Crevice and Pitting Corrosion | ASME Section XI, 1989 Edition. ASME OM S/G, Pt 2. NRC GL 89-13. Plant Technical Specifications. |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM C1. REACTOR COOLANT PRESSURE BOUNDARY (Boiling Water Reactor)

| C2. | Reactor ((Pressuriz | Coolant System and Connected Lines rized Water Reactor) | | | | | | | |
|-----|-------------------------|--|--|--|--|--|--|--|--|
| | C2.1 | Reactor | Coolant System Piping & Fittings | | | | | | |
| | | C2.1.1 | Cold–Leg | | | | | | |
| | | C2.1.2 | Hot-Leg | | | | | | |
| | | C2.1.3 | Surge Line | | | | | | |
| | | C2.1.4 | Spray Line | | | | | | |
| | | C2.1.5 | Small-Bore RCS Piping | | | | | | |
| | C2.2 | Connecte | ed Systems Piping & Fittings | | | | | | |
| | | C2.2.1 | Residual Heat Removal (RHR) or Low-Pressure Injection System (Decay Heat Removal (DHR)/ Shutdown System) | | | | | | |
| | | C2.2.2 | Core Flood System (CFS) | | | | | | |
| | | C2.2.3 | Chemical and Volume Control System or High-Pressure Injection System (Makeup & Letdown Functions) | | | | | | |
| | | C2.2.4 | Sampling System | | | | | | |
| | | C2.2.5 | Drains and Instrument Lines | | | | | | |
| | | C2.2.6 | Nozzles and Safe Ends | | | | | | |
| | | C2.2.7 | Small-Bore Piping in Connected Systems | | | | | | |
| | C2.3 | Reactor (| Coolant Pump | | | | | | |

- C2.3.1 Bowl / Casing
- C2.3.2 Cover
- C2.3.3 Closure Bolting
- C2.4 Safety & Relief Valves
 - C2.4.1 Valve Body
 - C2.4.2 Bonnet

C2.4.3 Closure Bolting

C2.5 Pressurizer

- C2.5.1 Shell/Heads
- C2.5.2 Spray Line Nozzle
- C2.5.3 Surge Line Nozzle
- C2.5.4 Spray Head
- C2.5.5 Thermal Sleeves
- C2.5.6 Instrument Nozzle
- C2.5.7 Safe Ends
- C2.5.8 Manway and Flanges
- C2.5.9 Manway and Flange Bolting
- C2.5.10 Heater Sheaths and Sleeves
- C2.5.11 Support Keys, Skirt, & Shear Lugs
- C2.5.12 Integral Support
- C2.6 Pressurizer Relief Tank
 - C2.6.1 Tank Shell and Heads
 - C2.6.2 Flanges and Nozzles

D1 Steam Generator (Recirculating)

- D1.1 Pressure Boundary and Structural
 - D1.1.1 Top Head
 - D1.1.2 Steam Nozzle and Safe End
 - D1.1.3 Upper and Lower Shell
 - D1.1.4 Transition Cone
 - D1.1.5 Feedwater Nozzle and Safe End
 - D1.1.6 Feedwater Impingement Plate and Support
 - D1.1.7 Secondary Manways and Bolting
 - D1.1.8 Secondary Handholes and Bolting
 - D1.1.9 Instrument Nozzles
 - D1.1.10 Primary Manways and Bolting
- D1.2 Tube Bundle
 - D1.2.1 Tubes
 - D1.2.2 Tube Support Plates
 - D1.2.3 Tube Support Lattice Bars (Combustion Engineering)
 - D1.2.4 Tube Plugs
 - D1.2.5 Tube Repair Sleeves
- D1.3 Upper Assembly and Separators
 - D1.3.1 Feed Water Inlet Ring
- D1.4 Piping and Fittings
 - D1.4.1 Main Steam
 - D1.4.2 Feedwater
 - D1.4.3 Auxiliary Feedwater

IV D1-1

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D1.5 Safety and Relief Valves

D1.5.1 Body

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IV D1-2

D1. Steam Generator (Recirculating)

System, Structures, and Components

The system, structures, and components included in this table consist of the recirculatingtype steam generators, as found in Westinghouse and Combustion Engineering pressurized water reactors (PWRs), including all internal components, external primary and secondary water/steam nozzles and safe ends, and portions of main steam, feedwater, and auxiliary feedwater systems extending from the steam generator up to the first isolation valve outside of containment or to the first anchor point. 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," the primary water side (tube side) of the steam generator is classified as Group A Quality Standards and secondary water side, including portions of main steam, feedwater, and auxiliary feedwater systems extending up to the first isolation valve outside of containment, is classified as Group B Quality Standard. The aging management program for the lines that penetrate the containment, and associated isolation valves, is reviewed in Table V C.

The valve internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the steam generators include the reactor coolant system and connected lines (Table IV C2), containment isolation components (Table V C), main steam system (Table VIII B1), feedwater system (Table VIII D1), steam generator blowdown system (Table VIII F), and auxiliary feedwater system (Table VIII G).

| Fo | liqu | e molat | 0 - | <u> </u> | | ··· • | | a to a second | |
|-------|-------------------|--|---|---------------------------|----------------------|---------------------------------|--------------------------------|---|--|
| ß | houl | d be e | a agu | g effe | et due | to 30 | | steam Pr | |
| n | ray | not be a | readily | + 40 | tique e | tata es | in stee | du envir | Wisonmeur |
| Other | , pro | cees end | metry e | i chud | ing fo | certifier | much | ear indu | visonment onment true some data. |
| | IV F | REACTOR VESSE D1. STEAM G | EL, INTERNALS, ENERATOR (Rec | AND REACTO irculating) | R COOLANT | SYSTEM PI | aple r | vary have | some |
| | Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References | data. |
| | D1.1.1, D1.1.2 | Pressure Boundary and Structural | Top Head. Steam Nozzle & Safe End | Low-alloy | Up to 300°C Steam | Cumulative Fatigue Damage | Faligue | ASME Section III, 1989 Edition. GSI-190. | |
| | | | | | | | · - | | |
| | D1.1.2 | Pressure Boundary and Structural | Steam Nozzle & Safe End | LAS | Up to 300°C Steam | Wall Thinning | Erosion/ Corrosion (E/C) | NUREG-1344. EPRI NSAC-202L- R2. NRC IN 93-21. EPRI TR-102134. | |
| | | | | | | | | Operating Experience NRC BL 87-01. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18. | |
| | | | | | | | | NRC IN 91-18 31. NRC IN 91-28. NRC IN 92-35. NRC IN 95-11. NRC IN 97-84. | |
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| < | needs to be addressed i'm fati | que eval | vations. |
| |) In this case the environment | | so °C stear |
| | I what is the fatigue life, or en | | · . |
| 1 | effect, for steam ? shauld we st | tate fluit | |
| <u> </u> | environmental effect for steam of | should be | used 1 |
| V REACTOR VESSEL, INTERNALS, A | AND REACTOR COOLANT SYSTEM Can the environ inculating) for high T, P, water be used ? IS | steam | more appr |
| D1. STEAM GENERATOR [Rect Existing | N I I I I I I I I I I I I I I I I I I I | ruittici | - 01 |
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation | 4 |
| Components have been designed or | Fatigue is a time-limited aging analysis (TLAA) to be | Yes TLAA | ļ |
| valuated for fatigue for a 40 y design | performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | | |
| ife, according to the requirements of ASME Section III (edition specified in | Salety issue (Gold Too D to co and the | | |
| 0 CFR 50.55a) or other evaluations | | | |
| ased on cumulative usage factor (CUF). | CT AMD includes NIMARC | Yes, | 1 |
| Program delineated in NUREG-1344 for | (1) Scope of Program: The AMP includes NUMARC program delineated in Appendix A of NUREG-1344 and | Element 1 | |
| single phase lines and implemented hrough NRC Generic Letter 89-08: | implemented through NRC Generic Letter (GL) 89-08; | should be | |
| CHECWORKS Code; EPRI guidelines of | CHECWORKS computer Code; and EPRI guidelines of | further | |
| VSAC-202L-R2 for effective | NSAC-202L-R2. The program includes the following | evaluated | |
| rosion/corrosion program; and water | recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of | | |
| chemistry program based on EPRI guidelines for secondary water | thinning and repair/replace components, and (c) perform | | |
| chemistry (EPRI TR-102134). | follow-up inspections to confirm or quantity and take | 1 | |
| | longer term corrective actions. Technical aspects of the CHECWORKS Code, including the parameters and inputs, | 1 | |
| | are acceptable. However, the EPRI guidance document | | |
| | NSAC-2021-R2 (April 1999) is too general to ensure | | |
| | applicant's flow-accelerated corrosion program will be | | |
| | effective in managing aging in safety-related systems. (2) Preventive Actions: The rate of E/C is affected by piping | <i>,</i> | |
| | (2) Preventive Actions: The fate of E/C is anected by paping material, geometry and hydrodynamic conditions, and | 1 | |
| | operating conditions such as temperature, pH, and | | |
| | dissolved oxygen content. Mitigation is by selecting | | |
| | material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving | | |
| | bydrodynamic conditions through design modifications. | | |
| | (3) Parameters Monitored/Inspected: The AMP monitors | 1 | |
| | the effects of E/C on the intended function of piping by | | |
| | measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection | | |
| | program delineated in NUREG-1344 requires ultrasonic or | r | |
| | radiographic testing of 10 most susceptible locations and 5 | 5 | |
| | additional locations based on unique operating | | |
| | conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is | 3 | |
| | expanded based on engineering judgment. Analytical | | |
| | models such as those incorporated into the CHECWORKS | | |
| | code are used to predict E/C in piping systems based on | | |
| | specific plant data including material and hydrodynamic and operating conditions. The inspection data is used to | | |
| | calibrate and benchmark the models and code. | | |
| | (A) Detection of Aging Effects: Aging degradation of piping | , | ĺ |
| | and fittings occurs by wall thinning: extent and schedule of inspection assure detection of wall thinning before the | | |
| | loss of intended function of the piping. (5) Monitoring and | a | |
| | Trending: Inspection schedule of NUREG-1344 and EPRI | | |
| | guidelines should provide for timely detection of leakage. | | · . |
| | Inspections and analytical evaluations are performed | | |
| | during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed | | |
| | within 6 months. (6) Acceptance Criteria: Inspection | | |
| | results are used to calculate number of refueling or | | |
| | a operating cycles remaining before the component reaches | | 1 |
| | Code minimum allowable wall thickness. If calculations | | |
| | indicate that an area will | | |

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| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | ENERATOR (Rec | | | | | |
|--|--|---|--------------|---|---------------------|-------------------------------------|--|
| | Structure and | Region of | | Environ- | Aging | Aging | D.C |
| Item | Component | Interest | Material | ment | Effect | Mechanism | References |
| D1.1.3 | Pressure | | Carbon steel | | Cumulative | Fatigue | ASME Section III. |
| thru D1.1.6 | Boundary and Structural | Upper & Lower Shell, Transition Cone, FW Nozzle & Safe End, FW Impingement Plate Support | (CS). LAS | Secondary- side Water Chemistry at 5.3-7.2 MPa | Fatigue Damage | × | 1989 Edition. GSI-190. |
| D1.1.3, D1.1.4 | Pressure Boundary and Structural | Upper & Lower Shell, Transition Cone | LAS | Up to 300°C Secondary- side Water Chemistry at 5.3-7.2 MPa | Loss of Material | Crevice and Pitting Corrosion | ASME Section XI. 1989 Edition. EPRI TR-102134. Operating Experience NRC IN 82-37. NRC IN 85-65. NRC IN 90-04. |

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1. STEAM GENERATOR (Recirculating)

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

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| D1. STEAM GENERATOR (Reci | rculating | Further |
|--|--|---|
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) reach Code minimum (plus 10% margin), the component must be repaired or replaced. However, NRC staff has identified the problems in implementing E/C program that pertain to weakness or errors in (a) using predictive models, (b) calculating minimum wall thickness acceptance criteria, (c) analyzing the results of UT examinations, and (d) assessment of E/C program activities (NRC Information Notice IN 93-21). (7) Corrective Actions: Prior to service, repair or replace to meet the requirements of NUREG-1344. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjustment of chemistry and operating parameters, or selection of materials resistant to E/C. However, NRC staff has identified weakness or errors in (a) dispositioning components after reviewing the results of the inspection analysis, and (b) repairing or replacing components that failed to meet the acceptance criteria [IN 93-21]. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: Wall-thinning problems in single-phase systems have occurred in feedwater and condensate systems (NRC Bulletin No. 87- 01, INs 81-28, 92-35, 95-11), and in two-phase piping in extraction steam lines (INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (INs 89- 53, 91-18, 93-21, 97-84). The AMP outlined in NUREG- 1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems. Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| The program includes preventive measures to mitigate crevice corrosion by recommendations on secondary water chemistry of EPRI TR-102134 and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a) Table IWC 2500-1, examination category C-A for pressure retaining welds in pressure vessels, and examination category C-H for pressure retaining Class 2 components. | (1) Scope of Program: The program relies on preventive measures to mitigate crevice or pitting corrosion and inservice inspection (ISI) to monitor the effects of corrosion on the intended function of the steam generator shell. (2) Preventive Actions: Stringent control of secondary water chemistry in accordance with the guidance of EPRI TR-102134. frequent monitoring, and timely corrective action when specified impurity levels are exceeded, prevent or mitigate corrosion. (3) Parameters Monitored/ Inspected: The AMP monitors the effects of corrosion by detection and sizing of flaws in pressure retaining welds and by detection of coolant leakage(by inservice inspection [ISI]) Inspection requirements of Table IWC 2500-T, examination | Yes Element 4 should be further evaluated |

| L | | ENERATOR (Rec | irculating) | · · · · · · · · · · · · · · · · · · · | | <u></u> | ···· |
|--------|-------------------------------------|---|-------------|--|---------------------------------|--------------------------------|--|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| | | | | | | - | |
| | | - | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | • | |
| D1.1.5 | Upper Assembly and Separators | FW Nozzle & Safe End | | Up to 225°C Secondary- side Water Chemistry | Wall Thinning | Erosion/ Corrosion (E/C) | Same as the effect of Erosion/ Corrosion on Item D1.1.2 Steam Nozzle and Safe End |
| D1.1.6 | Upper Assembly and Separators | Feedwater Impingement Plate Support | | Up to 300°C Secondary- side Water Chemistry | Loss of section thickness | Erosion | Plant Technical Specifications |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1. STEAM GENERATOR (Recirculating)

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1. STEAM GENERATOR (Recirculating)

| D1. STEAM GENERATOR (Reci | rculating) | |
|---|--|------------|
| Existing | | Further |
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) | |
| E Him D | category C-A specify volumetric examination, extending | |
| Bo setting corroran and | 1/2 in. each side, of all circumferential and tubesheet-to- shell welds, and visual VT-2 (IWA-5240) examination | |
| France carronin appen | during system leakage and hydrostatic tests of all pressure | |
| only at the welds? | retaining Class 2 components. Requirements for training | |
| any at the sweets | and qualification of personnel and performance | |
| To inspection of only the | demonstration for procedures and equipment is in | |
| Lolo alie to 2 | conformance with Appendix VII and VIII of ASME Section | |
| welds adequate? | XI, or any other formal program approved by the NRC. | |
| Shouldn't we ingred for | (4) Detection of Aging Effects: The extent and schedule of | |
| crevile corrision in | the inspections prescribed by the program are designed to | |
| Cleve Coverse co | ensure that flaws cannot attain a depth sufficient to | |
| locations where crevices | threaten the integrity of the welds. However, based on NRC | . |
| | Information notice 90-04 where general corrosion pitting of the shell exists, the program requirements may not be | |
| exist? for pitting where | sufficient to differentiate isolated cracks from inherent | |
| sitting is expedied? | geometric conditions, and additional inspection | |
| | procedures may be required. (5) Monitoring and Trending: | |
| | Inspection schedule of ASME Section XI should provide | |
| | for timely detection of leakage. System leakage test is | |
| The reviewers | conducted prior to plant startup following each refueling | |
| Rusti R.I | outage, and hydrostatic test at or near the end of each | |
| grestion is how | inspection interval. (6) Acceptance Criteria: Any defect detected is compared with the requirements of Section XI, | |
| | IWC 3510. Any relevant conditions that may be detected | |
| a program that | during the leakage and hydrostatic tests are evaluated in | |
| | accordance with IWC-3410 and IWC-3516. (7) Corrective | |
| addresses welds | Actions: Welds containing flaws that exceed the maximum | |
| A | permissible size must be repaired. Repair and replacement | |
| associated with The | are in conformance with IWA-4000. (8 & 9) Confirmation | |
| las D + in | Process and Administrative Controls: Site QA procedures, | |
| component well | review and approval processes, and administrative controls, in conjunction with NRC oversight, are | |
| find effects of | implemented in accordance with the requirements of | |
| | Appendix B of 10 CFR 50. These requirements, in | |
| fitting and corrosion | conjunction with enhanced UT techniques, should | |
| Peters and coords in | continue to ensure the timely detection and correction of | |
| Rikely to occur | virtually all forms of this type of degradation but cannot | |
| | be depended upon to prevent further degradation. | |
| away from the | (10) Operating Experience: This AMP has resulted in the | |
| | timely detection and correction of corrosion in several steam generators in the US. (NRC Information Notices 82- | |
| weld ? | 37 & 85-65). | |
| | Same as the effect of Erosion/Corrosion on Item D1.1.2 | No |
| Same as the effect of Erosion/Corrosion on Item D1.1.2 Steam Nozzle and Safe | Steam Nozzle and Safe End | |
| End | | 1 |
| Brick | | |
| | | |
| • | | l |
| Plant-specific aging management | Plant-specific aging management program will be | Yes |
| program | evaluated | no AMP |
| | | |
| | | |

| | D1. STEAM G | ENERATOR (Rec | irculating) | | | | |
|-------------------|--|---|-----------------|--|-----------------|--------------------|--|
| | Structure and | Region of | | Environ- | Aging Effect | Aging Mechanism | References |
| Item | Component | Interest | Material CS, | ment Up to 300°C | Attrition | Wear | NUREG-1339. |
| D1.1.7, D1.1.8 | Pressure Boundary and Structural | Secondary Manway & Bolting, Secondary Handhold & Bolting | LAS | Secondary- side Water Chemistry at 5.3-7.2 MPa | Attrition | | EPRI NP-5769. NRC GL 91-17. ASME Section XI, 1989 Edition. Operating Experience IEB 82-02. |
| | | | | | | | |
| | | • | | | | - f | |
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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

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REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM īV

| Existing | The transferred Technical Pacin | Further Evaluation | |
|-------------------------------------|---|-----------------------|--------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation | |
| | (continued from previous page) | | |
| | needed to meet the requirements of IWB-3142 and IWA- 5250. The leakage source and areas of wear are located. (8) | | |
| | 82 9) Confirmation Process and Administrative Controls: | 1 1 | |
| | Site QA procedures, review and approval processes, and | | |
| | administrative controls are implemented in accordance | | |
| | with requirements of Appendix B to 10 CFR Part 50 and | | |
| | will continue to be adequate for the period of license | | |
| | renewal. (10) Operating Experience: To date, the present | | |
| • | AMP has been effective in ensuring the timely detection | | |
| | and correction of wear degradation in steam generator | | |
| - | manway and handhold. | | |
| | (1) Scope of Program: The staff guidance of Generic Letter | No | |
| nplementation of NRC Generic Letter | (GL) 88-05 provides assurances that a program has been | | |
| 8-05, and inservice inspection in | implemented consisting of systematic measures to ensure | | |
| onformance with ASME Section XI | that the effects of corrosion caused by leaking coolant | Something | is mir |
| dition specified in 10 CFR 50.55a), | containing boric acid does not lead to degradation of the | Some | |
| ubsection IWC, Table IWB 2500-1, | assurance that the reactor coolant pressure boundary will | | |
| esting category B-P. | have a extremely low probability of abnormal leakage. | | |
| | rapidly propagating failure, or gross rupture. The program | | |
| | includes (a) determination of principal location. | | |
| | (b) examinations requirements and procedures for | | |
| | locating small leaks, and (c) engineering evaluations and | | |
| | corrective actions. (2) Preventive Actions: Minimizing | | |
| | reactor coolant leakage by frequent monitoring of the | | |
| | locations where potential leakage could occur and | 1 | |
| | repairing the leaky components as soon as possible, | | |
| | prevent or mitigate boric acid corrosion. (3) Parameters | 1 | |
| | Monitored/Inspected: The AMP detects coolant leakage by | | |
| | inservice inspection (ISI). Inspection requirements of | | |
| | ASME Section XI, Table IWB 2500-1, testing category B-P | | |
| | specifies visual inspection of all Class 1 pressure- | | |
| | retaining components during system leakage and | | |
| | hydrostatic tests. (4) Detection of Aging Effects: Aging | | |
| | degradation of the component can not occur without | | |
| | leakage of coolant containing boric acid; extent and | | |
| | schedule of inspection assure detection of leakage before | | |
| | the loss of intended function of the component. | | |
| • | (5) Monitoring and Trending: Inspection schedule of | | |
| | ASME Section XI should provide for timely detection of | 1 | |
| | leakage. System leakage test is conducted at ~40-month intervals. (6) Acceptance Criteria: Any relevant | | |
| | conditions that may be detected during the leakage and | | ł |
| | hydrostatic tests are evaluated in accordance with IWB- | 1 | |
| | 3100 and acceptance standards of NRC Generic Letter 88- | | |
| | 05. (7) Corrective Actions: Prior to service, corrective | | |
| | measures are needed to meet the requirements of NRC | | |
| | Generic Letter 88-05. The leakage source and areas of | | |
| | general corrosion are located. Components with local | | |
| | areas of corrosion that reduces the wall thickness by more | : | 1 |
| | than 10% require analytical evaluation to demonstrate | | 1 |
| | acceptability, (8 & 9) Confirmation Process and | | |
| | Administrative Controls: Site QA procedures, review and | | |
| | approval processes, and administrative controls are | | 1 |
| | implemented in accordance with requirements of | | |
| | Appendix B to 10 CFR Part 50 and will continue to be | | 1 |
| | adequate for the period of license renewal. (10) Operating | | 1 |
| | Experience: | 1 | 1 |

| | | ENERATOR (Rec | nemacing) | | | | |
|-------------|--|------------------------------|-----------|--|-----------------|--|--|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| | | | | | | - | |
| D1. 1.10 | Pressure Boundary and Structural | Primary Manway Bolting | | Air, Leaking Chemically Treated Borated Water and/or Steam at temperature s up to 340°C | | Stress Corrosion Cracking (SCC) | NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. ASME Section XI. 1989 Edition. |
| | | | | | | | |

IVREACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEMD1.STEAM GENERATOR (Recirculating)

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1 STEAM GENERATOR (Recirculating)

| D1. STEAM GENERATOR (Rec |
|--|
| Existing Aging Management Program (AMP) |
| |

| not convistent | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|--------------------------|----------------------------|--|-----------|---|--|--------------------|--|
| borotid worden NEI 97-06 | | Steam Generator Tubes and Sleeves | Alloy 600 | Up to 300°C Secondary- side Water Chemistry at 5.3-7.2 MPa | Not Cruck Crack Initiation and Growth | n'steut PWSCC | Plant Technical Specifications, Reg. Guide 1.83. Reg. Guide 1.121. NRC GL 95-05. NRC IN 97-26. NRC IN 97-26. NRC IN 97-88. EPRI TR-105714, EPRI document "PWR Steam Generator Examination Guidelines: Rev. 5" |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

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Possibly these could be added wend discussed

Top of Tube theet, sludge pile, cresking has not been addressed - This would be due to SCC on crenice constrain cresking

REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM IV (The standard and and

| D1. STEAM GENERATOR (Recin | | Further |
|--|--|--|
| Existing | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) accordance with IWB-2400 requires inspection of all bolts, | |
| | System leakage test is conducted at each refueling outage. | |
| | evaluated in accordance with IWB-3100 by comparing ISI | |
| | IWB-3515 and IWB-3517. Any relevant conditions that | |
| | standards of IWB-3522. (7) Corrective Actions: Repair and | |
| | recommendations and guidelines of EPRI NP-5769. (8 & 9) | |
| | QA procedures, review and approval processes, and | |
| | with requirements of Appendix B to 10 CFR Part 50 and | |
| | renewal. (10) Operating Experience: Significant number of | |
| | failed or become degraded because of boric acid wastage or | |
| | generator and pressurizer manway closures, (b) valve | |
| | greater, and (c) control rod drive and pressurizer heater | |
| | means of ensuring bolting reliability. | No |
| Inservice inspection in conformance with Plant Technical Specifications | SCC of the steam generator tubes on the integrity of the | provided |
| and NRC Regulatory Guide (RG) 1.83 | with Plant Technical Specifications and RG 1.83 deal with | Plant Technical |
| Water Reactor Steam Generator Tubes." | describe the basis for determining when flawed tubes must | Specifi- cations |
| governed by NRC Regulatory Guide 1.121 | water chemistry guidelines given in EPRI TR-105714 | conform t EPRI |
| Steam Generator Tubes"), but defects at | (3) Parameters Monitored/Inspected: The inspection | guideline |
| the 1.121 requirements using the P*, F*, | alternatively, remaining sound wall thickness. | and NEI 9 06 and ar |
| applicable to cracking at the tube | (4) Detection of Aging Effects: The extent and schedule of the inspections prescribed by the program are designed to | adhered t |
| designed steam generators under certain | ensure that flaws cannot attain a depth sufficient to threaten the integrity of the tubes. Problems with tube | |
| Generic Letter (GL) 95-05 ("Voltage- | inspection (IN 97-88), e.g., failures to detect some flaws, uncertainties in flaw sizing, inaccuracies in flaw | |
| Steam Generator Tubes Affected by | locations, and inability to detect some cracks at locations with dents are addressed by current inspection guidelines | |
| Cracking"). Specific guidance on the | given in the EPRI document "PWR Steam Generator Examination Guidelines: Revision 5" and NEI 97-06. | |
| provided in the EPRI document "PWR Steam Generator Examination | (5) Monitoring and Trending: Required inspection intervals (typically ≈18 months or each refueling or | |
| Guidelines: Revision 5" and NEI 97-06. | maintenance/repair outage) provide for timely detection of SCC. (6) Acceptance Criteria: Any cracking detected is | |
| and plugging criteria may be contained | Specifications, RG 1.121, and GL 95-05. (7) Corrective | |
| Specifications. | Actions: Tubes containing flaws that exceed the maximum permissible size must be plugged or/repaired. (8 & 9) | |
| there . | | |
| | Existing Aging Management Program (AMP) Aging Management Program (AMP) Aging Management Program (AMP) Inservice inspection in conformance with Plant Technical Specifications and NRC Regulatory Guide (RG) 1.83 ('Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes." Plugging or repair of defective tubes is governed by NRC Regulatory Guide 1.121 ('Bases for Plugging Degraded PWR Steam Generator Tubes"), but defects at the tube sheet may be shown to satisfy the 1.121 requirements using the P*, F*. or L* criterion. Alternative criteria applicable to cracking at the tube support plates in Westinghouse- designed steam generators under certain circumstances are provided in NRC Generic Letter (GL) 95-05 ('Voltage- Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking"). Specific guidance on the inservice inspection of tubes is also provided in the EPRI document "PWR Steam Generator Examination Guidelines: Revision 5" and NEI 97-06. Supplemental inspection requirements and plugging criteria may be contained in plant-specific Technical Specifications. | Existing Aging Management Program (AMP) Evaluation and Technical Basis (continued, from previous page) accordance with WB-3400 requires inspection of all bolts, studs, nuts, bushing, and flange surfaces every 10, System leakage test is conducted at each relueling outage. (b) Acceptance Criteria: Any cracks in closure bolting are evaluated in accordance with WB-3100 by comparing ISI results with the acceptance standards of WB-3400 and IWB-3515 and IWB-3322. (7) Corrective Actions: Repair and replacement is in conformance with WA-4000 and recommendations and guidelines of EPRI NP-5769. (8 e. 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experiance: Significant number of incidents have been reported on bolts and nuts that have failed or become degraded because of bort acid wasage or SCC. Examples of affected fasteners include (a) steam generator and pressurizer manway closures, (b) valve bonnets and pump flange connections on lines 6 in. or greater, and (c) control of drive and pressurizer heater connections. The present AMP has provided effective means of ensuring botting reliability. Inservice inspection in conformance with Plant Technical Specifications and NRC Regulatory Guide 1.03. (1) Scope of Program: The program dala with the effects of SCC of the stam generator tubes on the integrity of the pressure boundary. Inservice inspection in accordance with Plant Technical Specifications and NRC Regulatory Guide 1.03. Timservice Inspection of Pressurized and NRC Regulatory Guide 1.03. (1) Scope of Program: The program dala with the effects of SCC of the stam generator tubes. A lot delex the provide guidance on the proving guidance on the proving gu |

delete? ilus youties to assic

| | | ENERATOR (Rec | ncuacing) | | | · · · · · · · · · · · · · · · · · · · | |
|--------|----------------------------|-----------------------------|-----------|---|-----------------------------------|---|--|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| | | - | | | | | |
| D1.2.1 | Tube Bundle | Steam Generator Tubes | Alloy 600 | Up to 300°C Secondary- side Water Chemistry at 5.3-7.2 MPa | Crack Initiation and Growth | Outer Diameter Stress Corrosion Cracking (ODSCC) | Plant Technical Specifications. Reg. Guide 1.83. Reg. Guide 1.121. NRC GL 95-05. EPRI document "PWR Steam Generator Examination Guidelines: Rev. 5". NEI 97-06 |

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1. STEAM GENERATOR (Recirculating)

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1. STEAM GENERATOR (Recirculating)

| D1. STEAM GENERATOR (Rec | irculating | Further |
|--|---|-------------|
| Existing | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) | Evaluation and reclimical basis | No, |
| nservice inspection in conformance | (1) Scope of Program: The program deals with the periodic | provided |
| ith Plant Technical Specifications | inspection of steam generator tube plugs. (2) Preventive | Plant |
| nd NRC Regulatory Guide 1.83 | Actions: Guidance on primary water chemistry provided | Technical |
| Inservice Inspection of Pressurized | in EPRI TR-102134 can significantly reduce PWSCC. The | Specifi- |
| Vater Reactor Steam Generator Tubes". | program also recommends that certain susceptible heats | cations |
| Correlations for estimating plug life | be avoided. (3) Parameters Monitored/ Inspected: The | conform to |
| ontained in Westinghouse reports | inspection activity in the program monitors flaw size and | |
| VCAP-12244 and WCAP 12245. Specific | depth. (4) Detection of Aging Effects: The extent and | EPRI |
| uidance on the inservice inspection of | schedule of the inspections prescribed by the program are | inspection |
| lugs is provided in the EPRI document | designed to ensure that flaws cannot attain a depth | guidelines |
| PWR Steam Generator Examination | sufficient to threaten the integrity of the tubes. Past | and NEI 97- |
| Guidelines: Revision 5" and NEI 97-06. | problems with failure to detect flaws in plugs have led to | 06 and are |
| Supplemental inspection requirements | leaking or failed plugs in several plants ((BL 89-01; 89-01, | adhered to. |
| nay be contained in plant-specific | S. 1: 89-01, S. 2; IN 89-33, 94-87). However, improved | |
| echnical Specifications. | detection procedures are provided in the EPRI document | |
| comment operationer | "PWR Steam Generator Examination Guidelines: Revision | |
| | 5" and NEI 97-06. (5) Monitoring and Trending: Required | |
| | inspection intervals (typically ≈ 18 months or each | |
| | refueling or maintenance/repair outage) are intended to | |
| | provide for timely detection of SCC. However, note item [4] | ľ |
| | immediately above (6) Acceptance Criteria: Any cracking | |
| | detected requires replacement. Plug lives can be estimated | |
| | using procedures in WCAP-12244 and 12245 and compared | |
| | with the limits given in those reports. (7) Corrective | |
| • | Actions: Tube plugs containing flaws or having | |
| | insufficient estimated lives must be replaced. (8 & 9) | |
| | Confirmation Process and Administrative Controls: Site | |
| | QA procedures, review and approval processes, and | |
| | administrative controls, in conjunction with NRC |] i |
| | oversight, are implemented in accordance with the | |
| | requirements of Appendix B of 10 CFR 50. This should | |
| | ensure the timely detection and correction of cracking. | |
| | (10) Operating Experience: Problems appear to have been | |
| | related to susceptible heats of material and improper heat | |
| | related to susceptible fleats of material and improper fleat | |
| | treatment. However, any Alloy 600 mechanical plugs | |
| | remaining in service must be considered susceptible (BL | 1 |
| | 89-01; 89-01, S 1; 89-01, S 2; IN 89-33, 94-87). | No, |
| inservice inspection in conformance | (1) Scope of Program: The program deals with the periodic | provided |
| with Plant Technical Specifications | inspection of steam generator tube plugs. (2) Preventive | Plant |
| and NRC Regulatory Guide 1.83 | Actions: Guidance on primary water chemistry provided | Technical |
| "Inservice Inspection of Pressurized | in EPRI TR-102134 can significantly reduce PWSCC. The | Specifi- |
| Water Reactor Steam Generator Tubes". | program also recommends that certain susceptible heats | cations |
| Specific guidance on the inservice | be avoided. (3) Parameters Monitored/Inspected: The | conform to |
| inspection of plugs is provided in the | inspection activity in the program monitors flaw size and | EPRI |
| EPRI document "PWR Steam Generator | depth. (4) Detection of Aging Effects: The extent and | |
| Examination Guidelines: Revision 5" | schedule of the inspections prescribed by the program are | inspection |
| and NEI 97-06. Supplemental | designed to ensure that flaws cannot attain a depth | guidelines |
| inspection requirements may be | sufficient to threaten the integrity of the tubes | and NEI 97- |
| contained in plant-specific Technical | (5) Monitoring and Trending: Required inspection | 06 and are |
| Specifications. | intervals (typically ≈ 18 months or each refueling or | adhered to. |
| opumations. | maintenance/repair outage) appears to provide for timely | • • |
| | detection of SCC, and no leakage due to failed plugs has / | |
| | been reported. (6) Acceptance Criteria: Any cracking | |
| | | |

| 1 | D1. STEAM G | ENERATOR (Rec | rcutating | | | ···· | ····· |
|--------|-------------------------------------|---|-----------|---|---------------------|-----------------------|--|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| | | | | | | - | |
| D1.25 | Tube Bundle | Tubes in the Region of Repair Sleeves | | Chemically Treated Borated Water at temperature s up to 340°C and 15.5 MPa | | PWSCC | Plant Technical Specifications; NRC Reg. Guide 1.83; NRC IN 94-05; EPRI document "PWR Steam Generator Examination Guidelines: Rev. 5"; NEI 97-06 |
| D1.3.1 | Upper Assembly and Separators | Feedwater Inlet Ring and Supports | | Up to 300°C Secondary- side Water Chemistry at 5.3-7.2 MPa | Loss of Material | Erosion/ corrosion | ASME Section XI. 1989 Edition.; NRC IN 91-19; NRC LER 50-362/90-05-01; Combustion Engineering Info- bulletin 90-04 |

IVREACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEMD1.STEAM GENERATOR (Recirculating)

| Existing | Production and Westerlast Destr | Further |
|---|--|-----------------------|
| D1. STEAM GENERATOR (Rec Existing Aging Management Program (AMP) | Evaluation and Technical Basis (continued from previous page) forms of degradation. (6) Acceptance Criteria: Any defect detected is compared with the requirements of the Plant Technical Specifications and with the recommendations of Combustion Engineering Info-bulletin 90-04. These requirements should ensure structural integrity. (7) Corrective Actions: Excessively degraded components must be repaired or replaced (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls, in conjunction with NRC oversight, are implemented in accordance with the requirements of Appendix B of 10 CFR 50. These requirements should continue to ensure the timely detection and correction of all forms of degradation. (10) Operating Experience: This form of degradation has been detected only in certain Combustion | Further Evaluation |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), ANSI B31.1, or other evaluations based on cumulative usage factor (CUF). | Engineering System 80 steam generators, where it has been successfully dealt with (NRC Information Notice 191- 19; NRC LER 50-362/90-05-01). Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. Det previous comment related for futigue life in steam | Yes TLAA |
| Same as the effect of Erosion/Corrosion on Item D1.1.2 Steam Nozzle and Safe End | Same as the effect of Erosion/Corrosion on Item D1.1.2 Steam Nozzle and Safe End | No |
| Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NB, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF). | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Same as the effect of Erosion/Corrosion on Item D1.1.2 Steam Nozzle and Safe End | Same as the effect of Erosion/Corrosion on Item D1.1.2 Steam Nozzle and Safe End | No |
| Same as the effect of Erosion/Corrosion on Item D1.1.2 Steam Nozzle and Safe End | Same as the effect of Erosion/Corrosion on Item D1.1.2 Steam Nozzle and Safe End | No |

IVREACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEMD1.STEAM GENERATOR (Recirculating)

| | | ENERATOR (Rec | nemaring | | | | |
|---------|-----------------------------|------------------------|----------|--|------------------|----------------------|--|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| D1.4.1 | Piping and Fittings | Main Steam | CS | Up to 300°C Steam | | | ASME Section XI. 1989 Edition |
| | | | | | | | |
| D1.4.2, | Piping and | Feedwater, | CS | Up to 300°C | Loss of | | ASME Section XI, |
| D1.4.3 | Fittings | Auxiliary Feedwater | | Secondary- side Water Chemistry | Material | Pitting Corrosion | 1989 Edition |
| D1.5.1 | Safety and Relief Valves | Body | CS | Up to 300°C Steam or Secondary- side Water Chemistry | Wall Thinning | E/C | Same as the effect of Erosion/Corrosio n on Item D1.1.2 Steam Nozzle and Safe End |

REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM IV D1. STEAM GENERATOR (Recirculating)

hav about the SG preserve vessel itself? hoh croking in the transition care area Same your ago DRAFT-12/06/99 IV D1-38

D2. Steam Generator (Once-Through)

- D2.1 Pressure Boundary and Structural
 - D2.1.1 Upper & Lower Heads
 - D2.1.2 Tube Sheets
 - D2.1.3 Primary Nozzles & Safe Ends
 - D2.1.4 Shell
 - D2.1.5 Feed Water and Auxiliary Feed Water Nozzles & Safe Ends

D2.1.6 Steam Nozzles & Safe Ends

- D2.1.7 Instrument & Drain Nozzles
- D2.1.8 Primary Manways & Bolting
- D2.1.9 Secondary Manways Handholes & Bolting
- D2.2 Tube Bundle

D2.2.1 Tubes

- D2.3 Piping and Fittings
 - D1.4.1 Main Steam
 - D1.4.2 Feedwater
 - D1.4.3 Auxiliary Feedwater
- D2.4 Safety and Relief Valves
 - D1.5.1 Body

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D2. Steam Generator (Once-Through)

- D2.1 Pressure Boundary and Structural
 - D2.1.1 Upper & Lower Heads
 - D2.1.2 Tube Sheets
 - D2.1.3 Primary Nozzles & Safe Ends
 - D2.1.4 Shell
 - D2.1.5 Feed Water and Auxiliary Feed Water Nozzles & Safe Ends
 - D2.1.6 Steam Nozzles & Safe Ends
 - D2.1.7 Instrument & Drain Nozzles
 - D2.1.8 Primary Manways & Bolting
 - D2.1.9 Secondary Manways Handholes & Bolting
- D2.2 Tube Bundle

D2.2.1 Tubes

- D2.3 Piping and Fittings
 - D1.4.1 Main Steam
 - D1.4.2 Feedwater
 - D1.4.3 Auxiliary Feedwater
- D2.4 Safety and Relief Valves
 - D1.5.1 Body

Some of the comments bookded for D1, steam Grenerator (Recirculating) Should be reviewed for D2, Steam Generator (Once-Thronga). DRAFT - 12/06/99 IV D2-1 comments provided for DI.I.I and DI.I.2 apply to D.2.1.1. Comment provided for D1.2.1 apply to D2.2.1

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IV D2-2

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CHAPTER V (12/06/99)

ENGINEERED SAFETY FEATURES

Major Plant Sections

- A. Containment Spray System
- B Standby Gas Treatment System (Boiling Water Reactor)
- C. Containment Isolation Components
- D1. Emergency Core Cooling System (Pressurized Water Reactor)
- D2. Emergency Core Cooling System (Boiling Water Reactor)
- E. Fan Cooler System

A Containment Spray System

- A.1 Containment Spray System
 - A.1.1 Piping and Fittings up to Isolation Valve
 - A.1.2 Flow Orifice/Elements
 - A.1.3 Temperature Elements/Indicators
 - A.1.4 Bolting
 - A.1.5 Eductors
- A.2 Header and Spray Nozzles System
 - A.2.1 Piping and Fittings
 - A.2.2 Flow Orifice
 - A.2.3 Headers
 - A.2.4 Spray Nozzles
- A.3 Chemical Addition System
 - A.3.1 Piping and Fittings
 - A.3.2 Storage Tank
- A.4 Pumps
 - A.4.1 Bowl/Casing
 - A.4.2 Bolting
- A.5 Valves (Hand, Control, Check, Motor-Operated) (in Containment Spray System)
 - A.5.1 Body and Bonnet
 - A.5.2 Bolting
- A.6 Valves (Hand, Control) (in Header and Spray Nozzle System)
 - A.6.1 Body and Bonnet

A.6.2 Bolting

A.7 Containment Spray Heat Exchanger

- A.7.1 Bonnet/Cover
- A.7.2 Tubing
- A.7.3 Shell
- A.7.4 Case/Cover
- A.7.5 Bolting

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|------------------------|-----------------------------|---|-------------------------|---|--|-------------------------------------|---|
| A.1.1 thru A.1.3 | Containment Spray System | Piping and Fittings up to Isolation Valve, Flow Orifice/ Elements, Temperature Elements/ | Stainless Steel (SS) | Chemically Freated Borated Water at Maximum Design Temperatur | Local Loss of Material Are Gny | Pitting and Crevice Corrosion | ASME Section XI. 1989 Edition. NRC IN 84-18. Plant Technical Specifications. EPRI TR-105714. |
| | | Indicators - | | | Greas of of greater Importance than other | wlar U | |
| | | | | | cireas? Which region | | |
| | | | | | is more imp | | |
| | | No an Nessai | l the of in | Comp Kuist | | • | ted in the experience |
| | | lozs y nati | 8 00 | Henne re Ih | l c ley p ans! | the so Nantige | and |
| | | | | Ţ | | · I | n 1997 - Marine Marine, ang ara- |

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ENGINEERED SAFETY FEATURES

| | SYSTEM (Pressurized Water Reactor) | | , |
|--|--|-----------------------------|------------|
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Further Evaluation | I |
| nservice inspection is in conformance | | Yes. | |
| vith ASME Section XI (edition specified | | Element 4 | 4 |
| n 10 CFR 50.55a), Table IWC 2500-1. | inservice inspection (ISI) to monitor the effects of | should be | i |
| xamination category C-H for pressure | | further | i i |
| etaining Class 2 components. Water | system components. (2) Preventive Actions: Control of | evaluated | i i |
| · | | • • | |
| hemistry program for minimizing | halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during | 1 | · |
| npurities by monitoring and naintaining water chemistry | | 1 1 | • |
| onditions based on guidelines of EPRI | operation, and monitor and control of water chemistry during shut down, mitigate potential for pitting and crevice | 1 | ı |
| onditions based on guidelines of EPRI/ R-105714 for primary water chemistry | | 1 | |
| R-105714 for primary water chemistry nd plant technical specifications for | | 1 | , |
| | - contaminants into the coolant system can occur, e.g., | 1 1 | |
| efueling water storage tank water hemistry. | contaminants in the boric acid, or introduced through the free surface of spent fuel nool INRC Information Notice IIN | 1 1 | |
| iemistry. | free surface of spent fuel pool (NRC Information Notice (IN) 84-181 or from water from the sump. The AMP must | 1 1 | |
| · | 84-18], or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section | 1 1 | • |
| , | therefore rely upon ISI in accordance with ASME Section | 4 1 | |
| · · · · · · · · · · · · · · · · · · · | XI to detect possible degradation. (3) Parameters | 1 | |
| , | Monitored/Inspected: The AMP monitors the effects of | 1 | |
| · • • | corrosion by control of system water chemistry and by detection of coolant leakage by inservice inspection (ISD | 1 1 | |
| , | detection of coolant leakage by inservice inspection (ISI). | .1 1 | |
| • , | Inspection requirements of ASME Section XI specify visual | 1 | |
| , | VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 2 | 1 | |
| | hydrostatic tests of all pressure retaining Class 2 | 1 | |
| | components required to operate or support the safety | 1 | |
| | function according to Table IWC 2500-1 category C-H. | 1 1 | |
| | (4) Detection of Aging Effects: Degradation of the | 1 1 | |
| | component due to corrosion would result in leakage of(coolant. However, a one-time inspection of representative | 1 1 | |
| 1 | | > How the same | 10% |
| , , | sample of the system population and most susceptible locations in the system should be conducted to ensure that | 1- 10-1 | is . |
| | significant degradation is not occurring and the | 1 sho cd | ale! |
| | component intended function will be maintained during | 1 yrue any | mpin |
| | the extended period. Follow up actions are based on the | 1 desort | ·nod |
| | inspection results and plant technical specification. | UETO T | (mu |
| | Inspection results and plant technical specification. | 1 1 | |
| | | 1s a | |
| | requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive | | , |
| 1 | ASTM standards, using a variety of nondestructive | Stand | ard |
| | techniques including visual, ultrasonic, and surface | I | - |
| | techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design | Stande Formul | la |
| | severity of conditions, time of service, and lowest design margin. (5) Monitoring and Trending: System leakage test | 1 Juni | Γ_ |
| | is conducted prior to plant startup following each refueling | user | tor |
| | outage, and hydrostatic test at or near the end of each | cil Is | · sicher |
| | inspection interval. The results of one-time inspection | used all s | ysp |
| | should be used to dictate the frequency of future | 11 | Ň., |
| | | or is H | he |
| | conditions that may be detected during the leakage and | samples done si by si | - 150 |
| | hydrostatic tests are evaluated in accordance with IWC- | Samag - | 2100 |
| | LYdrostatic tests are evaluated in accurate when the | 1 | -10 |
| | 3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components. (7) Correcting Actions: Prior to | done p | yster |
| | for Class 2 components. (7) Corrective Actions: Prior to | · 1 | т г_ |
| | service, corrective measures are needed to meet the | ku 151 | USHA |
| | requirements of IWB-3142 and IWA-5250. Repairs are in | - · · · | <i>i</i> - |
| | conformance with IWA-4000 and replacement according to | 1 | |
| | IWA-7000. (8 & 9) Confirmation Process and | | |
| | Administrative Controls: Site QA procedures, review and | - | |
| | approval processes, and administrative controls are | 1 | • |
| U U | implemented in accordance with requirements of | | • • • • • |
| | Appendix B to 10 CFR 50 and will continue to be adequate | 1 | |

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ENGINEERED SAFETY FEATURES

| CONTAINMENT | SPRAY SYSTEM | (Pressurized Wate | r Reactor) |
|-------------|--------------|-------------------|------------|
| | | | |

| A. CONTAINMENT SPRAY ST | ISTEM (Pressurized Water Reactor) | | |
|---|---|-----------------------|-----|
| Existing | The sector and Technical Radia | Further Evaluation | |
| Aging Management Program (AMP) | Evaluation and Technical Basis | Dvaluation | |
| | (continued from previous page) for the period of license renewal. (10) Operating | | |
| | Experience: Corrosion related degradation has not been | | |
| | reported for containment spray system components, but | | |
| | cracking has occurred in safety-related SS piping systems | | |
| | and portions of systems which contain oxygenated. | | |
| | stagnant, or essentially stagnant borated water. | | |
| Guidelines of Regulatory Guide (RG) 1.44 | (1) Scope of Program: The program includes preventive | No | |
| to avoid sensitization of stainless steels | measures to mitigate stress corrosion cracking (occ) of | | |
| and, based on plant specifications, | stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of | | |
| inservice inspection in conformance | containment spray system components. (2) Preventive | | |
| with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, | Actions: Selection of material in compliance with the | | |
| examination category C-F-1 for | guidelines of Regulatory Guide (RG) 1.44 prevents or | | |
| pressure retaining welds in Class 2 | mitigates SCC. Control of halogens, sulfates, and oxygen in | | |
| stainless steel piping. Water chemistry | the primary water to less than 0.05, 0.05, and 0.005 ppm, | | |
| program for minimizing impurities by | respectively, during operation, and monitor and control of respectively, during operation, and monitor and control of | | |
| monitoring and maintaining water | water chemistry during shut down, mitigate potential of SCC. However, inadvertent introduction of contaminants | | |
| chemistry conditions based on | into the coolant system can occur, e.g., contaminants in the | | • |
| guidelines of EPRI TR-105714 for primary water chemistry and plant | boric acid, or introduced through the free surface of spent | | |
| technical specifications for refueling | fuel pool INRC Information Notice (IN) 84–18, or from | | |
| water storage tank water chemistry. | water from the sump. The AMP must therefore rely upon | | |
| | ISI in accordance with ASME Section XI to detect possible | | |
| | degradation. (3) Parameters Monitored/Inspected: The | | |
| | AMP monitors the effects of SCC on the intended function of the piping by control of system water chemistry and by | | |
| | detection and sizing of cracks by ISI. Inspection | | |
| | requirements of IWC 2500-1 category C-F-1, specify for | | |
| | circumferential and longitudinal welds in each pipe or | | |
| | branch run NPS 4 or larger, volumetric and surface | | |
| | examination of ID region, and surface examination of OD | | |
| | surface. Surface examination is conducted for | | |
| | circumferential and longitudinal welds in each pipe or branch run less than NPS 4. Requirements for training | | |
| · · · · · · · · · · · · · · · · · · · | and qualification of personnel and performance | | |
| ************************************** | demonstration for procedures and equipment are in | should | |
| | conformance with Appendices VII and VIII of ASME | Shou | |
| | Section XI, or any other formal program approved by the | K th | 165 |
| | NRC. (4) Detection of Aging Effects: Degradation of piping | | • |
| | and fittings due to SCC can not occur without crack injtiation: inspection schedule assures detection of cracks | is to true | 10 |
| · | before the loss of intended function of the piping | AINC | 101 |
| | (5) Monitoring and Trending: Inspection schedule in | . Eli | La |
| | accordance with IWC-2400 should provide timely detection | ot Time | he |
| | of cracks. System leakage test is conducted prior to plant | 1 | 2 |
| | startup following each refueling outage, and hydrostatic | ר איד | 5 |
| | test at or near the end of each inspection interval. (6) Acceptance Criteria: Any SCC degradation is evaluated | 1 | • |
| • · | in accordance with IWC-3100 by comparing ISI results with | l. | |
| | the acceptance standards of IWC-3400 and IWC-3514. | | |
| | Supplementary surface examination may be performed on | | |
| | interior and/or exterior surfaces when flaws are detected in | 1 | |
| | volumetric examination. (7) Corrective Actions: Repairs | | |
| | are in conformance with IWA-4000, replacement according to IWA-7000, and reexamination in accordance | | |
| | | | |

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ENGINEERED SAFETY FEATURES v

| Existing | m 1 dia and material David | Further Evaluation |
|---|--|-----------------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| • | (continued from previous page) | 1 |
| | in conformance with Appendices VII and VIII of ASME | |
| | Section XI, or any other formal program approved by the | |
| | NRC. (4) Detection of Aging Effects: Degradation of the | |
| | piping due to SCC can not occur without crack initiation. | |
| | The extent of inspection required by ASME Section XI is | 1 |
| | considered adequate to detect cracking of susceptible SS | |
| | components and cladding in the weld regions. (5) Monitoring and Trending: Inspection schedule in | |
| | accordance with IWC-2400 should provides timely | |
| | detection of cracks. (6) Acceptance Criteria: Any SCC | |
| | degradation is evaluated in accordance with IWC-3100 by | |
| | comparing ISI results with the acceptance standards of | |
| | IWC-3400. (7) Corrective Actions: Repair and replacement | |
| | are in conformance with IWA-4000 and IWC-3133, and | |
| | reexamination in accordance with requirements of IWA- | |
| | 2200. (8 & 9) Confirmation Process and Administrative | |
| | Controls: Site QA procedures, review and approval | |
| | processes, and administrative controls are implemented in | 1 |
| | accordance with requirements of Appendix B to 10 CFR | |
| | Part 50 and will continue to be adequate for the period of | |
| | license renewal. (10) Operating Experience: No significant | |
| | cracking has been reported for chemical addition lines in | |
| | PWRs. | |
| idelines of Regulatory Guide (RG) 1.44 | (1) Scope of Program: The program includes preventive | Yes, Element 4 |
| avoid sensitization of stainless steels | measures to mitigate stress corrosion cracking (SCC) and | should be |
| i, based on plant specifications. | inservice inspection (ISI) to monitor the effects of SCC on | further |
| ervice inspection in conformance | the storage tank. (2) Preventive Actions: Selection of | evaluated |
| h ASME Section XI (edition specified | material in compliance with the guidelines of Regulatory | evaluated |
| 0 CFR 50.55a), Table IWC 2500-1. | Guide (RG) 1.44 prevents or mitigates SCC. (3) Parameters | |
| mination category C-H for pressure | Monitored/ Inspected: The AMP monitors the effects of SCC by detection of leakage. Inspection requirements of | |
| aining Class 2 components. | ASME Section XI specify visual VT-2 (IWA-5240) | |
| | examination during system leakage test and system | |
| | hydrostatic test of all pressure retaining Class 2 | |
| | components required to operate or support the safety | |
| | function, according to Table IWC 2500-1 category C-H. | |
| | (4) Detection of Aging Effects: Degradation of the | |
| | component due to SCC can not occur without leakage of | |
| | coolant. However, a one-time inspection of representative | الما د |
| \sim | sample of the system population and most susceptible | - How samp |
| | locations in the system should be conducted to ensure that | - A |
| | significant degradation is not occurring and the | Sump |
| | component intended function will be maintained during | 1.1. |
| | the extended period. Follow up actions are based on the | determ. |
| | inspection results and plant technical specification. | + |
| | Inspection is performed in accordance with the | |
| | requirements of ASME Code, 10CFR50 Appendix B, and | |
| | ASTM standards, using a variety of nondestructive | |
| | techniques including visual, ultrasonic, and surface | |
| | severity of conditions, time of service, and lowest design | |
| | severity of conditions, time of service, and lowest design margin. (5) Monitoring and Trending: System leakage test | |
| • | is conducted prior to plant startup following each refueling | |
| | outage, and hydrostatic test at or near the end of each | |
| | inspection interval. The results of one-time inspection | |
| | should be used to dictate the frequency of future | |
| | inspections. (6) Acceptance Criteria: Any | |
| | | |

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V ENGINEERED SAFETY FEATURES

| V ENGINEERED SAFETY FEATURE | STEM (Pressurized Water Reactor) | |
|--|---|---|
| | | Further |
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB- 3516. Any evidence of aging effects or unacceptable results should be evaluated. (7) Corrective Actions: Repair and replacement are in conformance with IWA-4000 and IWB- 4000. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: No significant cracking has been reported for chemical addition storage tanks in PWRS. | |
| Inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1. examination category C-H for pressure retaining Class 2 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 pumps, and additional NRC staff guidelines of NRC Generic Letter 89-04, inservice testing performed in accordance with ASME Subsection IWP (or Operation and Maintenance Code Subsection ISTB) for pumps, or other approved program in the plant specifications. Water chemistry program based on EPRI guidelines of TR-105714 for minimizing impurities by monitoring and maintaining primary water chemistry. | (1) Scope of Program: The program relies on preventive measures to mitigate crevice or pitting corrosion and combination of inservice inspection [ISI] and inservice testing [IST] to monitor the effects of corrosion on the intended function of containment spray system components. (2) Preventive Actions: Control of halogens. sulfates, and oxygen in the primary water to less than 0.05. 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down. mitigate potential for pitting and crevice corrosion. However, inadvertent introduction of contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 84-18], or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation. (3) Parameters Monitored/ Inspected: The AMP monitors the effects of corrosion by control of water chemistry and by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA- 5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 2 components required to operate or support the safety function according to Table WC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 2 pumps and additional guidelines of NRC Generic Letter (GL) 89-04. IST is performed in accordance with ASME Subsection IWP (or OM Code Subsection ISTB). (4) Detection of Aging Effects: Degradation of the component due to corrosion would result in leakage of coolant or degradation of pump performance. However, a one-time inspection of representative Sample of the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requi | Yes, Element 4 should be further evaluated - How is sample Size deferminect |

V A-15

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ENGINEERED SAFETY FEATURES

| Existing | STEM (Pressurized Water Reactor) | Further Evaluation | |
|---|--|------------------------|-------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Staluation | |
| | (continued from previous page) | | |
| | nondestructive techniques including visual, ultrasonic, | | |
| | and surface techniques. Selection of susceptible locations | | |
| | is based on severity of conditions, time of service, and | | |
| | lowest design margin. (5) Monitoring and Trending: | | |
| | System leakage test is conducted prior to plant startup | | |
| | following each refueling outage, and hydrostatic test at or | | |
| | near the end of each inspection interval. The results of | | |
| | one-time inspection should be used to dictate the frequency | | |
| | of future inspections. (6) Acceptance Criteria: Any relevant conditions that may be detected during the leakage and | | |
| | hydrostatic tests are evaluated in accordance with IWC- | | |
| | hydrostatic tests are evaluated in accordance and IWB-3516. 3100 and acceptance standards of IWC-3400 and IWB-3516. | | |
| | (7) Corrective Actions: Repairs are in conformance with | | |
| | WA-4000, replacement according to IWA-7000, and | | |
| | reexamination in accordance with requirements of IWA- | | |
| | 2200. (8 & 9) Confirmation Process and Administrative | | |
| 1 | Controlet Site OA procedures, review and approval | 1 I | |
| | processes and administrative controls are implemented in | 1 | |
| | accordance with requirements of Appendix B to IU CFR | 1 | |
| | Part 50 and will continue to be adequate for the period of | 1 | |
| | license renewal. (10) Operating Experience: Localized | | |
| | corrosion is likely to occur at flange connections where | | |
| | buildup of impurities can occur. | | |
| 1) How of Deceleters Outdo (DC) 1 44 | (1) Scope of Program: The program includes preventive | No | |
| uidelines of Regulatory Guide (RG) 1.44 | measures to mitigate stress corrosion cracking (SCC) of | | |
| avoid sensitization of stainless steels | stainless steel (SS) and inservice inspection (ISI) to | | |
| id, based on plant specifications, | monitor the effects of SCC on the intended function of | 1 1 | |
| service inspection in conformance | containment spray system components. (2) Preventive | | |
| th ASME Section XI (edition specified 10 CFR 50.55a), Table IWC 2500-1, | Actions: Selection of material in compliance with the | | |
| amination category C-G for pressure | mudelines of Regulatory Guide (RG) 1.44 prevents or | | |
| taining welds in pumps. Water | mitigates SCC. Control of halogens, suitates, and oxygen in | 1 1 | |
| emistry program based on EPRI | the primary water to less than 0.05, 0.05, and 0.005 ppin. | 1 . 1 | |
| idelines of TR-105714 for minimizing | respectively during operation, and monitor and control of | | |
| purities by monitoring and | motor operative during shut down. milleale polenual of | | |
| aintaining primary water chemistry. | SCC However inadvertent introduction of contaminants | | |
| mitaumig pranaly were the start | into the coolant system can occur, e.g., contaminants in the | | |
| | boric acid or introduced through the free surface of spent | | |
| | fuel pool [NRC Information Notice (IN) 84-18], or from | | |
| ſ | water from the sump. The AMP must therefore rely upon | | |
| | ISI in accordance with ASME Section XI to detect possible | 1 | |
| · · · · | degradation. (3) Parameters Monitored/Inspected: The | | |
| • | AMP monitors the effects of SCC on intended function of | | |
| | the pump by control of primary water chemistry and by detection and sizing of cracks by ISI. Inspection | | |
| | detection and sizing of cracks by ISI. Inspectating requirements of IWC 2500-1 category C-G, specifies surface | (NDE)ISI 10D Sho | 5 12' |
| | examination of either the inside or outside surface of all | INDE/IZ- | 2 |
| | examination of either the insule of outside building $1/2$ in. on either side of the weld. In a welds extending $1/2$ in. on either side of the weld. In a | Nº m | 10 |
| 1 | group of multiple pumps of similar design, size, function, | | 21110 |
| | group of multiple pumps of similar design date, the pump is and service in a system, examination of only one pump is | 1 . 1 | ر ، آ |
| | and service in a system, chammaterie to be addition of required. (4) Detection of Aging Effects: Degradation of | t-Sho | ud |
| | pumps due to SCC can not occur without crack initiation | | |
| | and growth. ISI schedule Sures detection of cracks before | | |
| | the loss of intended fundfilm of the pump. (b) monutor way | | |
| | and Trending: Inspection schedule in accordance with IWC- | 1 | |
| | 2400 should provide timely detection | | |
| | ATO SHOWN PROVIDE AND | | |
| | Sistere. | Set | |
| | | 511-51 | |
| | 1 control in | id . | • |
| | V PENOVE IN SI | ou id : | |
| | V A-17 DRAFT | iou id | sur |

V A-17

ENGINEERED SAFETY FEATURES

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| A. CONTAINMENT SPRAY ST Existing | STEM (Pressurized Water Reactor) | Further Evaluation |
|--|--|-----------------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| ignig indiago in the o | (continued from previous page) | |
| $\Omega \rightarrow$ | PO. 04 and 96-05. IST is performed in accordance with | |
| | ASME Subsection TWV (OM Code Appendix I and Subsection | |
| | (A) Detection of Aring Effects: Degradation of the | |
| ۰. | appropriate due to corrosion would result in leakage of | |
| | | |
| / | Sample of the system population and most susceptible | is sa |
| | Sample of the system population be conducted to ensure that | 15 50 |
| | significant degradation is not occurring and the | 13 50 |
| | component intended function will be maintained during | 1. |
| - | the extended period. Follow up actions are based on the | Referma |
| | inspection results and plant technical specification. | |
| | Inspection is performed in accordance with the | |
| | requirements of ASME Code, 10CFR50 Appendix B, and | |
| • | ASTM standards, using a variety of nondestructive | ļ l |
| | techniques including visual, ultrasonic, and surface | |
| | techniques Selection of susceptible locations is based on | |
| | agreeting of conditions, time of service, and lowest design | |
| | margin (5) Monitoring and Trending: System leakage lest | |
| | is conducted prior to plant startup following each relucing | |
| | l outage and hydrostatic test at or near the end of each | |
| 1 | inspection interval. The results of one-time inspection | |
| | ehould be used to dictate the frequency of future | |
| • | improved (6) Acceptance Criteria: Any relevant | |
| | conditions that may be detected during the leakage and | |
| | hudrostatic tests are evaluated in accordance with IWC | |
| | 1 2100 and acceptance standards of IWC-3400 and IWD-3010 | |
| | for Class 2 components. (7) Corrective Actions: Phor to | |
| | service, corrective measures are needed to meet the | |
| | requirements of IWB-3142 and IWA-5250. Repairs are in | |
| | conformance with IWA-4000 and repair according to IWA- | |
| | 7000. (8 & 9) Confirmation Process and Administrative | |
| | Controls: Site QA procedures, review and approval | |
| | processes, and administrative controls are implemented in | 4 |
| | accordance with requirements of Appendix B to 10 CFR | |
| | Part 50 and will continue to be adequate for the period of | |
| | license renewal. (10) Operating Experience: Corrosion has | 1 |
| | been observed in guide rings of relief valves (IN 98-23) and | |
| | charging pump casing (IN 94-63). | No |
| lelines of Regulatory Guide (RG) 1.44 | (1) Scope of Program: The program includes preventive | |
| void sensitization of stainless steels | measures to mitigate stress corrosion cracking (SCC) of | 1 |
| based on plant specifications, | stainless steel (SS) and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the | |
| rvice inspection in conformance | effects of SCC on the intended function of containment | [|
| ASME Section XI (edition specified | (elects of SCU on the interaction of community | 、 |
|) CFR 50.55a), Table IWC 2500-1. | spray system components. (2) Preventive Actions: Selection of material in compliance with the guidelines of | ÷ |
| nination category C-G for pressure | Regulatory Guide (RG) 1.44 prevents or mitigates SCC. | |
| ining welds in Class 2 valves. Water | Control of halogens, sulfates, and oxygen in the primary | |
| mistry program for minimizing | Control of halogens, suitates, and oxygen in the pretty water to less than 0.05, 0.05, and 0.005 ppm, respectively. | |
| urities by monitoring and | Water to less than 0.00, 0.00, and control of water | l 1 |
| ntaining water chemistry | during operation, and monitor and control of water | Į – |
| ditions based on guidelines of EPRI | chemistry during shut down, mitigate potential of SCC. | I |
| 105714 for primary water | However, inadvertent introduction of contaminants into | |
| mistry. | the coolant system can occur either e.g., contaminants in the coolant system can occur either e.g., contaminants of | |
| | the boric acid, or introduced through the free surface of the boric acid, or introduced through the free surface of | ľ |
| | from water from the sump. The AMP must therefore rely | ł |
| | from water from the sump. Inc AMP must uncreased rely | L |

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V

ENGINEERED SAFETY FEATURES

| Existing | | Further |
|---------------------------------------|---|----------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) | |
| | upon ISI in accordance with ASME Section XI to detect | |
| | possible degradation. (3) Parameters Monitored/Inspected: | |
| | The AMP monitors the effects of SCC on the intended | |
| | function of the valves by detection and sizing of cracks by | |
| | ISI. Inspection requirements of Table IWC 2500-1, category | |
| | C-G specify for all valves in each piping run examined | |
| | under category C-F, surface examination of either the | } |
| | inside or outside surface of all welds extending $1/2$ in. on | |
| | either side of the weld. In a group of multiple valves of | |
| | similar design, size, function, and service in a system. | |
| | examination of only one valve is required. (4) Detection of | |
| | Aging Effects: Degradation of valves due to SCC can not | |
| | occur without crack initiation and growth; ISI schedule | } |
| 1 | assures detection of cracks before the loss of intended |] |
| · WC- | function of the valves. (5) Monitoring and Trending: | |
| 1 hou | Innerion of the valves. (a) monthly that I remainly. | · · |
| Should | Inspection schedule in accordance with IWC-2400 should | |
| | provide timely detection of cracks. All welds are inspected | |
| | each inspection period from at least one valve in each | |
| | group with similar design and performing similar | |
| | functions in the system. Visual examination is required | |
| | only when the valve is disassembled for maintenance, | |
| | repair, or volumetric examination, but at least once during | |
| • | the period. (6) Acceptance Criteria: Any SCC degradation is | |
| | evaluated in accordance with IWC-3100 by comparing ISI | |
| | results with the acceptance standards of IWC-3400 and | |
| | IWC-3515 for surface examination of welds in Class 2 | |
| | valves. (7) Corrective Actions: Repairs are in conformance | |
| | with IWA-4000 and replacement according to IWA-7000. (8 | |
| | 8: 9) Confirmation Process and Administrative Controls: | ţ |
| | Site QA procedures, review and approval processes, and | 1 |
| | administrative controls are implemented in accordance | ļ |
| | with requirements of Appendix B to 10 CFR Part 50 and | |
| | will continue to be adequate for the period of license | |
| | renewal. (10) Operating Experience: Although the primary | · · |
| | pressure houndary piping of PWRs have generally not been | |
| | found to be affected by SCC because of low dissolved oxygen | |
| • · | levels and control of primary water chemistry, cracking | |
| | has occurred in safety injection lines (IN 97-19 and 84-18), | |
| | internal bolting in swing check valves (IN 89-02), and | |
| | estety-related SS nining systems which contain | |
| | oxygenated, stagnant, or essentially stagnant borated | |
| | water (IN 97-19). | |
| me as effects of Corrosion/Boric Acid | Same as effects of Corrosion/Boric Acid Wastage on | No |
| istage on containment spray system | containment spray system bolting (A.1.4). | ÷ |
| | | |
| ting (A.1.4). | - | |
| | | |
| | ~ | |
| | | |
| | | Vee |
| nt specific aging management | Plant specific aging management program is to be evaluated. | Yes. no AMP |
| ogram. | Cvanualcu. | |
| | | 1 |
| | | |

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ENGINEERED SAFETY FEATURES v

| Existing | | Further |
|--------------------------------------|--|--------------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) | |
| | exchanger fails to perform adequately, corrective actions | |
| × . | are taken in accordance with OM S/G Part 2. Root cause | |
| | evaluation and appropriate corrective action are taken | |
| | i when acceptable limits are exceeded or leakage is detected. | |
| | (8.8) 9) Confirmation Process and Administrative Controls: | |
| | Site OA procedures, review and approval processes, and | |
| | administrative controls are implemented in accordance | |
| | with requirements of Appendix B to 10 CFR Part 50 and | |
| | will continue to be adequate for the period of license | |
| | renewal. (10) Operating Experience: Operating plant | |
| - | experience with this AMP indicates timely detection of | |
| | corrosion in the containment spray heat exchangers. | |
| | corrosion in the containing of spray heat cating of or | No |
| he program relies on preventive | (1) Scope of Program: The program includes monitoring | |
| neasures to mitigate corrosion by | and control of water chemistry to minimize exposure to | |
| nonitoring and control of water | aggressive environments, and staff recommendations of | |
| hemistry to minimize exposure to | Generic Letter (GL) 89-13 or an equivalent program provide | |
| ggressive environments, and | assurance that open-cycle cooling water system is in | |
| nplementation of the | compliance with General Design Criteria and Quality | |
| commendations of Generic Letter 89- | Assurance requirements. Guidelines of GL 89-13 include | |
| 3 or an equally effective program to | (a) surveillance and control of biofouling, (b) test program | 1 |
| nsure that open-cycle cooling water | to verify heat transfer capabilities. (c) routine inspection | 1 |
| ystem is in compliance with General | and maintenance program to ensure that corrosion. | |
| esign Criteria and Quality Assurance | erosion protective coating failure, silting, and biolouing. | |
| equirements. Water chemistry control | can not degrade the performance of safety-related systems | |
| rogram based on EPRI TR-105714 for | serviced by open-cycle cooling water, (d) system walkdown | |
| rimary water and plant technical | inspection to ensure compliance with licensing basis, and | |
| pecifications for cooling water. | (e) review of maintenance, operating, and training | |
| peculcations for cooming waters | practices and procedures. (2) Preventive Actions: The | |
| | component is constructed of appropriate materials, control | |
| | of secondary side water chemistry, and lining or coating | |
| | protect the underlying metal surfaces from being exposed to | |
| | aggressive cooling water environment. Based on GL 89-13 | |
| | cooling water system is continuously chlorinated or | |
| | treated with biocide whenever the potential for biological | |
| | fouling species exists. (3) Parameters Monitored/ | |
| | Inspected: The AMP monitors the effects of corrosion by | |
| | surveillance program to detect coolant leakage and | |
| | surveillance program to detect coolant reaning and inservice testing to evaluate component performance. | ••• · |
| | Based on recommendations of GL 89-13 or its equivalent. | |
| | cooling water system is inspected for biofouling organisms. | |
| | sediment, protective coating failure, and corrosion; and | |
| | cooling water flow and temperature are monitored for | |
| | cooling water now and temperature are monitored for | |
| | component performance evaluation to ensure that flow | shoul |
| | blockage or excessive fouling accumulation does not exist. | A American |
| | (4) Detection of Aging Effects: Degradation of component | Show |
| | due to corrosion would result in leakage of coolant or | |
| | degradation of component performance; extent and | 1. Contract (1997) |
| | schedule of inspection/testing assure detection of | |
| | corrosion before the loss of intended function of the | |
| | component. (5) Monitoring and Trending: Results from | · · |
| | performance tests to verify heat transfer capabilities are | |
| | trended (6) Acceptance Criteria: Any relevant conditions | |
| | related to corresion or leakage are compared to established | |
| · | acceptable limits. Maximum levels for various impurities | |
| | in secondary side water and cooling water | |

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المورجة التجرير المتحقية والمرا

B Standby Gas Treatment System (Boiling Water Reactor)

- B.1 Ductwork and Dampers
- B.2 Electric Heater
- B.3 Filters
 - B.3.1 Filter Housing and Supports
 - B.3.2 Charcoal Absorber Filter
 - B.3.3 Elastomer Seals

B.4 Fan

C. Containment Isolation Components

- C.1 Personnel Hatch
 - C.1.1 Hatchway
 - C.1.2 Inner Door
 - C.1.3 Outer Door
- C.2 Equipment Hatch
 - C.2.1 Hatchway
 - C.2.2 Cover Plate
- C.3 Mechanical (pipe) Penetrations
 - C.3.1 Sleeve
 - C.3.2 Seal
 - C.3.3 Closure Plate
 - C.3.4 Anchors
 - C.3.5 Fasteners
- C.4 Electrical Penetrations
 - C.4.1 Sleeve
 - C.4.2 Header Plate
 - C.4.3 Seal
 - C.4.4 Anchors
- C.5 Fuel Transfer Penetrations
 - C.5.1 Sleeve
 - C.5.2 Closure Plate
 - C.5.3 Anchors
- C.6 Purge/Vent

C.6.1 Seal

- C.7 Leak Testing (Penetration, Integrated, & Isolation Valve Leak Test Systems)
 - C.7.1 Mechanical Penetrations
 - C.7.2 Sleeves
 - C.7.3 Seal
- C.8 Isolation Barriers Valves (BWR, in Lines for Emergency Core Cooling Systems, Feedwater, Main Steam)
 - C.8.1 Body
 - C.8.2 Bonnet
- C.9 Isolation Barriers Valves (PWR, in Lines for Emergency Core Cooling Systems, Feedwater, Auxiliary Feedwater, Main Steam, and Blowdown Piping)

C.9.1 Body

C.9.2 Bonnet

C.10 Isolation Barriers - Valves (BWR & PWR, in Lines for Fire Protection, Plant Heating, Waste Gas, Plant Drain, Liquid Waste, & Cooling Water)

C.10.1 Body

C.10.2 Bonnet

| r | ENGIN | EERED SAFETT FEATURES |
|---|-------|----------------------------------|
| | C | CONTAINMENT ISOLATION COMPONENTS |

| (| C. CONTAIN | MENT ISOLATIO | ON COMPONE | INTS | | | | 7 |
|-------|---------------|---------------|--------------|------------|-----------------|------------|-------------------------|-----------|
| | Structure and | Region of | | Environ- | Aging Effect | Aging | References | |
| Item | Component | Interest | Material | ment | | Mechanism | ASME Code | { |
| C.1.1 | Personnel | Hatchway. | Carbon steel | Air: | Loss of | General | Section XI, 1992 | |
| thru | Hatch | Inner Door, | (Coating) | Occasional | Material | Corrosion | Section AI, 1992 | |
| C.1.3 | | Outer Door | | Leaking | | | Edition. | |
| 0.1.0 | 1 | | | Borated | | | 10 CFR 50 | |
| | | | | Water | | | Appendix J. | |
| | | | 1 | (PWRs) or | | | Regulatory Guide | |
| | | I | 1 | Oxygenated | 1 | | 1.54 | |
| | | | | Water | | | ANŚI 101.2. | |
| | | | | BWRs) | 1 | | ANSI 101.4. | 2 |
| | | | | DWRS | | | + | k Z |
| | | | | 1 | | | | IN. * |
| |] | | Ĩ | | | | Operating Experience | |
| | | | | | | | Experience | |
| | | | 1 | | | | NRC IN 89-79. | 0 00 |
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ENGINEERED SAFETY FEATURES CONTAINMENT ISOLATION COMPONENTS

| C. CONTAINMENT ISOLATIC | IN COMPONENTS | Further |
|---|---|-------------|
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | (continued from previous page) corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair is in conformance with IWA-4000 and replacement according to IWA-7000. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: Localized corrosion is likely to occur at crevice geometry where buildup of impurities can occur. | No |
| Program delineated in NUREC-0313, Rev. 2 and implemented through NRC Generic letter (GL) 88-01, and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, examination categories B-M-1 and B-M-2 for Class 1 valves; Table IWC 2500-1, examination category C-G for pressure retaining welds in Class 2 valves. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in TR-103515 and BWRVIP-29 to minimize the potential of crack initiation and growth. Also, the integrity of the containment isolations valves is verified in Type C leak rate tests in accordance with Appendix J of 10 CFR 50. | impurities can occur. (1) Scope of Program: The program includes implementing counter measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and combination of inservice inspection (ISI) to monitor SCC and its effects on the intended function of valves. NUREG-0313 and GL 88-01. respectively. describe the technical basis and staff guidance regarding mitigating IGSCC in BWRs. (2) Preventive Actions: Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC. e.g., low-carbon grades of cast SSs and weld metal. with a maximum carbon of 0.035% and minimum 7.5% ferrite. (3) Parameters Monitored/ Inspected: The AMP monitors SCC of valves by detection and sizing of cracks by implementing the inspection schedule, methods, personnel, sample expansion, and leak detection requirements of GL 88-01. In a group of multiple valves of similar design, size, function, and service in a system, examination of only one valve is required. Coolant water chemistry is monitored and maintained in accordance with the EPRI guidelines in BWRVIP-29 to minimize the potential of crack initiation and growth. (4) Detection of Aging Effects: Degradation of valves due to SCC can not occur without crack initiation and growth: ISI schedule delineated in the AMP is adequate and will assure detection of cracks or degradation of valves. (5) Monitoring and Trending: Inspection schedule in accordance with GL 88-01 should provide timely detection of cracks. All welds are inspected each inspection period from at least one valve in each group with similar design and performing similar functions in the system. Visual examination, but at least once during the period. (6) Acceptance Criteria: Any SCC degradation is evaluated in accordance with WC-3100 by comparing ISI results with the accentance standards of IWC-3400 and IWC-3515. | No Shoul |
| | (7) Corrective Actions: Repair is in conformance with WA-4000 and replacement is in accordance with IWA- 7000. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR | |
| • | Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: The | |

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ENGINEERED SAFETY FEATURES C. CONTAINMENT ISOLATION COMPONENTS

| Existing Aging Management Program (AMP) Evaluation and Techn frequency of luture inspections. (6) Any relevant conditions that may be leakage and hydrostatic tests are ev- with INVB-3100 and acceptance stan IWB-3522 for Class 1 components. IWD-3000 for Class 3 (7) Corrective Actions: Prior to ser- measures are needed to meet the re- and WA-5250. Repair and replacem- conformance with NW-4000 and IWI Confirmation Process and Adminis QA procedures, review and approval administrative controls are implem with requirements of Appendix B to will continue to be adequate for the renewal. (10) Operating Experience observed in guide rings of relief valv charging pump casing [IN 94-63). Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications. inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 5054). Table IWC 2500-1, examination category C-G for pressure etaining welds in Class 2 valves. Water themistry rolems and guidelines of EPRI R-105714 for primary water hiemistry. Also, the integrity of the ontations based on guidelines of EPRI R-105714 for primary water fifted in Type C Leak rate tests in coordance with Appendix J of 10 CFR 0. (a) Parameters Minform of 10 CFR 50.51. Table IWC 2500-1, suplicates and oxygen in the primary and monitor and control of water ch formitor whe feets of SCC on the in- troduction of contaminants into to occur, e.g. contaminants into the occur, e.g. contaminants in the bor introduction of contaminants into the counce with ASME Section XI to egradiation. Notice (IN) 84-181, or finance with ASME Section XI to ceramination notice (IN) 84-181, or finance with ASME Section XI to ceramination category B-M-1 NPS 4 or larger, volumetric examination on either side of the weld and through for welds less than NPS 4, surface co surface catending 1/2 in. on either side of the valves of similar de and service in a syst | 7 | December |
|--|--|-----------------------|
| Icontinued from previous page frequency of litture inspections. (0). Any relevant conditions that may be leakage and hydrostatic tests are ev- with IWB-3100 and acceptance stam IWB-3322 for Class 1 components. IWB-3322 for Class 1 components. IWB-3520. Repair and replacen conformance with IWA-4000 and IWD Confirmation Process and Adminia QA procedures. review and approval administrative controls are implem with requirements of Appendix B to will continue to be adequate for the renewal. (10) Operating Experience observed in guide rings of relief valve charging pump casing (IN 94-63). Guidelines of Regulatory Guide (RC) 1.44 in o avoid sensitization of stainless steels and, based on plant specifications, neervice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50:554). Table IWC 2500-1, xamination category C-G for pressure etaining water chemistry onditions based on guidelines of EPRI relimistry. Also, the integrity of the introduction of contaminants in the bor (2) Preventive Actions: Selection XI down, mitigate potential of SCC. Ho introduction of contaminants in the bor introduction of contaminants in the bor (2) Freestive Section XI (edition staintasing water chemistry onditions based on guidelines of EPRI o. 0.0 CoS, 0.05, and 0.005 ppm, respectiv and monitor and control of water ch introduction of contaminants in the bor introduction of cont | inical Basis | Further Evaluation |
| renewal. (10) Operating Experience observed in guide rings of relief valve charging pump casing [IN 94-63]. (1) Scope of Program: The program measures to mitigate stress corrosio stainless steel (SS) and inservice ins monitor the effects of SCC on the ini emergency core cooling system com (2) Preventive Actions: Selection of ramination categories B-M-1 and B-M- for Class 1 valves; Table IWC 2500-1. camination category C-G for pressure thaining water chemistry monitoring and aintaining water chemistry inditions based on guidelines of EPRI R-105714 for primary water memistry. Also, the integrity of the introduction of contaminants into the cordance with Appendix J of 10 CFR b. | Acceptance Criteria: be detected during the evaluated in accordance ndards of IWB-3400 and IWC-3100 and and IWB-3516 for Class 3 components. rvice, corrective equirements of IWB-3142 ement are in VB-4000. (8 & 9) istrative Controls: Site al processes, and mented in accordance to 10 CFR Part 50 and | |
| be avoid sensitivation of stainless steels and, based on plant specifications, iservice inspection in conformance the SME Section XI (edition specified 10 CFR 50.55a), Table IWB 2500-1, camination category C-G for pressure training welds in Class 2 valves. Water nemistry program for minimizing npurities by monitoring and antaining water chemistry inditions based on guidelines of EPRI 2-105714 for primary water termistry. Also, the integrity of the intriment isolations valves is rified in Type C leak rate tests in cordance with Appendix J of 10 CFR | ce: Corrosion has been ves (IN 98-23) and | N |
| compliance with the requirements of (RG) 1.44 prevents or mitigates SCC. sulfates, and oxygen in the primary of one class 2 valves. Water hemistry program for minimizing appurtites by monitoring and aintaining water chemistry onditions based on guidelines of EPRI R-105714 for primary water hemistry. Also, the integrity of the intriment isolations valves is mified in Type C leak rate tests in cordance with Appendix J of 10 CFR b. AMP monitors the effects of SCC on XI to degradation. (3) Parameters Monitor AMP monitors the effects of SCC on XI to degradation. (3) Parameters Monitor AMP monitors the effects of SCC on a the valves by detection and sizing of inspection requirements of Table IWE valves, examination category B-M-1 NPS 4 or larger, volumetric examinat on either side of the weld and throug for welds less than NPS 4, surface exist surface extending 1/2 in. on either side or welds extending 1/2 in. on either side group of multiple valves of similar de and service in a system, examination required. (4) Detection of Aging Effe- valves due to SCC can not occur with and growth; ISI schedule assure deter | ion cracking (SCC) of nspection (ISI) to ntended function of nponents. | No |
| hemistry program for minimizing npurities by monitoring and laintaining water chemistry onditions based on guidelines of EPRI R-105714 for primary water nemistry. Also, the integrity of the intrainment isolations valves is cordance with Appendix J of 10 CFR). | of Regulatory Guide C. Control of halogens, water to less than | |
| R-105714 for primary water memistry. Also, the integrity of the intainment isolations valves is rifled in Type C leak rate tests in cordance with Appendix J of 10 CFR | hemistry during shut lowever, inadvertent the coolant system can | |
| cordance with Appendix J of 10 CFR degradation. (3) Parameters Monitor AMP monitors the effects of SCC on the the valves by detection and sizing of inspection requirements of Table IWE valves, examination category B-M-1 NPS 4 or larger, volumetric examination on either side of the weld and through for welds less than NPS 4, surface exists surface extending 1/2 in. on either side Category B-M-2 specifies visual VT- internal surfaces of the valve. Table I 2 valves, category C-G specifies for al piping run examined under category examination of either the inside or ou welds extending 1/2 in. on either side group of multiple valves of similar de and service in a system, examination required. (4) Detection of Aging Effect valves due to SCC can not occur with and growth; ISI schedule assured dete | el pool [NRC from water from the y upon ISI in | |
| valves, examination category B-M-1 NPS 4 or larger, volumetric examination on either side of the weld and through for welds less than NPS 4, surface ex- surface extending 1/2 in. on either side Category B-M-2 specifies visual VT- internal surfaces of the valve. Table I 2 valves, category C-G specifies for al piping run examined under category C examination of either the inside or ou welds extending 1/2 in. on either side group of multiple valves of similar de and service in a system, examination required. (4) Detection of Aging Effe- valves due to SCC can not occur with and growth; ISI schedule assured dete | ored/inspected: The intended function of f cracks by ISI. | - |
| Category B-M-2 specifies visual VT- internal surfaces of the valve. Table I 2 valves, category C-G specifies for al piping run examined under category G examination of either the inside or ou welds extending 1/2 in. on either side group of multiple valves of similar de and service in a system, examination required. (4) Detection of Aging Effect valves due to SCC can not occur with and growth; ISI schedule assured dete | 1 specify for all welds ation extending 1/2 in. gh wall thickness, and | ۶ |
| examination of either the inside or ou welds extending 1/2 in. on either side group of multiple valves of similar de and service in a system, examination required. (4) Detection of Aging Effect valves due to SCC can not occur with and growth; ISI schedule assured deter | side of the weld. -3 examination of IWC 2500-1 for Class all valves in each | |
| and service in a system, examination required. (4) Detection of Aging Effective valves due to SCC can not occur with and growth; ISI schedule assured detection | outside surface of all le of the weld. In a lesign, size, function. | |
| L'ied | on of only one value is fects: Degradation of hout crack initiation | |
| zhou | | |
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D1 Emergency Core Cooling System (Pressurized Water Reactor)

- D1.1 Piping & Fittings
 - D1.1.1 Core Flood System (CFS)
 - D1.1.2 Residual Heat Removal (RHR) or Shutdown Cooling (SDC)
 - D1.1.3 High Pressure Safety Injection (HPSI)
 - D1.1.4 Low Pressure Safety Injection (LPSI)
 - D1.1.5 Connecting lines to Chemical & Volume Control System (CVCS) & Spent Fuel Pool (SFP) Cooling
 - D1.1.6 Lines to Emergency Sump
 - D1.1.7 Bolting for Flange Connections
- D1.2 HPSI & LPSI Pumps
 - D1.2.1 Bowl/Casing
 - D1.2.2 Bolting
- D1.3 RWT Circulation Pump
 - D1.3.1 Bowl/Casing
 - D1.3.2 Bolting
- D1.4 Valves
 - D1.4.1 Body and Bonnet
 - D1.4.2 Bolting
- D1.5 Heat Exchangers (RCP, HPSI, & LPSI Pump Seals; & RHR)
 - D1.5.1 Bonnet/Cover
 - D1.5.2 Tubing
 - D1.5.3 Shell
 - D1.5.4 Case/Cover
 - D1.5.5 Bolting

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D1.6 Heat Exchangers (RWT Heating)

- D1.6.1 Bonnet/Cover
- D1.6.2 Tubing
- D1.6.3 Shell
- D1.6.4 Bolting
- D1.7 Safety Injection Tank (Accumulator)
 - D1.7.1 Shell
 - D1.7.2 Manway
 - D1.7.3 Penetrations/Nozzles
- D1.8 Refueling Water Tank (RWT)
 - D1.8.1 Shell
 - D1.8.2 Manhole
 - D1.8.3 Penetrations/Nozzles
 - D1.8.4 Bolting
 - D1.8.5 Perimeter Seal

ENGINEERED SAFETY FEATURES V

| D1. EMERGENCY CORE COOL | LING SYSTEM (Pressurized Water Reactor) | | - |
|---|---|------------|--------------------------|
| Existing | | Further | |
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation | 4 |
| | (continued from previous page) of IWA-2200. (8 & 9) Confirmation Process and | | |
| | Administrative Controls: Site QA procedures, review and | 1 | |
| | approval processes, and administrative controls are | | |
| | implemented in accordance with requirements of | | |
| | Appendix B to 10 CFR Part 50 and will continue to be | | 1 |
| · · · · · · · · · · · · · · · · · · · | adequate for the period of license renewal. (10) Operating | | |
| | Experience: Although the primary pressure boundary | | |
| | piping of PWRs have generally not been found to be | | 1 |
| | affected by SCC because of low dissolved oxygen levels and | 1 | 1 |
| | control of primary water chemistry, potential of SCC | | |
| | exists from inadvertent introduction of contaminants into the primary coolant system (IN 84-18). SCC has been | | 1 |
| | observed in safety injection lines (IN 97-19 and 84-18). | I | 1 |
| • | charging pump casing cladding (INs 80-38 and 94-63), and | | |
| | instrument nozzles in safety injection tanks (IN 91-05). | | |
| Inservice inspection is in conformance | (1) Scope of Program: The program relies on preventive | Yes, | 1 |
| with ASME Section XI (edition specified | measures to mitigate crevice or pitting corrosion and | Element 4 | |
| in 10 CFR 50.55a), Table IWB 2500-1, | inservice inspection (ISI) to monitor the effects of | should be | |
| testing category B-P for pressure | corrosion on the intended function of emergency core | further | ľ |
| retaining Class 1 components, e.g., CFS | cooling system components. (2) Preventive Actions: | evaluated | |
| and other components within the | Control of halogens, sulfates, and oxygen in the primary | | 1 |
| containment; Table IWC 2500-1, | water to less than 0.05, 0.05, and 0.005 ppm, respectively. during operation, and monitor and control of water | 1 | |
| examination category C-H for pressure | | | · · |
| retaining Class 2 components, e.g., most components in the safety injection | introduction of contaminants into the coolant system can | | 1 |
| system; and Table IWD 2500-1, test and | occur either e.g., contaminants in the boric acid, or | | 1 |
| examination category D-B for systems | introduced through the free surface of spent fuel pool [NRC | 1 | ! I |
| in support of emergency core cooling. | Information Notice (IN) 84-18], or from water from the | | 1 |
| e.g., refueling water tank (RWT) heating | sump. The AMP must therefore rely upon ISI in | 1 | |
| system. Water chemistry program for | accordance with ASME Section XI to detect possible | | |
| minimizing impurities by monitoring | degradation. (3) Parameters Monitored/Inspected: The AMP monitors the effects of corrosion by control of | I ! | i j |
| and maintaining water chemistry | system water chemistry and by detection of coolant | ł | i I |
| conditions based on guidelines of EPRI TR-105714 for primary water chemistry | leakage by inservice inspection (ISI). Inspection | i j | i I |
| and plant technical specifications for | requirements of ASME Section XI specify visual VT-2 | 1 1 | i |
| refueling water storage tank water | (IWA-5240) examination during system leakage and | 1 1 | |
| chemistry. | hydrostatic tests of all pressure retaining Class 1 | i 1 | |
| •••••• | components according to Table IWB 2500-1 category B-P; | - | i i |
| 1 | Class 2 components required to operate or support the | l | İ I |
| | safety function according to Table IWC 2500-1 category C- H; and Class 3 components in support of emergency core | | Ì |
| | cooling according to Table IWD 2500-1 category D-B. | | |
| · · | (4) Detection of Aging Effects: Degradation of the | | |
| | component due to corrosion would result in leakage of | | |
| | coolant. However, a one-time inspection of representative | -++00 | v vs sample vmined |
| ł | sample of the system population and most susceptible | | |
| Ť | locations in the system should be conducted to ensure that | 16. | co. all |
| | significant degradation is not occurring and the | the | Sumpre |
| | component intended function will be maintained during | | •. |
| | the extended period. Follow up actions are based on the inspection results and plant technical specification. | dife | anne d |
| | Inspection is performed in accordance with the | ung | mine |
| | requirements of ASME Code, 10CFR50 Appendix B, and | | 2 |
| | ASTM standards, using a variety of nondestructive | | è |
| | techniques including visual, ultrasonic, | | <i>,</i> |
| | | | |

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ENGINEERED SAFETY FEATURES

| Existing | ING SYSTEM (Pressurized Water Reactor) | Further |
|--|---|------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Guidelines of Regulatory Guide (RG) 1.44 | (1) Scope of Program: The program includes preventive | Yes. |
| to avoid sensitization of stainless steels | measures to mitigate stress corrosion cracking (SCC) and | Element 4 |
| and, based on plant specifications, | inservice inspection (ISI) to monitor the effects of SCC on | should be |
| inservice inspection in conformance | the intended function of the RWT. (2) Preventive Actions: | further |
| with ASME Section XI (edition specified | Selection of material in compliance with the | evaluated |
| in 10 CFR 50.55a), Table IWC 2500-1. | requirements of Regulatory Guide (RG) 1.44 prevents or | |
| examination category C-H for pressure | mitigates SCC. (3) Parameters Monitored/ Inspected: The | |
| retaining Class 2 components, and | AMP monitors the effects of SCC on intended function of | |
| water chemistry control program based | the RWT by detection of leakage. Inspection requirements | |
| on plant technical specifications. | of ASME Section XI specify visual VT-2 (IWA-5240) | |
| • | examination during system leakage test and system | |
| | hydrostatic test of all pressure retaining Class 2 | |
| | components required to operate or support the safety | |
| | function, according to Table IWC 2500-1 category C-H. | 1 |
| | (4) Detection of Aging Effects: Degradation of the | 1 |
| | component due to SCC can not occur without leakage of | |
| | endant. However, a one-time inspection of representative | |
| ζ | sample of the system population and most susceptible | |
| | locations in the system should be conducted to ensure that | |
| | significant degradation is not occurring and the | |
| | component intended function will be maintained during the extended period. Follow up actions are based on the | |
| · · | inspection results and plant technical specification. | |
| | Inspection is performed in accordance with the | |
| | requirements of ASME Code, 10CFR50 Appendix B, and | |
| | ASTM standards, using a variety of nondestructive | |
| | techniques including visual, ultrasonic, and surface | |
| | techniques. Selection of susceptible locations is based on | |
| | severity of conditions, time of service, and lowest design | |
| | margin. (5) Monitoring and Trending: System leakage test | |
| | is conducted prior to plant startup following each | |
| | refueling outage, and hydrostatic test at or near the end of | |
| | each inspection interval. The results of one-time | |
| | inspection should be used to dictate the frequency of future | |
| | inspections. (6) Acceptance Criteria: Any relevant | |
| | conditions that may be detected during the leakage and | |
| | hydrostatic tests are evaluated in accordance with IWC- | |
| 1. A | 3100 and acceptance standards of IWC-3400 and IWB-3516. | |
| | Any evidence of aging effects or unacceptable results are | • |
| | evaluated. (7) Corrective Actions: Repair and replacement | |
| | are in conformance with IWA-4000 and IWB-4000. (8 & 9) | |
| | Confirmation Process and Administrative Controls: Site | • |
| | QA procedures, review and approval processes, and | |
| | administrative controls are implemented in accordance | |
| | with requirements of Appendix B to 10 CFR Part 50 and | \$ |
| | will continue to be adequate for the period of license | • |
| | renewal. (10) Operating Experience: SCC has been | |
| | observed in safety injection lines (IN 97-19 & 84-18). | |
| | charging pump casing cladding (INs 80-38 and 94-63), and instrument nozzles in safety injection tanks (IN 91-05) | |
| | instrument nozzies in salety injection tanks (in 91-00)." | |

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ENGINEERED SAFETY FEATURES V

| and a second | ING SYSTEM (Pressurized Water Reactor) | Further |
|--|--|------------|
| Existing | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) | | Yes. |
| Inservice inspection in conformance | (1) Scope of Program: The program relies on preventive measures to mitigate crevice or pitting corrosion and | Element 4 |
| with ASME Section XI (edition specified | inservice inspection (ISI) to monitor the effects of | should be |
| in 10 CFR 50.55a). Table IWC 2500-1, | corrosion on the intended function of emergency core | further |
| test and examination category D-B for | cooling system components. (2) Preventive Actions: | evaluated |
| systems in support of emergency core | Control of water chemistry based on plant technical | |
| cooling, and water chemistry control | specifications. (3) Parameters Monitored/ Inspected: The | |
| program based on plant technical specifications. | AMP monitors the effects of corrosion by detection of | |
| specifications. | coolant leakage by ISI. Inspection requirements of ASME | |
| | Section XI, Table IWD 2500-1, category D-B specify visual | |
| | VT-2 (IWA-5240) examination during system leakage and |] |
| | hydrostatic tests of all pressure retaining Class 3 | |
| | components in support of emergency core cooling. | 1 |
| | (4) Detection of Aging Effects: : Degradation of the | 1 |
| · · · · · | component due to corrosion would result in leakage of | |
| | coolant. However, a one-time inspection of representative | |
| (| sample of the system population and most susceptible | |
| | locations in the system should be conducted to ensure that | 1 |
| | significant degradation is not occurring and the | |
| · · · | component intended function will be maintained during | |
| | the extended period. Follow up actions are based on the | |
| | inspection results and plant technical specification. | |
| | Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and | |
| | ASTM standards, using a variety of nondestructive | |
| | techniques including visual, ultrasonic, and surface | |
| | techniques. Selection of susceptible locations is based on | |
| | severity of conditions, time of service, and lowest design | 1 |
| | margin. (5) Monitoring and Trending: System leakage test | |
| | is conducted prior to plant startup following each | |
| | refueling outage, and hydrostatic test at or near the end of | |
| | each inspection interval. The results of one-time | |
| | inspection should be used to dictate the frequency of future | |
| | inspections. (6) Acceptance Criteria: Any relevant | |
| | conditions that may be detected during the leakage and | |
| | hydrostatic tests are evaluated in accordance with IWD- | |
| | 3000 for Class 3 components. Any evidence of aging effects | |
| | or unacceptable results are evaluated. (7) Corrective | |
| | Actions: Repair and replacement are in conformance with | |
| | IWA-4000 and IWB-4000. (8 & 9) Confirmation Process | |
| | and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are | |
| | and approval processes, and administrative controls are implemented in accordance with requirements of | |
| | Appendix B to 10 CFR Part 50 and will continue to be | |
| | adequate for the period of license renewal. (10) Operating | |
| | Experience: Localized corrosion is likely to occur at | \$ |
| | crevices that may allow buildup of impurities due to | • |
| | stagnant conditions. | |
| And allows of Recolatory Coulds (RC) 1.44 | (1) Scope of Program: The program includes preventive | Yes, |
| Guidelines of Regulatory Guide (RG) 1.44 | measures to mitigate stress corrosion cracking (SCC) of | Element 4 |
| o avoid sensitization of stainless teels, inservice inspection in | stainless steel (SS) and inservice inspection (ISI) to | should be |
| conformance with ASME Section XI | monitor the effects of SCC on the intended function of the | further |
| edition specified in 10 CFR 50.55a). | RWT. (2) Preventive Actions: Selection of material in | evaluated |
| able IWD 2500-1, test and examination | compliance with the requirements of Regulatory Guide | |
| | (RG) 1.44 prevents or mitigates SCC. Control of water | |
| atedory D-B for systems in support of | | |
| ategory D-B for systems in support of | chemistry is based on plant technical specifications. | |
| ategory D-B for systems in support of mergency core cooling, and water hemistry control program based on | chemistry is based on plant technical specifications. (3) Parameters Monitored/Inspected: The AMP monitors the effects of SCC on intended function of the RWT by | |

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| D1. EMERGENCY CORE COOL Existing | ING SYSTEM (Pressurized Water Reactor) | Further |
|--|--|------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| ABAID MANAGOMOUT LOGICAL (MAN) | (continued from previous page) | |
| | detection of leakage. Inspection requirements of ASME | · · |
| | Section XI Table IWD 2500-1. category D-B specily visual | |
| | VT-2 (IWA-5240) examination during system leakage and | |
| | hydrostatic tests of all pressure retaining Class 3 | |
| | components in support of emergency core cooling. | |
| | (A) Detection of Aging Effects: Degradation of the |] |
| | component due to SCC can not occur without leakage of | |
| | coolant. However, a one-time inspection of representative | |
| F | sample of the system population and most susceptible | |
| | locations in the system should be conducted to ensure that | 1 |
| 3 | significant degradation is not occurring and the | 1 |
| | component intended function will be maintained during | |
| | the extended period. Follow up actions are based on the | |
| | inspection results and plant technical specification. | 1 |
| | Inspection is performed in accordance with the | |
| | requirements of ASME Code, 10CFR50 Appendix B, and | |
| | ASTM standards, using a variety of nondestructive | 1 |
| | techniques including visual, ultrasonic, and surface | 1 |
| | techniques. Selection of susceptible locations is based on | |
| | severity of conditions, time of service, and lowest design | |
| | margin (5) Monitoring and Trending: Inspection schedule | |
| , | of ASME Section XI should provide for timely detection of | |
| | leakage. System leakage test is conducted prior to plant | |
| | startun following each refueling outage, and hydrostatic | |
| | test at or near the end of each inspection interval. The | 1 |
| | results of one-time inspection should be used to dictate the | 1 |
| | frequency of future inspections. (6) Acceptance Criteria: | 1 |
| | Any relevant conditions that may be detected during the | |
| | leakage and hydrostatic tests are evaluated in accordance | |
| | with IWD-3000 for Class 3 components. Any evidence of | |
| | aging effects or unacceptable results are evaluated. | |
| | (7) Corrective Actions: Repair and replacement are in | |
| | conformance with IWA-4000 and IWB-4000. (8 82 9) | |
| | Confirmation Process and Administrative Controls: Site | |
| | OA procedures, review and approval processes, and | |
| | administrative controls are implemented in accordance | 1 |
| | with requirements of Appendix B to 10 CFR Part 50 and | |
| | will continue to be adequate for the period of license | - |
| | renewal. (10) Operating Experience: Although the primary | |
| | pressure boundary piping of PWRs have generally not been | 1 |
| 1 | found to be affected by SCC because of low dissolved | |
| | orvgen levels and control of primary water chemistry. | |
| | significant potential of SCC exists from inadvertent | |
| 1 | introduction of contaminants into the primary coolant | , |
| | system (IN 84-18). SCC has been observed in safety | 1 * |
| | injection lines (IN 97-19 and 84-18), charging pump casing | 1 |
| | oladding (INs 80-38 and 94-63), internal bolting in swing | ł |
| | check valves (IN 89-02), and instrument nozzles in salety | 1 |
| | injection tanks (IN 91-05). | l |
| | Some as effect of Corrosion/Boric Acid Wastage of Item | No |
| une as effect of Corrosion/Boric Acid | D1.1.7 Bolting for flange connections in Items D1.1.1 thru | I |
| astage of Item D1.1.7 Bolting for inge connections in Items D1.1.1 thru | D1.1.5. | |
| | | 1 1.000 |
| .1.5. | | j. |
| | | |

D2 Emergency Core Cooling System (BWR)

D2.1 Piping & Fittings

- D2.1.1 High Pressure Coolant Injection (HPCI)
- D2.1.2 Reactor Core Isolation Cooling (RCIC)
- D2.1.3 High-Pressure Core Spray (HPCS)
- D2.1.4 Low-Pressure Core Spray (LPCS)
- D2.1.5 Low Pressure Coolant Injection (LPCI) or Residual Heat Removal (RHR)
- D2.1.6 Lines to Spent Fuel Pool (SFP) and Suppression Chamber (SC)
- D2.1.7 Lines to Containment Spray System (CSS)
- D2.1.8 Automatic Depressurization System (ADS)
- D2.1.9 Lines to HPCI and RCIC Pump Turbine
- D2.1.10 Lines from HPCI and RCIC Pump Turbines to Condenser
- D2.2 Pumps (HPCS or HPCI Main & Booster, LPCS, LPCI or RHR, & RCIC)
 - D2.2.1 Bowl/Casing
 - D2.2.2 Suction Head
 - D2.2.3 Discharge Head
- D2.3 Valves (Check, Control, Hand, Motor Operated, & Relief Valves)
 - D2.3.1 Body and Bonnet
- D2.4 Heat Exchangers (RHR & LPCI)
 - D2.4.1 Tubes
 - D2.4.2 Tubesheet
 - D2.4.3 Channel Head
 - D2.4.4 Shell
- D2.5 Header and Spray Nozzles System

- D2.5.1 Piping and Fittings
- D2.5.2 Flow Orifice
- D2.5.3 Headers
- D2.5.4 Spray Nozzles
- D2.6 Isolation Condenser
 - D2.6.1 Tubing
 - D2.6.2 Tubesheet
 - D2.6.3 Channel Head
 - D2.6.4 Shell

ENGINEERED SAFETY FEATURES v

| Existing | man and material Deale | Further Evaluation |
|--|--|-------------------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | |
| Water chemistry program based on EPRI | (1) Scope of Program: The program relies on preventive | Yes, Element 4 |
| guidelines of TR-103515 and | measures to mitigate general, crevice, and picting corrosion | should be |
| molemented through the plant | and inservice inspection (ISI) to monitor the effects of | further |
| echnical specifications for minimizing | corrosion on emergency core cooling system components. | evaluated |
| mpurities by monitoring and | (2) Preventive Actions: Mitigation is by monitoring and | evaluated |
| naintaining water chemistry | control of water chemistry to minimize concentration of | |
| onditions, and inservice inspection is | corrosive impurities in accordance with the EPRI | |
| n conformance with ASME Section XI | guidelines of TR-103515. (3) Parameters Monitored/ | |
| edition specified in 10 CFR 50.55a). | Inspected: The AMP monitors the effects of corrosion by | |
| able IWC 2500-1, examination | detection of coolant leakage by inservice inspection (ISI). | |
| ategory C-H for pressure retaining | Inspection requirements of ASME Section XI specify visual | ł |
| lass 2 components. | VT-2 (IWA-5240) examination during system leakage and | |
| • | hydrostatic tests of all pressure retaining Class 2 | 1 |
| | components according to Table IWC 2500-1 category C-H. | |
| | (4) Detection of Aging Effects: Degradation of the | Į |
| | component due to corrosion would result in leakage of | 1 |
| | coolant. However, a one-time inspection of representative | |
| | sample of the system population and most susceptible | |
| | locations in the system should be conducted to ensure that | |
| | significant degradation is not occurring and the | |
| | component intended function will be maintained during | |
| 1 | the extended period. Follow up actions are based on the | |
| - | inspection results and plant technical specification. | |
| | Inspection is performed in accordance with the | |
| | requirements of ASME Code, 10CFR50 Appendix B, and | |
| | ASTM standards, using a variety of nondestructive | |
| | techniques including visual, ultrasonic, and surface | |
| | techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design | |
| | margin. (5) Monitoring and Trending: System leakage test | |
| · · · | is conducted prior to plant startup following each refueling | 1 |
| | outage, and hydrostatic test at or near the end of each | |
| | inspection interval. The results of one-time inspection | |
| | should be used to dictate the frequency of future | |
| | inspections. (6) Acceptance Criteria: Any relevant | |
| | conditions that may be detected during the leakage and | |
| | hydrostatic tests are evaluated in accordance with IWC- | |
| | 3100 and acceptance standards of IWC-3400 and IWB-3516 | |
| | for Class 2 components. Any evidence of aging effects or | |
| | unacceptable results are evaluated. (7) Corrective Actions: | |
| | Prior to service, corrective measures are needed to meet the | |
| | requirements of IWB-3142 and IWA-5250. Repair are in | |
| | conformance with IWA-4000 and IWB-4000 and | |
| · | molecement according to IWA-7000 and IWB-7000. (8 82 9) | |
| | Confirmation Process and Administrative Controls: Site | |
| | OA procedures, review and approval processes, and | · · · • |
| | administrative controls are implemented in accordance | |
| | with requirements of Appendix B to 10 CFR Part 50 and | |
| | will continue to be adequate for the period of license | |
| | renewal. (10) Operating Experience: Localized corrosion is | • |
| | likely to occur at mechanical joints, because of crevice | |
| | geometry at the sealing surfaces that may allow buildup of | ł |
| | geometry at the sealing surfaces that may allow of the impurities due to stagnant conditions. No significant | 1 |
| | corrosion related problem has been reported for piping and | |
| A setting of the set /li> | fittings in BWR emergency core cooling system. | inter de la composition |
| | intrinks in DAV cincificuely core cooming of acount | |

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ENGINEERED SAFETY FEATURES v

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| Existing | | Further |
|--|---|-----------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluatio |
| | (continued from previous page) | |
| | implemented in accordance with requirements of | |
| • | Appendix B to 10 CFR Part 50 and will continue to be | 1 |
| | adequate for the period of license renewal. (10) Operating | |
| | Experience: Wall-thinning problems in two-phase piping | 1 |
| | have occurred in extraction steam lines (INs 89-53, 97-84) | |
| | and moisture separation reheater and feedwater heater | 1 |
| | drains (INs 89-53, 91-18, 93-21, 97-84). | 1 |
| | | Yes. |
| ater chemistry program based on EPRI | (1) Scope of Program: The program relies on preventive | Element 4 |
| uidelines of TR-103515 and | measures to mitigate general, crevice, and pitting | should be |
| aplemented through the plant | corrosion and combination of inservice inspection (ISI) | further |
| chnical specifications for minimizing | and inservice testing (IST) to monitor the effects of | evaluated |
| npurities by monitoring and | corrosion on the intended function of emergency core | evaluated |
| aintaining water chemistry | cooling system components. (2) Preventive Actions: | |
| onditions; inservice inspection in | Mitigation is by monitoring and control of water | 1 |
| onformance with ASME Section XI | chemistry to minimize concentration of corrosive | 1 |
| dition specified in 10 CFR 50.55a). | impurities in accordance with EPRI guidelines of TR- | 1 |
| able IWC 2500-1, examination | 103515 and implemented through the plant technical | I |
| tegory C-H for pressure retaining | specifications. (3) Parameters Monitored/Inspected: The | |
| ass 2 components; and based on the | AMP monitors the effects of corrosion by ISI to detect | Ł |
| sting requirements of 10 CFR 50.55a | coolant leakage and IST to evaluate component | ľ |
| r ASME Code Class 2 pumps, and | performance. Inspection requirements of ASME Section | |
| ditional NRC staff guidelines of NRC | XI specify visual VT-2 (IWA-5240) examination during | |
| eneric Letter 89-04, inservice testing | system leakage test and hydrostatic test of all pressure | |
| rformed in accordance with ASME | retaining Class 2 components according to Table IWC | |
| ubsection IWP (or Operation and | 2500-1 category C-H. Based on the requirements of 10 CFR | |
| aintenance Code Subsection ISTB) for | 50.55a for ASME Code Class 2 pumps and additional | |
| imps, or other approved program in | guidelines of NRC Generic Letter (GL) 89-04. IST is | |
| e plant specifications. | performed in accordance with ASME Subsection IWP (or | |
| c plant specifications. | OM Code Subsection ISLB). (4) Detection of Aging Effects: | |
| | Degradation of the component due to corrosion would | |
| | result in leakage of coolant or degradation of component | |
| | performance. Hinwever, a one-time inspection of | |
| | representative sample of the system population and most | |
| | susceptible locations in the system should be conducted to | |
| | ensure that significant degradation is not occurring and | |
| | the component intended function will be maintained | |
| · | during the extended period. Inspection is performed in | |
| | accordance with the requirements of ASME Code, | |
| | accordance with the requirements of Asing Courc, 10CFR50 Appendix B, and ASTM standards, using a | |
| | variety of nondestructive techniques including visual, | |
| | ultrasonic, and surface techniques. (5) Monitoring and | |
| | Ultrasonic, and surface lecturidues. (of monthly unit | |
| | Trending: ISI/IST schedule of ASME Section XI should | |
| | provide for timely detection of corrosion. System leakage | |
| | test is conducted prior to plant startup following each | |
| | refueling outage, and hydrostatic test at or near the end of | + |
| | each inspection interval. The results of one-time | |
| | inspection should be used to dictate the frequency of future | |
| | inspections. (6) Acceptance Criteria: Any relevant | |
| | conditions that may be detected during the leakage and | |
| | hydrostatic tests are evaluated in accordance with IWC- | • |
| | 3100 and acceptance standards of IWC-3400 and IWB-3516 | |
| | for Class 2 components. Any evidence of aging effects or | |
| | unacceptable results are evaluated. (7) Corrective Actions: | |
| | Prior to service, | |

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V ENGINEERED SAFETY FEATURES

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D2 EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

| Existing | | Further |
|---|---|-----------------------------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Same as for Erosion/Corrosion of Item | (continued from previous page) corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. (10) Operating Experience: Localized corrosion is likely to occur at flange connections and other crevices where buildup of impurities can occur. No significant corrosion related problem has been reported for pumps in BWR emergency core cooling system. Same as for Eroston/Corrosion of Item D2.1.9 lines to | Yes, Element 1 |
| 02.1.9 lines to HPCI & RCIC pump wrbine and D2.1.10 lines from HPCI & RCIC pump turbine to condenser. | HPCI & RCIC pump turbine and D2.1.10 lines from HPCI & RCIC pump turbine to condenser. | should be further evaluated |
| Vater chemistry program based on EPRI | (1) Scope of Program: The program relies on preventive | Yes. Element 4 |
| uidelines of TR-103515 and | measures to mitigate crevice of pitting corresion and | should be |
| nplemented through the plant | combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the | further |
| chnical specifications for minimizing | intended function of emergency core cooling system | evaluated |
| npurities by monitoring and | components. (2) Preventive Actions: Mitigation is by | |
| naintaining water chemistry | monitoring and control of water chemistry to minimize | |
| onditions; inservice inspection in | concentration of corrosive impurities by following EPRI | |
| onformance with ASME Section XI edition specified in 10 CFR 50.55a). | guidelines of TR-103515 and implemented through the | |
| able IWC 2500-1. examination | plant technical specifications. (3) Parameters Monitorea/ | |
| ategory C-H for pressure retaining | Inspected: The AMP monitors the effects of corrosion by | |
| lass 2 components; and based on the | ISI to detect coolant leakage and IST to evaluate | |
| sting requirements of 10 CFR 50.55a | component performance. Inspection requirements of | |
| or ASME Code Class 2 valves, staff | ASME Section XI specify visual VT-2 (IWA-5240) | |
| uidelines of NRC Generic Letter (GL) 89- | examination during system leakage test and hydrostatic | |
| 4 regarding the scope of inservice | test of all pressure retaining Class 2 components, | |
| sting (IST), and information in NRC | according to Table IWC 2500-1 category C-H. Based on the | |
| N 88-70 regarding scope and testing of | requirements of 10 CFR 50.55a for ASME Code Class 2 | |
| afety-related check valves, and in GL | valves and additional guidelines of NRC GLs 89-04 and 96- 05, IST is performed in accordance with ASME Subsection | |
| 6-05 regarding safety-related motor- | 105, ISI is performed in accordance with Abilib Subsection IWV (OM Code Appendix I and Subsection ISTC). | |
| perated valves. IST is performed in | (4) Detection of Aging Effects: Degradation of the | |
| ccordance with ASME Subsection IWV | component due to corrosion would result in leakage of | |
| Operation and Maintenance Code ppendix I and Subsection ISTC), to | coolant or degradation of component performance | |
| hsure that the changes in design-basis | However a ope-time inspection of representative/sample x | • |
| erformance of safety-related valves | of the system population and most susceptible location | |
| sulting from degradation can be | the system should be conducted to ensure that significant | |
| lentified and managed. | degradation is not occurring and the component intended | |
| termine and amondon. | function will be maintained during the extended period. | |
| | inspection is performed in accordance with the | |
| | | |
| | requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards. using a variety of nondestructive | |

E Fan Cooler System

- E.1 Fan Coolers
 - E.1.1 Cooling Coils
 - E.1.2 Fan Housing
 - E.1.3 Blades
 - E.1.4 Fasteners
 - E.1.5 Piping
 - E.1.6 Fittings

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- NRC Bulletin 89-02, Stress Corrosion Cracking of High-Hardness Type 410 Stainless Steel Internal Preloaded Bolting in Anchor Darling Model S350W Swing Check Valves or Valves of Similar Design, July 19, 1989.
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CHAPTER VI

ELECTRICAL COMPONENTS

Major Electrical Components

- A. Electric Cables
- B. Electrical Connectors
- C. Electrical Penetration Assemblies
- D. Electrical Buses
- E. Electrical Insulators
- F. Transmission Conductors

G. Ground Conductors / Grocend Grid

A. Electric Cables

- A.1 Power, Instrumentation and Control Cables
 - A.1.1 Conductor
 - A.1.2 Shield Wire
 - A.1.3 Insulation
 - A.1.4 Jacket

VI A-1

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 technology. 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.

System Interfaces

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.

* Include a section on aging management of "inaccessible" and "buried" cables.

Not necessarily Trees. They may

Medium voltage cables normally

estilize ground cours shields etc.

utélize similar materials but not similar constructions.

| | Structure and | Region of | | Environ- | Aging | Aging | | _ |
|-------|---|---------------------------|---|--|--|------------|--|------|
| Item | Component | Interest | Material | ment | Effect | Mechanism | References | |
| A.1.1 | Component Power, Control, & Instrument Cables | Conductor | Copper • coated or non-coated • stranded or solid | Humid, Chemical Exposure Add Tempe- valeere | Increased circuit resistance, heating, signal noise, | Corrosion | IE Bulletin 79-1B (DOR Guideline) NUREG-0588 IEEE Standards • 323-1971 • 323-1974 • 383-1974 • 317-1976 • 338-1987 | |
| | | | | | J. Corr | | 1205-1993 Regulatory Guide 1.89, Rev. 1 10CFR50.49 EQ Rule | |
| * | These compon releve | referen rents mt to | nces a en Cr | re pe apter ductor | VI. | to They | he clect are not | heco |
| | | | | | • | | | |

time-temperature and Radiction queivalent pricaging

VI. ELECTRICAL COMPONENTS **A. Electric Cables**

Cables

| A. Electric Cables | Cables / 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: | Therefore, EQ cannot be considered a typical aging management program. However, the TLAA does provide some assurance that | A. Environme ntally Qualified Equipment Yes. In the case |
| 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 | 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. | where the TLAA is projected to the end of the period of extended operation, the analysis attributes |
| 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 (URED 6.4.222 1002) | 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 For \mathcal{L} . $\mathcal{L}S$ 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: | identified should be addressed |
| (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. | (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 | |
| 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 II requirements. The original qualification of many of these components night not have included pre-aging prior to exposing them to accident conditions. | 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 2 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 | intended sources dife |
| | | |

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|------|----------------------------|-----------------------|----------|------------------|-----------------|--------------------|------------|
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| Aging Management Program (AMP) Evaluation and Technical Basis 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 | Aging Management Program (AMP)Evaluation and Technical BasisEvaluationAging Management Program (AMP)Evaluation and Technical BasisEvaluationthe 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 mantained at the plant site in an auditable form for the duration of the installed life of the equipment. (10) Operating Experience: Pasive 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 | Aging Management Program (AMP)Evaluation and Technical BasisEvaluationAging Management Program (AMP)Evaluation and Technical BasisEvaluationthe 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 | Existing | | Further |
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| 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 | 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 | 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, 996), 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 | | | Evaluation |
| the only acceptable corrective action is refurbishment or replacement. (3 & 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 | Aging Management Program (AMP) | 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 | |

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
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| Existing | | Further |
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| Aging Management Program (AMP) | Evaluation and Technical Basis | 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. | |
| | Den land the second discussion discussion discussion discussion | |
| | 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 that encludes consid | evalue |
| | 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 | |

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| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
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Further Existing Evaluation Evaluation and Technical Basis Aging Management Program (AMP) 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, 5 NEI) provides guidance on addressing GSL-168 in license renewal 6 applications. It states that, until the generic issue is resolved, " Agn 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." not It should be noted that, currently, there are no acceptable nondestructive CM techniques to measure the integrity of electric cables in situ. It does not appear that itilities can take credit for low-Voltage current functional testing of cables by periodic system or circuit testing as a means of satisfying the criteria for an item to be ISC Cables 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-B. Non-environmentally Qualified Equipment B. Non-environmentally Qualified Calles environme Equipment (accessible Cable ntally The aging management programs discussed are generic in nature In many applications, electrical equi Qualified and should be developed based on specific plant applications. may not be environmentally qualified, and Equipment These programs will be evaluated on a plant specific basis. other aging management programs may be applicable. The following are examples. Yes. Aging Inspection Program A plant For those electrical components that are specific accessible, a visual inspection can be used to evaluation provide some indication of aging degradation. is required. , fretting The visual inspection can check for surface, anomalies, such as discoloration, cracking or surface contamination that would indicate the presence of antive 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 Discuss this only in the context of cables. 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.

- pertaining to the EQ of low-voltage I & C cables in the context of

| Item | Structure and Component | Region of Interest | Material | Environ- ment | 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 instrumnt. cable | Corrosion | Same as effect of corrosion on conductor for cables (A.1.1). |
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| | Power, Control, & Instrument Cables | Insulation | Polymers such as 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 | Same as effect of corrosion on conductor for cables (A.1.1). |
| | | | | Add Tempe. rateere, Radiation | | cables A-dd Embritt- lemeet | |
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1f change the word Equipment to "Cables"

| Existing | | Further |
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| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| A. Environmentally Qualified Equipment | A. Environmentally Qualified Equipment | A. |
| Same as effect of corrosion on conductor for cables (A.1.1). | Same as effect of corrosion on conductor for cables (A.1.1). | Environme ntally 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). | <u>B. Non-environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | <u>B. Non-</u> <u>environme</u> <u>ntally</u> <u>Qualified</u> <u>Equipment</u> Same as |
| | <u>Note:</u> The most probable location for shield wire corrosion is at exposed sites, such as terminations on equipment or terminal strips | 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). | <u>A. Environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | A. Environme ntally 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 vables (A.1.1) | <u>B. Non-environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | <u>B. Non-</u> environme ntally Qualified Equipment Same as |
| | <u>Note:</u> Underwater cables or cables with prolonged exposure to humid environment, should be specifically designed for such applications. | Same as effect of corrosion on conductor for cables (A.1.1). |
| | | (<i>n.1.1</i>). |

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| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|-------|--|-----------------------|---|--|---|------------------------|---|
| A.1.3 | Power, Control, & Instrument Cables | Insulation | Polymers such as 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). |
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change the word "Equépment" to "Cables".

| Existing | | Further |
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| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| A. Environmentally Qualified Equipment | A. Environmentally Qualified Equipment | <u>A.</u> |
| A. Environmentally Quanted Equipment Same as effect of corrosion on conductor for cables (A.1.1). | Same as effect of corrosion on conductor for cables (A.1.1). | Environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). |
| | | B Non- |
| 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- environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). |
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| Item | Structure and Component | Region of Interest | Material | Environ- ment | 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 environ- mental protection to underlying insulation. | Hardening, Cracking | Same as effect of corrosion on conductor for cables (A.1.1). |
| | | | | | Exposure of insulation to outside conditions. | | |
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change the word " Equipment" to " Cables".

| | isting | Evaluation and Technical Basis | Further Evaluation |
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| | ent Program (AMP) | A. Environmentally Qualified Equipment | A. |
| <u>A. Environmentally</u> Same as effect of correct cables (A.1.1). | Qualified Equipment osion on conductor for | <u>A. Environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | A. Environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables |
| B. Non-environments Equipment Same as effect of corro cables (A.I.I). | | B. Non-environmentally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). <u>Note:</u> Jackets provide some degree of protection to underlying insulation from exposure to outside stressors, such as radiation, oxygen, moisture, dirt, dust and other contaminants. | (A.1.1). <u>B. Non-</u> <u>environme</u> <u>ntally</u> <u>Qualified</u> <u>Equipment</u> Same as effect of |
| | | 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. | corrosion on conductor for cables (A.1.1). |
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| Item | Structure and Component | Region of Interest | Material | Environ- ment | 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). |
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| Existing | Evaluation and Technical Basis | Further Evaluation |
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| Aging Management Program (AMP) | A. Environmentally Qualified Equipment | A. |
| <u>A. Environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | A. Environmentally Oddimed Equipment Same as effect of corrosion on conductor for cables (A.1.1). | A. Environmed ntally 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). <u>Note:</u> 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- environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). |
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| Γ | Item | Structure and Component | Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|---|-------|--|----------|---|---|---|--------------------|---|
| | A.1.4 | Power, Control, & Instrument Cables | Jacket | Polymers such as Neoprene, CSPE, PVC | Vibration, maint- enance abuse | Exposure of insulation to outside conditions | Wear and tear | Same as effect of corrosion on conductor for cables (A.1.1). |
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VI. ELECTRICAL COMPONENTS A. Electric Cables

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

B. **Electrical Connectors**

- **B.1**
- Splices B.1.1 Jackets
 - B.1.2 Seals
 - B.1.3 Insulators

Mechanical Connectors **B.2**

B.2.1 Terminal Lugs, compression fittings, fusion connectors, contact pins

Terminal Blocks **B.3**

B.3.1 Block Assembly

VI R-1

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.

| Item | Structure and Component | Region of Interest | Material | Environ- ment | 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). | $\left(\right)$ |
| | | | · | Add. | conditions | | Confusing | |
| | | | C | temilie ntami- Neuts. | | | Is n't then specific | e ce |
| | | | | | | | Specific IEEE St ou Connec IEEE S | P. |
| | | | | | | | IEEE S | d. |
| | | | | | | | 572-198 | 5. |
| 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). | |
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Marking everything same as effect of corrosion is confusing when you are discussing fackets or splices. Provide appropriate text or cross-Refe evences

| · | Proprieta Statistica | Further |
|---|--|--|
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Aging Management Flogram (AMF) | A. Environmentally Qualified Equipment | A. |
| 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). | Environme ntally 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). | <u>B. Non-environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | B. Non- environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). |
| A. Environmentally Oralified Equipment Same as effect of corrosion on conductor for cables (A.I.I). | <u>A. Environmentally Ouslified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | A. Environze: ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A. I. 1). |
| B. Non-environmentally Qualified Equipment Same at effect of corrosion on conductor for cables (A .1.1). | <u>B. Non-environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | B. Non- environms ntally Qualified Equipment Samp as effect of corrosion on conductor for cables (A.1.1). |

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|-------|----------------------------|---|--|---|--|------------------------------|---|
| B.1.2 | Splices | Seals (potting) Compounds (gaskets, sealant) | Organic Compounds or cement, Rubber | High temp. hmidity, Mech. Stress | Moisture intrusion, leakage current, Signal noise/ Error, circuit | Creep, distortion | Same as effect of corrosion on conductor for cables (A.1.1). |
| | | | | | failure | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 3.1.3 | Seliese | | | | | | |
| .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). |
| | | | | | | | |
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| Existing | | Further Evaluation |
|---|--|---|
| Aging Management Program (AMP) | Evaluation and Technical Basis | |
| A. Environmentally Qualified Equipment | A. Environmentally Qualified Equipment | A. |
| Same as effect of corrosion on conductor for cables (A.1.1). | Same as effect of corrosion on conductor for cables (A.1.1). | Environme ntally Qualified Equipment Same as effect of corrosion on conductor |
| B. Non-environmentally Qualified | B. Non-environmentally Qualified Equipment | for cables (A.1.1). <u>B. Non-</u> |
| Equipment Same as effect of corrosion on conductor for cables (A.1.1). | Same as effect of corrosion on conductor for cables (A.1.1). | environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A. 1.1). |
| A. Environmentally Qualified Equipment | A. Environmentally Qualified Equipment | <u>A.</u> |
| Same as effect of corrosion on conductor for cables (A.1.1). | Same as effect of corrosion on conductor for cables (A.1.1). | Environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). |
| <u>B. Non-environmentally Qualified</u> <u>Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | <u>B. Non-environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | B. Non- environme ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). |

| Item | Structure and Component | Region of Interest | Material | Environ- ment | 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 Open-, Circeut | 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 Of eu - Circeut | Distortion, cracking, work hardening | Same as effect of corrosion on conductor for cables (A.1.1). |

| | · • • • • • • • • • • • • • • • • • • • | Further |
|---|---|----------------------|
| Existing | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) | A. Environmentally Qualified Equipment | <u>A.</u> |
| A. Environmentally Qualified Equipment | A. Environmentally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). | Environme |
| Same as effect of corrosion on conductor for | Same as effect of corrosion on conductor for cubies (A.1.1). | ntaliy |
| cables (A.1.1). | | Qualified |
| | | Equipment |
| | | Same as |
| | | |
| | | effect of |
| | | corrosion |
| | | on conductor |
| • | | |
| | | for cables |
| | | (A.1.1). |
| | B. Non-environmentally Qualified Equipment | B. Non- |
| B. Non-environmentally Qualified | Same as effect of corrosion on conductor for cables (A.1.1). | environme |
| Equipment | same as effect of corrosion on conductor for cables (A.1.1). | ntaily |
| Same as effect of corrosion on conductor for | | Qualified |
| cables (A.1.1). | | Equipment |
| · · | | Same as |
| | | effect of |
| | | corrosion |
| • | | on |
| | | conductor |
| | | for cables |
| | | (A.I.I). |
| | · | |
| A. Environmentally Qualified Equipment | A. Environmentally Qualified Equipment | A. |
| Same as effect of corrosion on conductor for | Same as effect of corrosion on conductor for cables (A.1.1). | Environme |
| cables (A.1.1). | | ntally Ourslifest |
| | | Qualifies |
| | | Equipment Same as |
| | | |
| | | effect of |
| | | corrosion |
| | | on conductor |
| | | for cables |
| | | (A.1.1). |
| | | (21.1.1). |
| B. Non-environmentally Qualified | B. Non-environmentally Qualified Equipment | B. Non- |
| | Same as effect of corrosion on conductor for cables (A.1.1). | environme |
| Equipment Same as effect of corrosion on conductor for | | ntally |
| some as effect of corrosion on conductor for | | Qualified |
| cables (A.I.I). | | Equipment |
| | | Same as |
| | | effect of |
| | | - corrosion |
| | | on |
| | | conductor |
| | | for cables |
| | | |
| | 4 · | (A.1.1). |

| Item | Structure and Component | Region of Interest | Material | Environ- ment | 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). |
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| - | · . | | | | | | |
| B.3.1 | Terminal Blocks | Block assembly | Organic Compounds | Moisture, Contami- nants | Shorting | Loss of insulating properties | Same as effect .; corrosion on conductor for |
| | | | · | | | | cables (A.1.1). |
| | | | | | | | |
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| Existing | · · | Further |
|--|--|---|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| A. Environmentally Qualified Equipment | A. Environmentally Qualified Equipment | <u>A.</u> |
| Same as effect of corrosion on conductor for cables (A.1.1). | Same as effect of corrosion on conductor for cables (A.1.1). | Environme ntally Qualified Equipment Same as effect of corrosion on |
| | | conductor for cables (A.1.1). |
| B. Non-environmentally Qualified <u>Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | <u>B. Non-environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | B. Non- environmc ntally 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). | <u>A. Environmentally Qualified Equipment</u> Same as effect of corrosion on conductor for cables (A.1.1). | <u>A.</u> <u>Environme</u> <u>ntally</u> |
| | • | Qualified Equipment Same as effect of corrosion |
| | | on conductor for cables (A.1.1). |
| B. Non-environmentally Qualified <u>Equipment</u> 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- environt.s ntally Qualified Equipment Same as effect of corrosion on conductor for cables (A.1.1). |

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

The EPA encludes pipe segment, head plates and associated penetration cable sealeire système, penetration cabling, pigtaile to the field connection points.

VI. ELECTRICAL COMPONENTS C. Electrical Pénetration Assemblies

Systems, Structures and Components

This review table addresses electric penetration assemblies (EPA). EPAs are used to route electric cable circuits through the containment wall. They provide electrical continuity for the circuit, as well as a pressure boundary for the containment. Individual sub-components for a typical modular type EPA are addressed in terms of aging mechanisms and effects.

System Interfaces

Electric penetration assemblies functionally interface with all electric circuits that must be routed through the containment wall.

VI. ELECTRICAL COMPONENTS C. Electrical Penetration Assemblies

| _ | Structure and | Region of | 1 | Environ- | Aging | Aging | |
|-------|--|----------------------------------|--|--|---------------------------------|---|---|
| Item | Component | Interest | Material | ment | Effect | Mechanism | References |
| C.1.1 | Modular Electrical Penetration Assemblies | O-ring seals | Organic compound | High temp., Radiation, Oxygen X Bui HLemid | Loss of pressure boundary | Hardening, oxidation Creef due to the ma aging | Same as effect of corrosion on conductor for cables (A.1.1). |
| | Modular Electrical Penetration Assemblies | Conductor-to- insulator seals | Fused glass/metal Fused epoxy/* metal Mechanical swage | Moisture, Contami- nants | Loss of pressure boundary | Creeb | Same as effect of corrosion on conductor for cables (A.1.1). |
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E. Electrical Insulators

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- E.1 Station Post Insulators E.1.1 Assembly
- E.2 Strain/suspension Insulators E.2.1 Assembly

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Systems, Structures and Components

This review table addresses electric insulators, including station post insulators and suspension insulators. Station post insulators and suspension insulators form an integral part of the utility transmission system connecting the power station to offsite power sources, and tying the main generator output to the utility's power grid. Station post insulators provide electrical insulation, spacing, and support between sub-station and switchyard electrical buses and their support structures. Similarly, suspension insulators provide electrical insulation, spacing, and support between transmission line conductors and their transmission structures.

System Interfaces

, and distributione

Electric insulators functionally interface with the utility transmission system connecting the power station to offsite power sources, and tying the main generator output to the utility's power grid

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|-------|----------------------------|-----------------------|---|--|---|---|------------|
| E.1.1 | Station post insulator | Assembly | Porcelain, Galvanized Metals, Stainless Steel, Cement Epoxy | High temperature , dirt, dust, salt, vibration, and humidity | Leakage current, loss of function, cracking ffcesh- OVer | Surface contaminati on or oxidation, loss of material due to wear, corrosion, mechanical stress | IN 93-95 |
| | | | | | | | |
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VI E-3

| Existing | 1 | Further |
|---|--|------------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Insulator Inspection Program | As one potential means of managing aging of insulators, an | No |
| | inspection program can be implemented in which periodic visual | 1 |
| While no requirement currently exists for | inspections of the components are performed. The 10 criteria | |
| such a program, periodic visual inspection of | identified in the draft SRP-LR are discussed for such a program | |
| insulators is a potential method of managing | below: | |
| aging degradation for these components. The | (1) Scope: The inspection program should include all insulators | |
| inspection program should check for | that are important to safety. (2) Preventive Actions: Any | |
| indications of any of the identified aging | preventive actions that can be taken to mitigate aging degradation | |
| mechanisms, such as cracking or surface | should be identified. (3) Parameter Monitored/Inspected: The | |
| contamination. If no indications are found, | parameters to be monitored/inspected should be determined based | |
| this would provide some assurance that aging | on the aging mechanisms identified as important for these | |
| degradation is not adversely impacting the | components. Each of the aging mechanisms presented in this table | |
| ability of the components to perform their | should be addressed by identifying a parameter or indicator that | |
| intended function. If indications of aging | can be observed during the inspection. (4) Detection: Each of the | |
| degradation are noted, corrective actions can | parameters/indicators should be observed during the inspection to | 1 |
| be taken prior to failure occurring. | provide some assurance that aging degradation is detected prior to | |
| or taken prior to randre occurring. | failure. (5) Monitoring and Trending: Any aging indicators noted | |
| | during the inspection should be quantified, to the extent possible, | |
| | to allow trending in future inspections. (6) Acceptance Criteria: | |
| | An acceptance criteria should be established for each of the | |
| | parameters/indicators identified such that once the criteria is | |
| | exceeded, corrective actions must be taken to refurbish or replace | |
| | the component. (7) Corrective Actions: Based on the acceptance | |
| | criteria established, corrective actions should be implemented to | |
| | refurbish or replace components not meeting the minimum | |
| | | |
| | acceptance criteria. (8 & 9) Confirmation Process and | • |
| | Administrative controls: A process should be included to ensure | |
| | that inspection results are reviewed and compared against | |
| | acceptance criteria, and that corrective actions are implemented, | |
| | when necessary. Appropriate administrative controls should be in | |
| | place to ensure that the inspections are performed in a standardized | |
| | manner and at the proper frequency, and that results are properly | |
| | documented. (10) Operating experience: Past operating | |
| | experience should be reviewed and evaluated to identify any plant | |
| | specific aging issues that should be addressed for these | |
| | components in the program. | |
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VI E-4

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|-------|---------------------------------------|-----------------------|--|---|---|---|------------|
| E.2.1 | Strain and suspension insulator | Assembly | Porcelain, Galvanized Metals, Stainless Steel, Cement | High temperature , dirt, dust, salt, vibration, and humidity, wind | Leakage current, loss of function, cracking | Surface contaminati on or oxidation, loss of material due to wear, corrosion, mechanical stress, vibration | IN 93-95 |
| | | | | | | | |
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F. Transmission Conductors

F.1 Conductor F.1.1 Assembly

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VI. ELECTRICAL COMPONENTS F. Transmission Conductors

Systems, Structures and Components/

This review table addresses transmission conductors. Transmission conductors form an integral part of the utility transmission system connecting the power station to offsite power sources, and tying the main generator output to the utility's power grid.

and distribution

System Interfaces

Transmission conductors functionally interface with the utility transmission system connecting the power station to offsite power sources, and tying the main generator output to the utility's power grid

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VI. ELECTRICAL COMPONENTS F. Transmission Conductors

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|-------|----------------------------|-----------------------|--------------------|---|--------------------------------|--|------------|
| F.1.1 | Transmission conductors | Assembly | Aluminum, Steel | High temperature , vibration, dirt, dust, salt, wind, ice, oxygen, and humidity | Leakage current, fatigue | Surface contaminati on or oxidation, corrosion, material loss due to wear faigue | None |
| | | | | | | | · |
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G. Ground Conductors

G.1 Conductor G.1.1 Assembly

VI. ELECTRICAL COMPONENTS G. Ground Conductors Grid. Ground Grid.

Systems, Structures and Components

This review table addresses ground conductors. The electrical ground conductors make up the plant's electrical ground system. This system establishes the reference ground potential for electrical system voltages in the entire plant. Electric power system voltage measurements are referenced to the ground system, and all protective relaying, basic insulation levels, instrumentation, controls, and metering depend on the design integrity of the plant ground system. Personnel and equipment safety are also dependent on the ground system grid.

System Interfaces

Ground conductors functionally interface with all circuits that are electrically connected to ground.

Draft November 12, 1999

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VI. ELECTRICAL COMPONENTS G. Ground Conductors

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Environ- ment Aging Effect N Humidity, salt, Loss of function, S oxygen increased oo electrical oo oresistance resistance ca mage | | References |
|-------|----------------------------|-----------------------|-------------------|------------------|--|---|------------|
| G.1.1 | Ground conductor | Assembly | Copper, bronze | sait, | | | None |
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VI. ELECTRICAL COMPONENTS G. Ground Conductors

| | Eulisting | | Further |
|----------|--|--|------------|
| | Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | Ground Conductor Inspection Program | As one potential means of managing aging of ground conductors, | No |
| ph | Ground Conductor Inspection Arogram | an inspection program can be implemented in which periodic | |
| Physical | Inspection of ground grid conductors may or | visual inspections, along with indirect measurements of ground | |
| - | may not be included in a plant preventive | integrity are performed. The 10 criteria identified in the draft SRP- | |
| | maintenance program. No generally accepted | LR are discussed for such a program below: | |
| | methods to monitor the integrity of cable | (1) Scope: The inspection program should include all ground | |
| | ground conductors exist. Periodic visual | conductors that are important to safety. (2) Preventive Actions: | |
| | inspection is one potential approach, | Any preventive actions that can be taken to mitigate aging | |
| | however, the majority of the ground grid is | degradation should be identified. (3) Parameter | |
| | inaccessible. Indirect indicators of ground | Monitored/Inspected: The parameters to be monitored/inspected | |
| | integrity are provided through instrument | should be determined based on the aging mechanisms identified as | |
| | calibration programs, periodic inspection, | important for these components. Each of the aging mechanisms | |
| | maintenance, and testing of protective | presented in this table should be addressed by identifying a | |
| | relaying, and the monitoring of electric power | parameter or indicator that can be observed during the inspection. | |
| | system quality and operating parameters. | (4) Detection: Each of the parameters/indicators should be | |
| | | observed during the inspection to provide some assurance that | |
| | While no requirement currently exists for | aging degradation is detected prior to failure. (5) Monitoring and | |
| | such a program, periodic visual inspection of | Trending: Any aging indicators noted during the inspection should | |
| | accessible ground conductors is a potential | be quantified, to the extent possible, to allow trending in future | |
| | method of managing aging degradation for | inspections. (6) Acceptance Criteria: An acceptance criteria | |
| | these components. The inspection program | should be established for each of the parameters/indicators | |
| | should check for indications of any of the | identified such that once the criteria is exceeded, corrective actions | |
| | identified aging mechanisms, such as | must be taken to refurbish or replace the component. (7) | |
| / | corrosion. In addition, infrared thermography | Corrective Actions: Based on the acceptance criteria established, | |
| | can be used to identify hot spots. Since the | corrective actions should be implemented to refurbish or replace | |
| | majority of the ground grid is inaccessible, | components not meeting the minimum acceptance criteria. (8& 9) | |
| | indirect indicators of ground integrity should | Confirmation Process and Administrative controls: A process | |
| | also be included. If no indications are found, | should be included to ensure that inspection results are reviewed | |
| | this would provide some assurance that aging | and compared against acceptance criteria, and that corrective | |
| | degradation is not adversely impacting the | actions are implemented, when necessary. Appropriate | |
| | ability of the components to perform their | administrative controls should be in place to ensure that the | |
| | intended function. If indications of aging | inspections are performed in a standardized manner and at the | |
| | degradation are noted, corrective actions can | proper frequency, and that results are properly documented. (10) | |
| | be taken prior to failure occurring. | Operating experience: Past operating experience should be | |
| | | reviewed and evaluated to identify any plant specific aging issues | |
| | | that should be addressed for these components in the program. | |
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CHAPTER VII (12/06/99)

AUXILIARY SYSTEMS

Major Plant Sections

- A1. New Fuel Storage
- A2. Spent Fuel Storage
- A3. Spent Fuel Pool Cooling and Cleanup (PWR)
- A4. Spent Fuel Pool Cooling and Cleanup (BWR)
- A5. Suppression Pool Cleanup System (BWR)
- B1. Light Load Handling Systems (Related to Refueling)
- B2. Overhead Heavy Load Handling Systems
- C1. Open Cycle Cooling Water System (Service Water System)
- C2. Closed Cycle Cooling Water System
- C3. Ultimate Heat Sink
- D. Compressed Air System
- E1. Chemical and Volume Control System (PWR)
- E2. Standby Liquid Control System (BWR)
- E3. Reactor Water Cleanup System (BWR)
- E4. Coolant Storage/Refueling Water System (PWR)
- E5. Shutdown Cooling System (Old BWR)
- F1. Control Room Area Ventilation System
- F2. Auxiliary and Radwaste Area Ventilation System
- F3. Primary Containment Heating and Ventilation System
- F4. Diesel Generator Building Ventilation System
- G. Fire Protection
- H1. Diesel Fuel Oil System
- H2. Emergency Diesel Generator System
- I. Liquid Waste Disposal System

A1. New Fuel Storage

- A1 New Fuel Storage
 - A1.1 New Fuel Rack
 - A1.1.1 New Fuel Rack Assembly

A1. New Fuel Storage

System, Structures, and Components

The system, structures, and components included in this table comprise the new fuel storage which contains carbon steel new fuel storage racks located in the auxiliary building. The racks are exposed to temperature and humidity conditions of the auxiliary building. The racks are generally painted with protecting coating. 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 new fuel storage are classified as Group C Quality Standards.

System Interfaces

No other systems contained in this report interface with the new fuel storage.

While PWR and BWRs are not explicitly mentioned, the term auxiliary building is mentioned implying PWRs. Were BWRs not examined because the BWR new fuel vaults generally have covers which my prevent moisture from getting to the new fuel racks?

VII AUXILIARY SYSTEMS

| VII . | A1. NEW FUEL STORAGE | | | | | | | | | |
|----------------|----------------------------|---------------------------|-----------------|---|-------------------------------|--|--|--|--|--|
| · · · · · · · | Structure and | Region of | | Environ- | Aging | Aging | Deferre | | | |
| Item | | Interest | Material | ment | | | | | | |
| Item A1.1.1 | Component New Fuel Rack | Interest | Carbon Steel | ment Indoors: Exposed to temperature and humidity conditions inside the Auxiliary Building | Effect Loss of Material | Mechanism General Corrosion, Coating Degrada- tion | References Plant Technical Specifications. | | | |
| A1.1.1 | New Fuel Rack | New Fuel Rack Assembly | Carbon Steel | Indoors: exposed to temperature and humidity conditions inside the Auxiliary Building | Local Loss of Material | Pitting Corrosion and Crevice Corrosion, Coating Degrada- tion | Plant Technical Specifications. | | | |

While there is analysis done to show that fuel in these racks will not be physically able to go critical, there is also a requirement that (for PWRs) the floor drains be operable. If these drains are considered a passive component, then they should be considered.

A2. Spent Fuel Storage

A2.1 Spent Fuel Storage Rack

A2.1.1 Neutron-Absorbing Sheets

A2. Spent Fuel Storage

A2.1 Spent Fuel Storage Rack

A2.1.1 Neutron-Absorbing Sheets

In my judgement, there are other passive components associated with the spent fuel pool. These include inflatable seals and the stainless steel pool liner. Regarding the liner, pools generally have leak detection systems which provide a surveillance method for pool leakage. This may be adequate to provide indication of a leak in the liner. However, previous operating experience thru 1996 indicated evens involving small leaks (less than 50 gallons per day).

Regarding the inflatable seals in gates in both BWR and PWR pools, there was previous operating experience indicated problems with these seals. Mention of these seals may be appropriate if these are considered passive components.

DRAFT - 12/06/99

A2. Spent Fuel Storage

System, Structures, and Components

The system, structures, and components included in this table comprise the pressurized water reactor (PWR) spent fuel storage. The PWR spent fuel storage contains stainless steel spent fuel storage racks and Boraflex sheets (if used) submerged in a chemically treated borated water. The intended function of the spent fuel rack is to separate spent fuel assemblies. Boraflex sheets fastened to the storage cells provide for neutron absorption and help maintain subcriticality of spent fuel assemblies in the spent fuel pool. 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 spent fuel storage are classified as Group C Quality Standards.

System Interfaces

No other systems contained in this report interfaces with the PWR spent fuel storage.

BWRs have fixed poison in the spent fuel pools (SFPs) which while not subject to degradation from borated water, is subject to irradiation degradation and, therefore has some aging susceptibility. There is no BWR spent fuel pool poison discussion. Consideration should be given to BWR SFPs as well.

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Boraflex was not the only poison material containing boron used in reactor spent fuel pools. I found reference to boral also. Consideration should be given to mentioning them as well as boraflex.

VII AUXILIARY SYSTEMS A2. SPENT FUEL STORAGE

| J | Structure and | Region of | Ţ | Environ- | Aging | Aging | J | 1 | | |
|--------|---------------|--------------|---|---|---------------|----------------------------|-------------------|---------------|--|--|
| Item | Component | Interest | Material | ment | Effect | Mechanism | References | | | |
| A2.1.1 | Spent Fuel | Neutron- | Boraflex | Immersed in | Loss of Boron | Boraflex | EPRI NP-6159. | 1 | | |
| | Storage Racks | Absorbing | | Chemically | Carbide | Degrada- | EPRI TR-101926. | 1 | | |
| 1 | J J | Sheets | | Treated | Material; | tion | EPRI TR-103300 | 1 | | |
| | | | 1 | Borated | Reduction of | | Plant Technical | | | |
| 1 | 1 | | | Water | Neutron- | | Specifications. | V | | |
| | | | | | Absorbing | - | ~ | | | |
| [| [| 1 | 1 | | Capacity: Gap | | Operating | | | |
| 1 | | Í | 1 | | Formation | | Experience | | | |
| | | 1 | ł | | due to | | NRC IN 87-43. | | | |
| | | | 1 | | Shrinkage of | | NRC IN 93-70. | | | |
| 1 | | - | ĺ | | Boraflex | 1 | NRC IN 95-38. | | | |
| | | | | | Panels | | NRC GL 96-04. | | | |
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| | | The sar | ne words w | ould seem | onnlinut | | | | | |
| | | | | | applicable | to BWRs a | is well. 🔪 🛃 📗 | | | |
| | | i i | | | | | | | | |
| | | 1 inese s | These same words would seem appropriate for other poisons.) | | | | | | | |
| | | | | i. | 1. fr fr. d | | si poisons.) | | | |
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| | | | / Techr | nical Specit | fications (TS | are prob | ably not universa | ally used for | | |
| | | | boron | control in | the poison r | naterial alt | hough they do s | et an upper | | |
| | | | limita | | Looctivity | Curson TS | S review in the p | ast did not | | |
| | | 1 | amit o | in luer pool | reactivity. | | by TC other ther | hy | | |
| | | | indica | ite control | of the poiso | n material | by TS other than | | | |
| | | | reacti | vity of fuel | in the SFP. | Is this wh | at is meant by T | 57 | | |
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| A2. SPENT FUEL STORAGE | | Further |
|---|--|-------------------|
| Existing | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) | Evaluation and rechniced parts on managing | Yes. |
| Aging Management Program (AMP) Generally, a Boraflex monitoring program on the test coupons or the inctual Boraflex panels, based on nanufacturer's recommendations, should be implemented in the initial installation of the spent fuel racks to issure that no unexpected degradation of the Boraflex material would compromise the criticality analysis in support of the design of spent fuel storage racks. The applicable AMP, based on manufacturer's suggestion, is isually implemented by the plant technical specifications and relies on periodic inspection, testing, monitoring and analysis of the criticality design to assure that the required 5% subcriticality margin is maintained. The frequency of the inspection and testing should be about every 4-5 years based on the manufacturer's recommendation for a 40-year service life for the spent fuel racks. The AMP should include: (1) Visual inspection of the physical conditions of the sampling coupons for detecting degradation of the Boraflex material, such as discoloration and reduction of thickness. (2) Performing neutron attenuation testing called "blackness testing" to determine gap formation in Boraflex panels. (3) Sampling and analysis for silica levels in the spent fuel pool water and trending the results using the RACKLIFE code. (4) Measurin boron areal density by the BADGER device. (5) Corrective actions should be initiated if the test results found that the 5% subcriticality margin cannot be maintained because of the current or projected future Boraflex degradation. | (1) Scope of Program: The AMP should focus on managing the effects of Boraflex material degradation (i.e., loss of boron carbide neutron absorber due to gradual degradation of polymer matrix in the release of silica from Boraflex following gamma irradiation and long- term exposure to the wet pool environment) on the intended function of the spent fuel racks to prevent criticality. (2) Preventive Actions: Periodic visual inspection of sampling coupons prevents unexpected degradation of the Boraflex material. (3) Parameters Monitored/Inspected: The parameters monitored should include physical conditions of the sample coupons such as thickness. discoloration, and hardness, which are conditions directly related degradation of the Boraflex material. Operating experience has shown that the degraded surfaces of the test coupons have a gray discoloration. When Boraflex is subjected to gamma radiation and long-term exposure to the spent fuel pool environment, the ply siloxane polymer matrix becomes degraded and silica filler and boron carbide are released. NRC Information Notice (IN) 95-38 indicated that the loss of boron carbide (washout) from Boraflex is characterized by slow dissolution of the silica from the surface of the Boraflex and a gradual thinning of the material. Visual inspection should be used to detect Boraflex degradation such as discoloration and reduction of thickness. In addition gap formation and decrease of areal boron density should be monitored. (4) Detection of Aging Effects: Because Boraflex contains about 25 percent boron carbide, sampling and analysis the presence of silica in the spent fuel pool provide an indication of depletion of boron carbide from Boraflex. The amount of boron carbide released from Boraflex. The amount of boron carbide released from Boraflex should be correlated to the levels of silica present in the spent fuel pool. This is supplemented by direct measurement of boron loss using BADGER device. (5) Monitoring and Trending: The periodic inspection measurements and analysis | no generic AMP |

Terry management and a second se

| A | A2. SPENT FUEL STORAGE Environ- Aging Aging | | | | | | |
|------|---|-----------------------|----------|------|--------|-----------|------------|
| Item | Structure and Component | Region of Interest | Material | ment | Effect | Mechanism | References |
| | | | | | | | |
| | | | | | | | |
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A3. Spent Fuel Pool Cooling and Cleanup (Pressurized Water Reactor)

A3.1 Piping

- A3.1.1 Pipe, Fittings and Flanges
- A3.1.2 Studs and Nuts
- A3.2 Filter
 - A3.2.1 Studs and Nuts

A3.3 Strainer

A3.3.1 Studs and Nuts

- A3.4 Check Valve
 - A3.4.1 Body and Bonnet
 - A3.4.2 Studs and Nuts

A3.5 Hand Valve

- A3.5.1 Body and Bonnet
- A3.5.2 Studs and Nuts
- A3.5.3 Linings
- A3.6 Heat Exchanger
 - A3.6.1 Shell
 - A3.6.2 Nozzles
 - A3.6.3 Studs and Nuts
- A3.7 Ion Exchanger
 - A3.7.1 Studs and Nuts
- A3.8 Pump
 - A3.8.1 Casing
 - A3.8.2 Studs and Nuts

A3.9 Flow Orifice

A3.9.1 Studs and Nuts

A3.10 Spent Fuel Transfer Tube

A3.10.1 Studs and Nuts

A3. Spent Fuel Pool Cooling and Cleanup (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the pressurized water reactor (PWR) spent fuel storage. The PWR spent fuel storage contains stainless steel spent fuel storage racks and Boraflex sheets (if used) submerged in a chemically treated borated water. The intended function of the spent fuel rack is to separate spent fuel assemblies. Boraflex sheets fastened to the storage cells provide for neutron absorption and help maintain subcriticality of spent fuel assemblies in the spent fuel pool. 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 spent fuel storage are classified as Group C Quality Standards.

System Interfaces

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No other systems contained in this report interfaces with the PWR spent fuel storage.

| Item | Structure and Component | Interest | Material | Environ- ment | Aging Mechanism | References |
|--------|----------------------------|--------------------------------|-------------------------|---|-------------------------------------|--|
| 43.1.1 | Piping | Pipe, Fittings, and Flanges | Stainless Steel (SS) | Chemically Treated Borated Water | Pitting and Crevice Corrosion | ASME Section XI. 1989 Edition. NRC IN 84-18. NRC IN 96-11. NRC GL 88-05 EPRI TR-105714. Plant Technical Specifications. |
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A3. SPENT FUEL POOL COOLING AND CLEANUP (Pressurized Water Reactor)

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A3. SPENT FUEL POOL COOLING AND CLEANUP (Pressurized Water Reactor)

| | | ING AND CLEANUP (Pressurized Water Reactor) | |
|---|---|--|------------|
| | Existing | | Further |
| | Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| | The AMP relies on minimizing | (1) Scope of Program: The AMP relies on monitoring and | Yes, |
| | impurities by monitoring and | maintaining the water chemistry and inservice inspection | Element 4 |
| | maintaining the borated water | (ISI) for managing the effects of pitting and crevice | should be |
| (| chemistry in accordance with the | corrosion on the intended function of the spent fuel pool | further |
| | guidelines of EPRI TR-105714 and | cooling and cleanup system components. (2) Preventive | evaluated |
| | implemented by plant technical | Actions: Monitoring and maintaining the system water | |
| ; | specifications, and inservice inspection | chemistry in accordance with the guidelines of EPRI TR- | |
| | (ISI) is in conformance with ASME | 105714 helps to minimize impurities in the system fluid. | |
| | Section XI (edition specified in 10 CFR | The AMP generally contains chemical parameter | |
| | 50.55a), Table IWD 2500-1, test and | specifications, sampling frequency, analysis, and | |
| | examination category D-C for systems | corrective actions. Chemical parameters, such as | |
| | in support of residual heat removal | concentrations of chloride, sulfate, oxygen, and | |
| | from spent fuel storage pool. | impurities are monitored and controlled. The preventive | |
| 1 | | actions, however, are considered inadequate because of | |
| | | inadvertent introduction of impurities into the system due | |
| | the second | to unacceptable levels of contaminants in the boric acid. | |
| | 1050 | exposure of the spent fuel pool free surface to airborne | |
| į | DES ALLY | contaminants (IN 84-18), or from ingress of demineralizer | |
| | ALC AST AL | resins (IN 96-11). (3) Parameters Monitored/Inspected: | |
| | me as y it is | The system water chemistry is monitored and controlled | |
| | Willing our on a | | |
| | WHIVER SALL OFF? WHIVER SALL OFF? UNIVER SALL | to mitigate the effects of pitting and crevice corrosion on the intended function of the component. Examination | |
| | | category D-C of ASME Section XI Table IWD 2500-1 | |
| | por me. | U . | |
| | | requires visual VT-2 examination during system leakage and hydrostatic test. (4) Detection of Aging Effects: Within | |
| 1 | 10 10 | the spent fuel pool cooling system there are regions of low | |
| | A AM | and stagnant flow conditions where impurities and/or | |
| 1 | | corrosive chemicals may concentrate and cause crevice | |
| | 1 | and pitting corrosion. VT-2 examination of ASME Section | |
| 1 | 00' | XI, Table IWD 2500-1 will not detect pitting and crevice | |
| 1 | 1 | corrosion. Therefore, a one-time inspection of | |
| ł | 1 der | representative components and susceptible locations | |
| | 1 Mar | should be undertaken to ensure that significant corrosion | |
| 1 | 1 · | is not occurring. Based on piping/component geometry | |
| 1 | | | : |
| I | | and fluid flow conditions, susceptible locations can be identified. Follow up actions are based on the inspection | |
| 1 | | and allow the local and the lo | |
| I | | and Trending: The results of periodic monitoring of | |
| 1 | AND I J | borated water chemistry provide data for trending. The | |
| ł | CURCTIC SIK | results of the one-time inspection should be used to dictate | |
| ł |)ELG- MAP ILNIE | future inspection. System leakage test is conducted prior | |
| | PORT ANE RE | to plant startup following each refueling outage and | |
| I | SELECTION B IMPORTHENT IF IMPORTHENT IF INPORTENT IS TO BE INSPORTENT IS TO BE INSPORTENT IS TO BE DONE. | hydrostatic test at or near the end of each inspection | |
| I | 14 4 67 | interval (6) Accentance Criteria. The chemistry | |
| l | pro 12 | interval. (6) Acceptance Criteria: The chemistry monitoring program provides specification of chemical | |
| I | ONA IL | parameters and acceptable levels. Any relevant conditions | |
| I | . spour | that may be detected during the leakage and hydrostatic | |
| ł | /V ···] | tests are evaluated in accordance with IWD-3000. (7) | |
| ł | N. P. | | |
| l | 000° | Corrective Actions: Plant borated water chemistry control | |
| L | ·V··· | program specifies the target values for the chemistry | |
| L | - | parameters. Corrective actions are taken if the target | |
| L | } | values are exceeded. Corrective actions of the above one- | |
| l | , | time inspection are based on the results of the inspection. | |
| | | Furthermore, IWA-5250 requires that the source of | |
| | | leakage detected during the pressure test should be located | |
| I | | and evaluated for corrective measures. Repair and | |
| | 1 | replacement are in accordance with IWA-4000 and | |

Environ-Aging Structure and Region of Aging Interest Effect Material ment Mechanism References Item Component A3.1.1 Piping Pipe, Fittings, Chemically Loss of General, ASME Section XI, Carbon and Flanges Steel (CS) Treated Material Pitting and 1989 Edition. Borated Crevice NRC IN 84-18. Water Corrosion NRC IN 96-11. EPRI TR-105714. NRC GL 88-05. Plant Technical Specifications. A3.1.1 Piping Pipe, Fittings, SS Chemically Crack Stress ASME Section XI, and Flanges Treated Initiation Corrosion 1989 Edition. Borated and Growth Cracking **Regulatory** Guide Water (SCC) 1.44. NRC IN 84-18. NRC GL 88-05. NRC IN 97-19. EPRI TR-105714. Plant Technical Specifications.

A3. SPENT FUEL POOL COOLING AND CLEANUP (Pressurized Water Reactor)

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A3. SPENT FUEL POOL COOLING AND CLEANUP (Pressurized Water Reactor)

| A3. SPENT FUEL POOL COOL | ING AND CLEANUP (Pressurized Water Reactor) | · |
|--|--|-------------|
| Existing | | Further |
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation |
| Long-term exposure of the rubber | An inspection program should be implemented to manage | Yes, |
| linings to borated water can result in | the effects of rubber degradation on the intended function | no existing |
| rubber degradation such as, welling, | of the component. The program should include sampling | AMP |
| hardening and cracking which. in turn, | criteria, inspection method, inspection frequency, | |
| can cause corrosion of the underlying | acceptance criteria, and corrective action. Plant specific | |
| carbon steel surfaces. No existing aging | aging management program is to be evaluated. | |
| management program. | | |
| The AMP relies on minimizing | (1) Scope of Program: The program relies on monitoring | Yes, |
| impurities by monitoring and | and maintaining reactor coolant and cooling water | Element 4 |
| maintaining reactor coolant and | chemistry and inservice inspection (ISI) for managing the | should be |
| cooling water chemistry implemented | effects of pitting and crevice corrosion on the intended | further |
| by plant technical specifications, and | function of the component. (2) Preventive Actions: | evaluated |
| inservice inspection (ISI) in | Monitoring and maintaining the chemistry conditions of | |
| conformance with ASME Section XI | reactor coolant and cooling water will minimize the | 1 |
| (edition specified in 10 CFR 50.55a). | impurities in the system fluid. The preventive actions, | I |
| Table IWD 2500-1, test and examination | however, are considered inadequate because of | |
| category D-C for systems in support of | inadvertent introduction of impurities into the system. | |
| residual heat removal from spent fuel | Also, high concentration of impurities at locations having | |
| storage pool. | stagnant flow could cause pitting and crevice corrosion. | |
| | (3) Parameters Monitored/Inspected: The parameters | |
| | monitored in the borated water are provided in the | |
| | specifications based on EPRI guidelines. The parameters | |
| · | include dissolved iron, dissolved copper, chlorides, dissolved oxygen, suspended solids, pH, and hydrazine. | |
| | Examination category D-C of ASME Section XI Table IWD | |
| | 2500-1 requires visual VT-2 examination during system | |
| | leakage test and system hydrostatic test to detect the | |
| | leakage. (4) Detection of Aging Effects: Within the spent | |
| | fuel pool cooling system, there are regions of low and | |
| | stagnant flow conditions where impurities and/or | |
| • | corrosive chemicals may concentrate and cause pitting | |
| | and crevice corrosion. Visual examination VT-2 required | |
| | by IWD 2500-1 will not detect pitting and crevice | |
| | corrosion. Therefore, a one-time inspection of | |
| | representative components and susceptible locations | |
| | should be undertaken to ensure that significant corrosion | |
| | is not occurring. Based on piping/component geometry | |
| | and fluid flow conditions, susceptible locations can be | |
| | identified. Follow up actions are based on inspection | |
| | results and plant technical specification. (5) Monitoring | |
| | and Trending: The results of periodic monitoring of | |
| | borated water chemistry provide data for trending. The | |
| | results of the one-time inspection should be used to dictate | |
| | future inspection. System leakage test is conducted prior | |
| | to plant startup following each refueling outage, and | |
| | hydrostatic test at or near the end of each inspection | |
| | interval.(6) Acceptance Criteria: The chemistry | |
| | monitoring program provides specification of chemical | |
| | parameters and acceptable levels. Any relevant conditions | |
| | that may be detected during the leakage and hydrostatic | |
| | tests are evaluated in accordance with acceptance | |
| | standards of IWD-3000 for Class 3 components. (7) | |
| | Corrective Actions: Plant borated water chemistry | |
| | control program specifies the target values for the | |
| | chemistry parameters. Corrective actions are taken if the | |
| | target values are exceeded. Corrective actions of the above | |
| · | one-time inspection are based on the results of the | |

| A3. | SPENT FUEL I | OOL COOLING ANI |) CLEANUP (Pressu | rized Water Re | actor) |
|-----|--------------|-----------------|-------------------|----------------|--------|
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| r | I Charles and | Derting of | T | T Environ | Ading | Ading | T | | | |
|--------------------------|--|--|-------------------------------|---|---------------------|---|--------------------------------|--|--|--|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References | | | |
| | | | | | | - | | | | |
| A3.6.1 thru A3.6.3 | Heat Exchanger | Shell, Nozzles (external surface), Studs and | CS, LAS | Air, leaking Chemically Treated Borated Water | Loss of Material | Boric Acid Corrosion | NRC GL 88-05. | | | |
| A3.7.1 | Ion Exchanger | Nuts Studs and Nuts | CS, LAS | Air, leaking Chemically Treated Borated Water | Loss of Material | Boric Acid Corrosion | NRC GL 88-05. | | | |
| A3.8.1 | Pump | Casing | SS, CS with SS Cladding | Chemically Treated Borated Water | Loss of Material | Pitting and Crevice Corrosion, Cavitation Erosion | 1989 Edition. ASME OM Code- | | | |
| | The pump vent pipe has a history of a few problems. Should it be mentioned explicitly? | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

A4. Spent Fuel Pool Cooling and Cleanup (Boiling Water Reactor)

A4.1 Piping

A4.1.1 Pipe, Fittings and Flanges

A4.2 Valves

A4.2.1 Body and Bonnet

A4.3 Heat Exchanger

A4.3.1 Shell

A4.4 Pump

A4.4.1 Casing

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AUXILIARY SYSTEMS FANIP (Boiling Water Reactor)

| | NG AND CLEANUP (Boiling Water Reactor) | Further Evaluatio |
|--|---|----------------------|
| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluatio |
| Aging Management Pogram (11) | (continued from previous page) | |
| | not 50 and will continue to be adequate for the period of | |
| | lisence renewal (10) Operating Experience: Localized | |
| | corrosion is likely to occur at crevice geometry where | |
| | huildup of impurities can occur. | Yes. |
| the minimizing | The program relies on monitoring | Element 4 |
| he AMP relies on minimizing | a maintaining the chemistry conditions of the offeren | should be |
| ipurities by monitoring and | compared the effects of Diffing and Creview | further |
| aintaining the system water | | evaluated |
| nemistry implemented by plant chnical specifications, and inservice | | evaluatee |
| ispection (ISI) is in conformance with | the second and the second and second and second | |
| SME Section XI (edition specified in 10 | CARINE C 0212 Rev 9 and PPRI guidemics specimee | |
| FR 50.55a), Table IWD 2500-1, test and | 102515 minimize the impurities in the system name | |
| xamination category D-C for systems | Decompters directly related to corrosion, such as | |
| a support of residual heat removal | i the state of ablastice sultate OXVECH, duy | |
| om spent fuel storage pool. | in the second and controlled. Is Full chickers | |
| om spent her storage poor | an and in enected the parameters monitored | |
| | the stand inon discolved conter, cilloriues, dissorted | |
| | and nyurazine. Disserved | |
| | | |
| • | Evamination Calepoly D-D VI Abuild Contract | 1 |
| | La LL TUD 9500.1 regulites VISUAL VI-2 Commundor | |
| | i during anotem leakage test and system nyurostane cost to | |
| | detect the leakage. However, high concentration of | |
| | detect the leakage. However, high example, how could cause impurities at locations having stagnant flow could cause | |
| | pitting and crevice corrosion. (4) Detection of Aging pitting and crevice corrosion. (4) Detection of Aging | |
| · | Effects: Visual examination VT-2 required by IWD 2500-1 | 1 |
| | can detect and identify the leakage, but can not detect pitting and crevice corrosion. Therefore, inspection at | |
| | pitting and crevice corrosion. Includic, inspectively and susceptible locations should be undertaken to ensure that | |
| | susceptible locations should be united to an and significant corrosion is not occurring. 5) Monitoring and | |
| | significant corrosion is not occurring. system water Trending: The frequency of monitoring system water | 1 |
| | LI WEEK LU VILLO W | 1 |
| | chemistry ranges from several time per period provide data for month. The results of monitoring should provide data for | |
| | trending. (6) Acceptance Criteria: The chemistry | |
| | monitoring program provides chemical parameter | 1 |
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| | I and compositive actions If the Succilicu values and | d, |
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| | a mostione program. UA Droceutics, sice rotation | nd |
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| | | le |
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| | euch as at the tubesneet-snei joint, and outer of the | |
| | the shell side of heat exchanger. | |



| | A4. SPENT FU | TEMS TEL POOL COOLI Region of | | Environ- | Aging | A-88 | References |
|---------------|--------------|-------------------------------------|-------------------------------|--|---------------------|--|---|
| Itam | Component | Interest | Material | ment | Effect | Mechanism | ASME Section XI. |
| Item 4.4.1 | Pump | Casing | SS. CS with SS Cladding | Oxygenated Water at Temperatur e up to 51°C | Loss of Material | Pitting and Crevice Corrosion | 1989 Edition. ASME OM Code- 1990, Subsection |
| | | | | (125°F) | | | ISTB. NUREG- 0313 Rev. 2. NRC GL 89-04. Plant Technical Specifications. EPRI TR-103515 |
| | | | | | | | |
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| | T. | HE ANT. BC- MC SOME | SIPHO | Dec | FOR | BUP. | pould |
| | | some | TIMES | a CHE | ee u | efre. | - |
| | | witte | TIMES OF | - her | 2 7 00 | | |
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(Rolling Water Reactor)

B1. Light Load Handling Systems (Related to Refueling)

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

B1.1.1 Structural Girders

B1.2 Rail System

B1.2.1 Frame Cut Holes

B1.2.2 Rail

Jit:

General comments:

Format question: The only difference between the "B1" (Light Load) section and the "B2" (Heavy Load) section is added reference to NUREG-0612 for the "Structural Girders - Loss of Materials" row. Things could be greatly simplified. Too much redundancy.

The following additions should be considered:

Item B1.1.1 <u>Structural Girders</u> (aging effect; cumulative fatigue damage)

The aging mechanism of fatigue in the "Structural Girders" would most likely be manifest in cracking of the truck flanges, truck web and girder web on both sides at each corner of the crane. These would be normal stress points.

Suggest including a visual inspection for cracking in the above areas.

Item B1.1.1 <u>Structural Girders</u> (aging effect; loss of material)

As stated in the "Evaluation and Technical Basis" section, "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." It would appear that all that is needed is the inspection criteria in ASME B30.2 that relates to passive components. The current draft appears to be excessive.

Item B1.2.1 Rail System - Frame Cut Holes (aging effect; cumulative fatigue damage)

I'm not sure why this item is listed. I assume that this item refers to the rail supports. Why not group this item with B1.1.1 under fatigue?

Item B1.2.2 Rail (aging effect; attrition)

The "Evaluation and Technical Basis" section draft also appears to be excessive. The two main areas for consideration should be the alignment of the rails, and the potential for bolts to become loose. Alignment checking and bolt torque checking should resolve most rail problems. The existence of a crane surveillance by the licensee and adequate corrective actions to address any deficiencies, should be sufficient.

Item B2.1.1 <u>Structural Girders</u> (aging effect; cumulative fatigue damage)

Same comment stated for Item B1.1.1.

Item B2.1.1 <u>Structural Girders</u> (aging effect; loss of material)

Same comment stated for Item B1.1.1.

Item B2.2.1 Rail System - Frame Cut Holes (aging effect; cumulative fatigue damage)

Same comment stated for Item B1.2.1.

Item B2.2.2 Rail (aging effect; attrition)

Same comment stated for Item B1.2.2.

B2. Overhead Heavy Load Handling System

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

B2.1.1 Structural Girders

B2.2 Rail System

B2.2.1 Frame Cut Holes

B2.2.2 Rail

C1. Open Cycle Cooling Water System (Service Water system)

- C1.1 Piping
 - C1.1.1 Piping and Fittings
 - C1.1.2 Underground Piping and Fittings
- C1.2 Valves
 - C1.2.1 Body and Bonnet
- C1.3 Heat Exchanger
 - Ċ1.3.1 Shell
 - C1.3.2 Channel
 - C1.3.3 Channel Head
 - C1.3.4 Tube Sheets
 - C1.3.5 Tubes
- C1.4 Flow Orifice
 - C1.4.1 Body
- C1.5 Pump
 - C1.5.1 Casing
- C1.6 Basket Strainer
 - C1.6.1 Body

C1. Open Cycle Cooling Water System (Service Water System)

System, Structures, and Components

The system, structures, and components included in this table comprise the open cycle cooling water system which consists of piping, valves, heat exchangers, pumps, flow orifices, and basket strainers. The system contains raw untreated salt or fresh water. The system removes heat from the closed cycle cooling water system and, in some plants, other auxiliary systems and components such as steam turbine bearing oil coolers, or miscellaneous coolers in the condensate system. The heat is absorbed by the ultimate heat sink such as a cooling pond, cooling tower, river, lake, or sea. This table only addresses the heat exchangers for removing heat from the closed cycle cooling system; heat exchangers for removing heat from the closed cycle cooling system; heat exchangers for removing heat from the closed cycle cooling system; heat exchangers for removing heat from the closed cycle cooling system; heat exchangers for removing heat from the closed of cycle cooling system; heat exchangers for removing heat from the closed of cycle cooling system; heat exchangers for removing heat from other auxiliary systems and components are addressed in their respective systems, such as Table VIII A for steam turbine bearing oil coolers and Table VIII E for condensate system coolers. 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 open cycle cooling water system are classified as Group C Quality Standards.

~ Internals

Pumps and valves are considered to be active components and pump internals and seats, discs, bolting, and other valve items should be covered by the plant maintenance program.

System Interfaces

The systems that interface with the open cycle cooling water system include the closed cycle cooling water system (Table VII C2), ultimate heat sink (Table VII C3), and other miscellaneous auxiliary systems and components.

1 Low flow caritation ? pump casing; IN 89-09 and BL 38-04 Addinas low flow pump cavitation; The Service Water pumps I Subersible pumps at Sasguehana plant have expended Severely contantion-indicated almage ? properings in 1986, The low -flow issue was not adaptedly addressed by all plants. This ling be, in part, due to the lack of a generic guidline for determining the acceptance ? A pump for exercises windline for determining the acceptance ? A pump for exercises windline the Various modes and times reguired in support of both incomel and emergency conditions.

C1. OPEN CYCLE COOLING WATER SYSTEM (Service Water System)

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VII C1-4

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| | C1. OPEN CYCLE COOLING WATER SYSTEM (Service Water System) | | | | | | | | |
|--------|--|--------------------|-------------|------------|----------|---------------|------------------|--|--|
| | Structure and | | 1 | Environ- | Aging | Aging | D.C. | | |
| Item | Component | Interest | Material | ment | Effect | Mechanism | References | | |
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| 21.2.1 | Valves | Body and | | Raw, | Loss of | General, | ASME Section XI, | | |
| | (Check, Hand, | Bonnet | | Untreated | Material | Micro- | 1989 Edition. | | |
| | & Control | (with or | | Salt Water | | | NRC IN 94-03. | | |
| | Valves) | without | | or Fresh | | -Induced, | Plant Technical | | |
| 1 | 1 | Internal | | Water | | Fitting, and | Specifications. | | |
| 1 | 1 | Lining or | fresh water | | | Crevice | GL 89-13. | | |
| | 1 | Coating) | only) | | | Corrosion. | 1 | | |
| | t | . a . de 18 4.4 | | | L | + DE ALLOYING | - | | |
| | | Acuminan | | | | (AB | | | |
| | | ALUMINUM BRONZE | | | | MNNNNIA | | | |
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C1. OPEN CYCLE COOLING WATER SYSTEM (Service Water System)

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C1. OPEN CYCLE COOLING WATER SYSTEM (Service Water System)

| | C1. OPEN CYCLE COOLING WATER SYSTEM (Service Water System) | | | | | | | | |
|--------------------------|--|---|---|--|---------------------|--|--|--|--|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References | | |
| C1.3.1 thru C1.3.5 | Heat Exchanger (between open cycle and closed cycle cooling water systems) | Shell. Channel. Channel Head. Tube Sheet. Tubes | Shell, Channel, Channel Head: Carbon Steel: Tube sheet: | Shell Side: Treated Water: Tube Side: Raw Untreated | Loss of Material | General. Microbio- logically- Influenced. Pitting, and Crevice Corrosion | NRC GL 89-13. Plant Technical Specifications. Operating Experience NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 85-96. | | |
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C2. Closed Cycle Cooling Water System

C2.1 Piping

C2.1.1 Pipe, Fittings, and Flanges

C2.2 Valves (Check, Hand, Control, Relief, and Solenoid Valves)

C2.3.1 Body and Bonnet

C2.3 Pump

C2.3.1 Casing

C2.4 Tank

C2.4.1 Shell

C2.5 Flow Orifice

C2.5.1 Body

C2. Closed Cycle Cooling Water System

System, Structures, and Components

The system, structures, and components included in this table comprise the closed cycle cooling water system which consists of piping, valves, radiation element, temperature element, heat exchangers, pumps, tank, and flow orifices. The system contains chemically treated demineralized water. The closed cycle cooling water system is designed to remove heat from various auxiliary systems and components such as chemical and volume control system, spent fuel cooling system, etc. The open cycle cooling water system (Table VII C1) provides the cooling medium for the heat exchangers of the closed cycle cooling water system which serves as an infermediate barrier between the various supplied auxiliary systems and the open cycle cooling water system. 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 closed cycle cooling water system are classified as Group C Quality Standards.

The AMPs of the heat exchanger between the closed cycle and the open cycle cooling water systems are addressed in the open cycle cooling water system (Table VII C1). The AMPs of the heat exchangers between the closed cycle cooling water system and the interfacing auxiliary systems are included in their respective systems, such as Table VII A.3 for PWR spent fuel cooling water system, Table VII A4 for BWR spent fuel pool cooling and cleanup system, and Table VII E1 for chemical and volume control system.

internals

Pumps and valves are considered to be active components and pump internals and seats, discs, bolting, and other valve items should be covered by the plant maintenance program.

System Interfaces

The systems that interface with the closed cycle cooling water system include the open cycle cooling water system (Table VII C1), PWR spent fuel cooling water system (Table VII A3), BWR spent fuel cooling water system (Table VII A4), chemical and volume control system (Table VII E1), and other miscellaneous auxiliary systems and components.

VII C2-3

| VII AUXILLARY SYS | STEM | S |
|-------------------|------|---|
|-------------------|------|---|

CLOSED CYCLE COOLING WATER SYSTEM C2. Aging Effect Structure and Region of Environ-Aging Item Component Interest Material ment Mechanism References Pipe, Fittings, C2.1.1 Piping Carbon 35°C Local Loss of General. ASME Section XI. Chemically and Flanges Steel (CS) Material Pitting, and 1989 Edition. Treated De-Crevice Plant Technical mineralized Corrosion Specifications. Water piping Carbon NRC INSENG Pipe, F. Trings Chemically 1Vall trosioy the last of Smil 51, 2, 43 5+1 treated Consien NRC IEB37-01 WRC 61239-08 WRC IN 87-36 IN 88-17 Demindul Notes

C3. Ultimate Heat Sink

| C3.1 | Cooling Tov | ver |
|------|-------------|-----|
| | | |

- C3.1.1 Foundation
- C3.1.2 Exterior Concrete Above Grade
- C3.1.3 Exterior Concrete Below Grade
- C3.1.4 Interior Slabs
- C3.1.5 Masonry Block Wall
- C3.1.6 Concrete Surfaces Exposed to Flowing Water
- C3.1.7 Columns
- C3.1.8 Base Plates
- C3.1.9 Beams
- C3.1.10 Trusses
- C3.1.11 Bracings
- C3.2 Piping
 - C3.2.1 Piping and Fittings
- C3.3 Valves (Check, Hand, and Control Valves)
 - C3.3.1 Body and Bonnet
- C3.4 Pump
 - C3.4.1 Casing

C3. Ultimate Heat Sink

System, Structures, and Components

The ultimate heat sink consists of a lake, ocean. river, **spec**y pond, or cooling tower and provides sufficient cooling water for safe reactor shutdown and reactor cooldown via the residual heat removal system or other similar system. Due to the varying configurations of connections to lakes, oceans, and rivers, a plant specific aging management program is required. With respect to spray ponds, the spray modules should be covered by the plant maintenance program, and a plant specific aging management program is also required for the spray pond as an entity. Therefore, this table only addresses cooling towers.

The systems, structures and components included in this table consist of piping, valves, pumps, and concrete and steel components such as concrete walls, slabs, foundation, steel beams, columns, and base plates. The cooling tower contains raw or slightly treated fresh water. The ultimate heat sink absorbs heat from the open cycle cooling water system. The cooling tower is classified as Class 1 structures and other components such as piping and valves as Class 3.

Pumps and valves are considered to be active components and pump internals and seats, discs, and other valve items should be covered by the plant maintenance program.

System Interfaces

The systems that interface with the ultimate heat sink include the open cycled cooling water system (Table VII C1), containment spray system (Table V A), and emergency core cooling systems (Tables V D1 and D2).

Some general comments for consideration as appropriate

Aging management programs as applicable shall be provided for (1) trending deterioration of earthen dams and impoundments, including those that are cement stabilized; (2) trending and projecting silting and the rate of silt deposition since the original data was obtained; (3) trending and projecting meteorological, climatological, and oceanic data since the original data used in the FSAR was obtained, such as rain water run off for ponds and maximum and minimum temperatures, and controlling their affect on the UHS design basis, (4) trending and projecting existing and new equatic flora and fauna concentrations and controlling their affect on the UHS design basis; (5) for plants located on rivers, trending maximum and minimum river stages and their affect on the UHS design basis; and (6) monitoring of aging degradation of all upstream and downstream dams affecting the UHS. When not specifically addressed or defined in USARs, plants shall have a defined and documented UHS design basis as part of their aging management program. 4

D. Compressed Air System

D.1 Piping

D.1.1 Piping and Fittings

D.2 Air Accumulator

- D.2.1 Shell
- D.2.2 Manway

D.2.3 Manway Bolting

D.3 Valves

- D.3.1 Body and Bonnet
- D.4 Filter

D.4.1 Shell

- D.4.2 Manway
- D.4.3 Manway Bolting

D. Compressed Air System

D.1 Piping

> D.1.1 Piping and Fittings

Air Accumulator D.2

- D.2.1 Shell
- D.2.2 Manway

D.2.3 Manway Bolting Check VALVE Diry Valves

D.3

D.3.1 Body and Bonnet

Filter D.4

> D.4.1 Shell

D.4.2 Manway

D.4.3 Manway Bolting D.4.4 Filter medip

Dryer D 5 Columns VAIVES Drying medin (desiccont) D6 Pressure Regulators do Sensors for moisture monitors go? Hal lit where do

Harold Ornstein

VII D-2

D. Compressed Air system

System, Structures, and Components

The system, structures, and components included in this table comprise the compressed air system which consists of piping, valves, air accumulators and filters. The components normally contain very dry air, free of oil, water, and other contaminants. The system components and piping are located in various buildings at most nuclear power plants. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Guality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the compressed air system are classified as Group C Quality Standards.

Valves are considered to be active components and seats, discs, bolting, and other valve items should be covered by the plant maintenance program.

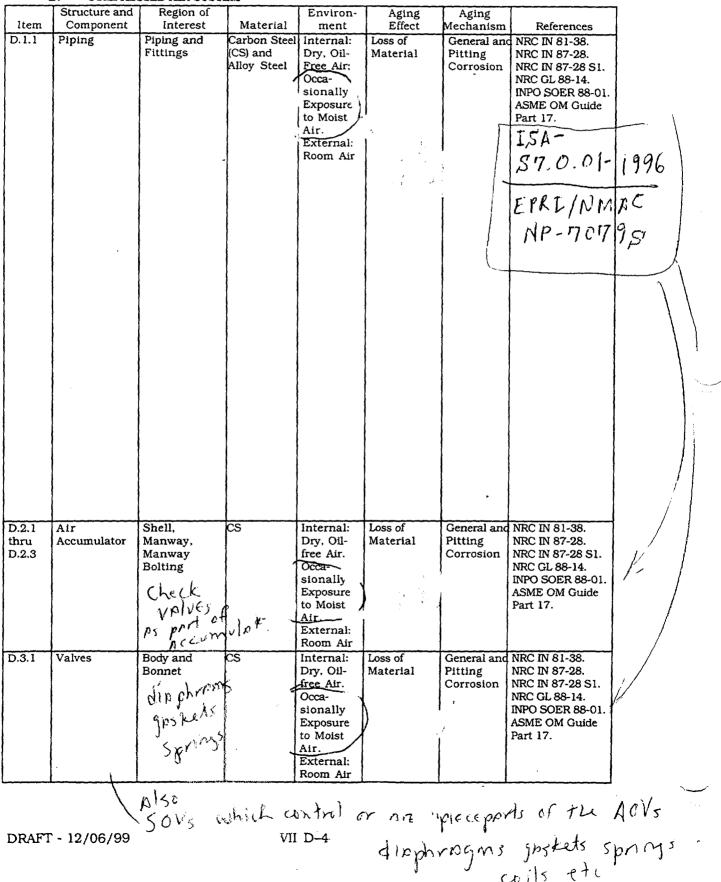
System Interfaces

No other systems contained in this report interface with the compressed air system.

NO - should be Always of the problem. This is the root of the problem

however their and the clean liness and the high quality of the pir must be assured because it Acts as the mostive power for artive (some SAFEtyrelnited) components - which miny . wit function properly because of contaministion VII D-3 from the AUN-SAFEty - Group of Economics

VII AUXILIARY SYSTEMS D. COMPRESSED AIR SYSTEM



AUXILIARY SYSTEMS VII

| | M Evaluation and Technical Basis | untity monitoring |
|---|---|---|
| VII AUXILIARY SYSTEMS | of Million | initicalisu6 |
| VII AUXILIARY SYSTEMS D. COMPRESSED AIR SYSTEM | <u>A</u> | Further D |
| Existing Aging Management Program (AMP) | | |
| The aging management program (AMP). based on NRC Generic Letter (GL) 88-14 and INPO's Significant Operating Experience Report (SOER) 88-01, relies | 1) Scope of Program: The program relies on improved system inspection and maintenance program to manage the effects of corrosion on the intended function of the compressed air system. (2) Preventive Actions: The system air quality is monitored and maintained in | Yes, Element 4 should be further evaluated. |
| on improved system inspections, maintenance, and testing, and generally includes: (1) frequent leak testing of valves, piping, and other system components, especially those made of carbon steel, and (2) preventative maintenance program which checks air quality at several locations in the system to address various aspects of the inonerability of air-operated | accordance with manufacturer's recommendations for individual components served. (3) Parameter Monitored/ Inspected: Based on the guidelines of NRC Generic Letter (GL) 88-14 perform inservice testing to verify proper air q'iality, and that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the air system is maintained. (4) Detection of Aging Effects: Degradation of the piping would become evident by observation of unacceptable | |
| components due to the presence of oil, water, rust, and other contaminants. Corrective actions are taken if any parameters are out of acceptable ranges, such as moisture content in the system air. The ASME Operation and Maintenance (OM) Guide Part 17, Performance Testing of Instrument Air System in Light-Water Reactor Power Plants, February 12, 1999 could be used as guidance for testing of air systems. | leakage rates. However, inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. Based on piping or component geometry and flow conditions, susceptible locations can be identified. (5) Monitoring and Trending: Effects of corrosion are detectable by periodic local leak rate tests that also provide for timely detection of aging effects based on operating experience. (6) Acceptance Criteria The testing results are used to verify that the design and performance of the entire air system is in | |
| But OM-17 But North A Critical Allow Similar All gunlity Similar All gunlity Similar All gunlity Similar Same as the effects of General and Pitting Corrosion on Item D.1.1 piping | 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: Potentially significant problems pertaining to air systems have been documented in NRC Information Notices (INs) 87-28 and 87-28 S1. Some of the systems that have been significantly degraded or have failed include decay heat removal, auxiliary feedwater, main steam isolation, containment isolation, and fuel pool seal system. | s |
| Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings. | Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings. | Yes, Element 4 should be further evaluated. |
| Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings. | Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings. | Yes, Element 4 should be further evaluated. |
| 5' | 7. 0.01-1996 préscribe VII D-5 DRAFT. | 'S Air gur - 12/06/99 |

| 1 | D. COMPRES | SED AIR SYSTE | 141 141 | Environ- | Aging | Aging | | |
|--------------------------------|---------------------|-----------------------|------------|---|---------------------|----------------------|---|------|
| | Structure and | Region of Interest | Material | ment | Effect | Mechanism | References NRC IN 81-38. | 1 |
| Item D.4.1 thru D.4.3 | Component Filter | | cs | Internal: Normally Dry, Oil- free Air. Occa- sionally Exposure to Moist Air. External: Room Air | Loss of Material | Pitting Corrosion | NRC IN 87-28. NRC IN 87-28 S1. NRC GL 88-14. INPO SOER 88-01. ASME OM Guide Part 17. | 0.01 |

Dryers - Critical for operation of Dir system Pressure (Regulators)

| Existing Aging Management Program (AMP) | Evaluation and Technical Basis | Further Evaluation |
|---|--|---|
| Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings. | Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings. | Yes, Element 4 should be further evaluated. |

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E1. Chemical and Volume Control System (Pressurized Water Reactor)

- E1.1 Piping (1500 psig rating)
 - E1.1.1 Pipe, Fittings and Flanges
 - E1.1.2 Stud and Nuts
- E1.2 Piping (150 psig rating)
 - E1.2.1 Pipe, Fittings and Flanges
 - E1.2.2 Studs and Nuts
- E1.3 High-Pressure Valve
 - E1.3.1 Body and Bonnet
 - E1.3.2 Studs and Nuts
- E1.4 Low-Pressure Valve
 - E1.4.1 Body and Bonnet
 - E1.4.2 Studs and Nuts
- E1.5 High-Pressure Pump
 - E1.5.1 Casing
 - E1.5.2 Closure Bolting
- E1.6 Low-Pressure Pump

E1.6.1 Casing

- E1.6.2 Closure Bolting
- E1.7 Letdown Heat Exchanger
 - E1.7.1 Tube/Tubesheet
 - E1.7.2 Studs and Nuts
 - E1.7.3 Channel/Cover
 - E1.7.4 Channel/Welds

- E1.8 Regenerator Heat Exchanger
 - E1.8.1 Tube/Tubesheet
 - E1.8.2 Studs and Nuts
 - E1.8.3 Channel/Cover
 - E1.8.4 Channel/Welds
 - E1.8.5 Shell
- E1.9 Basket Strainers
 - E1.9.1 Studs and Nuts
- E1.10 Tank
 - E1.10.1 Studs and Nuts
 - E1.10.2 Shell
 - E1.10.3 Manway
 - E1.10.4 Penetrations/Nozzles

E2. Standby Liquid Control System (Boiling Water Reactor)

E2.1 Piping

- E2.2 Solution Storage Tank
- E2.3 Solution Storage Tank Heaters
- E2.4 Pump Suction Valves
- E2.5 Injection Pumps
- E2.6 Relief Valves
- E2.7 Injection Valves
- E2.8 Containment Isolation Valves
- E2.9 Injection Sparger
- E2.10 Pump Suction Valves

E2. Standby Liquid Control System (Boiling Water Reactor)

E2.1 Piping

E2.2 Solution Storage Tank

E2.3 Solution Storage Tank Heaters

E2.4 Pump Suction Valves

E2.5 Injection Pumps

E2.6 Relief Valves

E2.7 Injection Valves

E2.8 Containment Isolation Valves

E2.9 Injection Sparger

E2.10 Pump Suction Valves

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7. This Subscition is a duplication of Subscition E 2.4.

E2. Standby Liquid Control System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the standby liquid control system, which serves as a backup reactivity control system in all boiling water reactors (BWRs) in the U.S. The major components of this system are the piping, solution storage tank, solution storage tank heaters, pump suction valves, injection pumps, relief valves, injection valves, containment isolation valves, injection sparger, and **pump-suction -valves**. All of these components operate in contact with a Na pentaborate solution and are fabricated of austenitic stainless steel. Based on U.S. 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 standby liquid control system are classified as Group B Quality Standards.

Pumps and valves are considered to be active components; seats, discs, and other valve and pump internals should be covered by the plant maintenance program.

System Interfaces

The system that interfaces with the standby liquid control system is the BWR reactor pressure vessel (Table IV.A1). If used, the standby liquid control system would inject sodium pentaborate solution into the pressure vessel near the bottom of the reactor core.

E3. Reactor Water Cleanup System

- E3.1 Piping
 - E3.1.1 Pipe and Fittings (beyond isolation valves)
- E3.2 Recirculation Pump
 - E3.2.1 Bowl/Casing
 - E3.2.2 Cover.
 - E3.2.3 Seal Flange
 - E3.2.4 Closure Bolting
- E3.3 Valves (Quality Group A)
 - E3.3.1 Body
 - E3.3.2 Bonnet
 - E3.3.3 Seal Flange
 - E3.3.4 Closure Bolting
- E3.4 Regenerative Heat Exchanger
 - E3.4.1 Tubing
 - E3.4.2 Shell
- E3.5 Non-Regenerative Heat Exchanger
 - E3.5.1 Tubing
 - E3.5.2 Shell
- E3.6 Filter/Demineralizer
 - E3.6.1 Internals

| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References | |
|--------|---|-----------------------|------------------------------|---|--------------------------------------|--------------------|---|----------------|
| E3.4.1 | Regenerative Heat Exchanger | Tubing | SS | Oxygenat ed water at 288°C. And 10 MPa max. | Crack Initiation and Growth | SCC, IGSCC | NRC GL 88-01 NRC GL 88-01, S1 | Cor W de |
| E3.4.1 | Regenerative Heat Exchanger | Tubing | SS | Oxygenat ed water at 288°C. And 10 MPa max. | | MIC | | Ade |
| E3.4.2 | Regenerative Heat Exchanger | Shell | HSLAS with SS cladding | Oxygenat ed water at 288°C. And 10 MPa max. | Crack Initiation and Growth | SCC, IGSCC | NUREG-0313 Rev. 2 NRC GL 88-01 NRC GL 88-01, S1 NRC IN 90-29 | |
| E3.4.2 | Regenerative Heat Exchanger | Shell | HSLAS with SS cladding | Oxygenat ed water at 288°C. And 10 MPa max. | | MIC | | |
| E3.5.1 | Non- Regenerative Heat Exchanger | Tubing | SS | Oxygenat ed water at 288°C. And 10 MPa max. | | міс | | |
| E3.5.2 | Non- Regenerative Heat Exchanger | Shell | HSLAS with SS cladding | Oxygenat ed water at 288°C. And 10 MPa max. | | MIC | | |

AUXILIARY SYSTEMS VII REACTOR WATER CLEANUP SYSTEM (Item E3.4.2 continued) E3. Addition Evaluation **Evaluation and Technical Basis** Aging Management Program into ... (4) Detection of Aging Effects: Governed by plant-... ... specific aging management program. {Address MIC and text sediment} ...

Additions to VII E3-12 and VII E3-14

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VII

AUXILIARY SYSTEMS

AUXILIARY SYSTEMS VII

A

| Existing | - I is and Tested Pasia | Further Evaluation |
|--|--|---|
| Aging Management Program (AMP) Same as the effect of stress relaxation | Evaluation and Technical Basis Same as the effect of wear on Item C1.2.4 Closure Bolting | No |
| on Item E3.2 Closure Bolting for Recirculation Pump. | for Recirculation Pump. | |
| | | |
| Components have been designed or evaluated for fatigue for a 40 y design ife, according to the requirements of ASME Section III (edition specified in IO CFR 50.55a), Subsection NB, or ANSI 331.1, or other evaluations based on cumulative usage factor (CUF). | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Same as the effect of stress corrosion cracking on Item E3.1: Piping and Pittings beyond second Isolation Valve. | Same as the effect of stress corrosion cracking on Item E3.1: Piping and Fittings beyond second Isolation Value. | Yes. Elements 3 through 7 should be further evaluated |
| Components have been designed or evaluated for fatigue for a 40 y design ife, according to the requirements of ASME Section III (edition specified in IO CFR 50.55a), Subsection NB, or ANSI 331.1, or other evaluations based on cumulative usage factor (CUF). | Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. | Yes TLAA |
| Materials selection in accordance with Audelines of NUREG-0313, Rev. 2 and equirements of Regulatory Guide 1.43 or the control of stainless steel ladding of low-alloy steels. Inservice nspection governed by plant-specific ging management program. | (1) Scope of Program: The program is focused on managing the effects of SCC of SS cladding on the intended function of the heat exchanger vessel. NUREG-0313 and GL 88-01. respectively. describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. (2) Preventive Actions: Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of austenitic SSs and weld metal, with a maximum carbon of 0.035% and minimum 7.5% ferrite in weld metal. Furthermore, hydrogen water chemistry and stringent control of conductivity is used to inhibit IGSCC. (3) Parameters Monitored/Inspected: Governed by plant-specific aging management program. (4) Detection of Aging Effects: Governed by plant-specific aging management program. (5) Monitoring and Trending: Governed by plant-specific aging management program. (6) Acceptance Criteria: Governed by plant-specific aging management program. (7) Corrective Actions: Governed by plant-specific aging management program. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and administrative controls are | Yes. Elements 3 through 7 should be further evaluated - INSERT INFORMAT TO ADDRE M.I. C. MM GEDIMEN |
| · · · · · | approval processes, and ance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. | |

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VII AUXILIARY SYSTEMS E3. REACTOR WATER CLEANUP SYSTEM

| | 1 | E3. REACTOR | WATER CLEAN | NUP SYSTEM | | | | | |
|---|-------------------|---|-------------|------------------------------|---|---|------------------------------|-------------------------------------|---|
| | | Structure and | Region of | | Environ- | Aging | Aging | References | |
| | Item | Component | Interest | Material | ment | Effect | Mechanism | References | |
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| | | | | | Orregeneted | Cumulative | Fatigue | ASME Section III, | |
| | E3.4.2 | Regenerative | Shell | ss | Oxygenated water at | Fatigue | Lungue | 1989 Edition. | |
| | | Heat | | | 288°C and | Damage | | ANSI B31.1. | |
| | | Exchanger | | | 10 MPa | Dunigo | | GSI-190. | |
| | | | • | | max. | | | | |
| | | | | | index. | | | | |
| | | | | | | | | | |
| 1 | | l ₄ | L | 1 | | | I | | |
| .v.A | E3.4.2 | Regenerative | Shell | . HSLAS | Oxygenated | | MIC | | \downarrow · \backslash |
| INTO' | | Heat Exchanger | | with SS | water at | | | | |
| | | | | cladding | 288°C, And | | | | |
| \sim | | | | | 10 MPa | | | | |
|) | | | | | max. | | | | |
| 7 | E8.5.1 | Non- | Tubing | SS | Oxygenated | Cumulative | Fatigue | ASME Section III, | () () () () () () () () () () |
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | -20.0.1 | Regenerative | 1 40-45 | | water at | Fatigue | | 1989 Edition. | يرجع يندو ي |
| | | Heat | | | 288°C and | Damage | | ANSI B31.1. | |
| | | Exchanger | | ł | 10 MPa | | | GSI-190. | |
| | | 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - | | | max. | | | | |
| | | | | | | | | | |
| | | | | | | ······································ | ļ | | 1 |
| | | | Tables | SS | Oxygenated | | MIC | | |
| In CAT | E3.5.1 | Non- | Tubing | 33 | water at | | | | |
| MERI | | Regenerative | | | 288°C. And | | | | |
| IN JE | | Heat Exchanger | | | 10 MPa | | | | |
| \backslash | | | | | max. | | | | |
| <u> </u> | | | | | 1 | | The block | ASME Section III, | |
| | E3.5.2 | Non- | Shell | SS | Oxygenated | Cumulative | Fatigue | 1989 Edition. | |
| | | Regenerative | | | water at | Fatigue | | ANSI B31.1. | |
| | | Heat | | | 188°C and | Damage | | GSI-190. | |
| | | Exchanger | | | 1 MPa max. | | | | |
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| 1 | | | | | | 19 ²⁰ a | E Baran | | |
| | | Astron T | | | | | and the second second second | approximation and the second second | |
| | | | | | | | MIC | | |
| 1 | ्र २ - २३ क्ला | | | | Charles and the second | | | | I N |
| hi con | | Non- | Shell | HSLAS | Oxygenated | | MIC | | |
| IN SERT | ्र २ - २३ क्ला | Non- Regenerative | | with SS | water at | а, стород сто Стород стород br>Стород стород | MIC | | |
| INSERT | ्र २ - २३ क्ला | Non- | | HSLAS with SS cladding | water at 288°C. And | | MAC | | |
| INSERT | ्र २ - २३ क्ला | Non- Regenerative | | with SS | water at 288°C. And 10 MPa | | MIC | | |
| INSERT | ्र २ - २३ क्ला | Non- Regenerative | | with SS | water at 288°C. And | | MIC | | |
| INISERT | ्र २ - २३ क्ला | Non- Regenerative | | with SS | water at 288°C. And 10 MPa | | MIC | | |

E4. Coolant Storage/Refueling Water Cleanup System

- E4.1 Refueling Water Tank (RWT) Heating
 - E4.1.1 Piping and Fittings
- E4.2 RWT Circulation Pump
 - E4.2.1 Bowl/Casing
 - E4.2.2 Bolting

E4.3 Valves

E4.3.1 Body

- E4.4 Heat Exchanger (RWT Heating)
 - E4.4.1 Bonnet or Cover
 - E4.4.2 Tubing
 - E4.4.3 Shell
- E4.5 Refueling Water Tank
 - E4.5.1 Shell
 - E4.5.2 Manhole
 - E4.5.3 Penetrations/Nozzles
 - E4.5.4 Tank Heating Coil
 - E4.5.5 Manhole Bolting
 - E4.5.6 Perimeter Seal

AUXILIARY SYSTEMS VII

| Existing | | Further | |
|---------------------------------------|--|-------------------------------|--|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluation | J |
| | (continued from previous page) | . 1 | |
| | for the period of license renewal. (10) Operating | . | J |
| | Experience: Localized corrosion is likely to occur at | . | 1 |
| | crevice geometry where buildup of impurities can occur. | . | 1 |
| | The potential exists for introduction of impurities into the | i | |
| | coolant system as contaminants in the boric acid or | 1 | i |
| | introduced through the free surface of spent fuel pool (IN | 1 | i - |
| 1 | 84-18), or from ingress of demineralizer resins (IN 96-11). | 1) | |
| | Corrosion has been observed in safety injection systems, | | res |
| ļ | e.g., guide rings of relief valves (IN 98-23) and charging | \sim | ۔ ب |
| | pump casing (IN 94-63). | | I |
| plementation of NRC Generic Letter | | No) | · · · · · · · · · · · · · · · · · · · |
| -05 and, based on plant | (GL) 88-05 provides assurances that a program has been | | 44-13 |
| ecifications, inservice inspection in | implemented consisting of measures to ensure that the | \mathcal{M} | 4m |
| nformance with ASME Section XI | effects of corrosion caused by leaking coolant containing | TH | 1 |
| lition specified in 10 CFR 50.55a), | boric acid does not lead to degradation and provides | 1 m YI | <u> </u> |
| ble IWD 2500-1, test and examination | assurance that the reactor coolant pressure boundary will | 1 (17) | M () |
| tegory D-B for systems in support of | have a extremely low probability of abnormal leakage. | 1001 | yo . |
| nergency core cooling, containment | rapidly propagating failure, or gross rupture. The program | 1 Yos! | · (|
| at removal, atmosphere cleanup, and | includes (a) determination of principal location, | 1 | - New |
| actor residual heat removal. | (b) examinations requirements and procedures for | cites | n V |
| | locating small leaks, and (c) engineering evaluations and | 1 | / - |
| | corrective actions. (2) Preventive Actions: Minimizing | 1 100 | 1 . |
| | reactor coolant leakage by frequent monitoring of the | 1 M 1 | 1 Auro |
| | locations where potential leakage could occur and | 1 1 : | 71- |
| | renairing the leaky components as soon as possible, | white is | 1 |
| | prevent or mitigate boric acid corrosion. (3) Parameters | | 1 '~ |
| <u>.</u> | Monitored/Inspected: The AMP monitors the effects of | | NW. |
| - | boric acid corrosion on the intended function of the | <u>۷۷.</u> آ | 1 |
| | component by detection of coolant leakage by inservice | ~~ | 121 |
| | inspection (ISI). Inspection requirements of ASME | I ANT N | <u>, </u> |
| | Section XI specify visual VT-2 (IWA-5240) examination | N. N. | 1 st. |
| | during system leakage test and system hydrostatic test of | ev | Swr. |
| | Class 3 components in support of emergency core cooling, | | PG |
| | containment heat removal, and reactor residual heat | | 1 |
| | removal, according to Table IWD 2500-1 category D-B. | 1 | 1 |
| | (4) Detection of Aging Effects: Extent and irequency of | | |
| | inspection appear to be adequate to detect aging effects. | + welker | t evalu |
| | (5) Monitoring and Trending: System leakage test under | | A |
| | Section XI is conducted at ≈ 40 -month intervals. | Firsther Should condite | A esial. |
| | (6) Acceptance Criteria: Any relevant conditions that may | ľ, | - new |
| | be detected during the leakage and hydrostatic tests are | 10- Dit | 1 -1 |
| | | Conduc | pus Tha |
| | components. (7) Corrective Actions: Repair and | Can la Darie Waste | |
| | replacement are in conformance with IWA-4000 and IWB- | Can X | and to |
| | 4000. (8 & 9) Confirmation Process and Administrative | L | • |
| | Controls: Site QA procedures, review and approval | Darie | aud |
| | processes, and administrative controls are implemented | 1 | |
| | in accordance with requirements of Appendix B to 10 CFR | lugato | an |
| | Part 50 and will continue to be adequate for the period of | | He. |
| | license renewal. It i Operating Experience. Done and | | ſ |
| | wastage observed in nuclear power plants may be | | |
| | classified into two distinct types: (a) corrosion that | 1 | |
| | increases the rate of leakage, e.g., corrosion of closure | | |
| | bolting or fasteners in reactor coolant pressure boundary. | | |
| | and (b) corrosion that occurs some distance from the | | |
| | source of leakage. Some recent incidents of | | |

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vn AUXILIARY SYSTEMS

| | Structure and | Region of | 1 | Environ- | Aging | Aging | |
|--------|-------------------------|-----------|-------------|--------------------|----------|-------------|------------------------------------|
| Item | Component | Interest | Material | ment | Effect | Mechanism | References |
| | | [| | | | | |
| | 1 | | | | | | 1 |
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| | ł | | ł |] | 1 | | |
| E4.3.1 | Valves | Body and | SS, | Up to 65°C | Loss of | Crevice and | ASME Section X |
| • | (Check Valves. | Bonnet | CS with SS | Chemically | Material | Pitting | 1989 Edition. |
| | Control Valves, Hand | | Cladding | Treated Borated | | Corrosion | NRC IN 84-18. NRC IN 94-63. |
| | Valves) | | | Water | | | NRC IN 96-11. |
| | | | | | | | NRC IN 98-23. |
| | | | | | | | Plant Technical Specifications. |
| | | | | | | | EPRI TR 102134 |
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| | | IF THE IS Further Evaluation | 15 |
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| | | x, 200 | 1.14 |
| | / / | 710 | THEN |
| | / | 15 | - <u>n</u> |
| AUXILIARY SYSTEMS | (Descaurized Water System) | 14 | Nº ~ |
| E4. COOLANT STORAGE/REF | UELING WATER SYSTEM (Pressurized Water System) | Further | .40 |
| Existing | Evaluation and Technical Basis | Evaluation | Nr- |
| Aging Management Program (AMP) | | F | NOR NERD FOR FURTHE FURTHE GURUP |
| | (continued from previous page) boric acid wastage (IN 86-108 S3) at Calvert Cliffs Unit 1 | | all all |
| | (Feb. 1004) and Three Mile Island Unit I (March 1994) | K . I | 15.075 |
| | indicate that although implementation of GL 88-00. | $() \rightarrow ()$ | I CULL . |
| | ansures timely detection of leakage, there may still be a |] | الريد آ |
| | lack of awareness of the conditions that can lead to boric | ν i | 1 |
| · | acid wastage. | [| 1 7- |
| The AMP relies on monitoring and | (1) Scope of Program: The program relies on preventive | Yes | |
| naintaining water chemistry in | measures to mitigate crevice or pitting corrosion and | Elements 4 | Devis |
| cordance with the guidelines of EPRI | combination of inservice inspection (ISI) to monitor the | and 5 should be | 10. |
| R 102134 and implemented by the | effects of corrosion on the intended function of the | further | |
| plant technical specifications; inservice | components. (2) Preventive Actions: Control of halogens | evaluated | |
| nspection in conformance with ASME | and oxygen in the primary water to less than 5 and | | l |
| Section XI (edition specified in 10 CFR | 0.01 ppm, respectively. during operation, and monitor and control of water chemistry during shut down. However, | 1 | |
| 50,55a), Table IWB 2500-1, test and | preventive actions are considered inadequate because of | 1 . ' | |
| examination category D-B for systems | inadvertent introduction of contaminants into the | l · | |
| n support of emergency core cooling. | account system either due to unacceptable levels of | 1 | |
| containment heat removal, atmosphere cleanup, and reactor residual heat | l contominants in the boric acid, or introduced through the | | ľ |
| removal. | free surface of spent fuel pool which can be a natural | | |
| removal. | a solucitor of airborne contaminants INRU miormation | | |
| | Notice (IN) 84-18. (3) Parameters Monitorea/ Inspecteu: | | |
| | The AMP monitors the effects of corrosion by ISI to detect coolant leakage. Inspection requirements of ASME | l | |
| | I Section XI Table IWD 2500-1, category D-B, specify visual | | |
| | VT-2 (WA-5240) examination during system leakage and | | |
| - 3 | hudrostatic test of all pressure retaining Class 3 | | |
| | acomponents (4) Detection of Aging Effects: Degradation of | 4 | |
| | the component due to crevice and Ditting corrosion califior | · | |
| | accur without leakage of coolant. However, extent and | | |
| | frequency of inspection may be inadequate; inspection of | | |
| | representative components and susceptible locations should be undertaken to provide additional assurance that | t | |
| | significant degradation is not occurring. Based on piping/ | 7 | |
| | a component geometry and fluid flow conditions, | | |
| | augustible locations can be identified and evaluated. | | |
| | (5) Monitoring and Trending: System leakage test unuer | | |
| | I Continue VI is conducted at ≈ 40 -month intervals. However, | .f | |
| | this may not be sufficiently frequent to detect the effects of this ARD, and a supplemental inspection program may be | • | |
| | and (6) Acceptance Criteria: Any relevant conditions | | |
| | hat may be detected during the leakage and nyurustauc | 1 | |
| | tests are grainated in accordance with IWD-3000 for Class | 4 | |
| | 2 components (7) Corrective Actions: Prior to service, | | |
| | a corrective measures are needed to meet the requirements | _ | |
| | of BWA-5250 Repair and replacement are in conformatice | ⁷ | 1 |
| 5 | with IWA-4000 and IWB-4000. (8 & 9) Confirmation Process and Administrative Controls: Site QA procedures | s. | |
| | Process and Administrative Controls. One get process | | |
| l I | antrois are implemented in accordance with | | 1 |
| | and will a service of Annendix B to 10 CFR Part 50 and will | | |
| | a sentious to be adequate for the period of license relieval. | | |
| | | 0 | 1 |
| | (10) Operating Experience: Localized corrosion is likely a | 7 | • |
| | (10) Operating Experience: Localized corrosion is likely to | A 1 | |
| | (10) Operating Experience: Localized corrosion is likely a | A 1 | |

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VII AUXILIARY SYSTEMS

| 1 | | STORAGE/REP | UELING WAT | the second s | | | |
|----------------|----------------------------|-----------------------|--------------------------|--|-----------------|----------------------|--------------------------------|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| | Component | merest | Matchiai | | Bilect | Meenamon | References |
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| E4.4.1 | Heat | Bonnet or | Bonnet/ | Chemically | | | ASME Section XI. |
| thru E4.4.3 | Exchanger (if used) | Cover, | Cover & | Treated | Material | Pitting Corrosion | 1989 Edition. NRC IN 84-18. |
| £4.4.3 | (RWT Heating) | Tubing, | Fubing: SS, Shell: CS | Borated Water; and | | Corrosion | NRC IN 04-10. |
| | (ICW I IICading) | onen | | Chemically | | } | |
| | | | | Treated | | 1 ! | |
| | | | ſ | Heating | | l . | |
| | | |] | Water | | | |
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| E4.4.3, | Heat | Shell | Shell: CS, | Air, | Loss of | Corrosion/ | NRC GL 88-05. |
| E4.4.3, | Exchanger | | Nuts: CS, | Leaking | Material | Boric Acid | ASME Section XI. |
| | (if used) | | Bolts/Studs: | Chemically | | Wastage of | 1989 Edition. |
| | (RWT Heating) | | Alloy Steel | Treated | | External | NRC IN 86-108 S3. |
| | 5 | Ĩ | ÷ | Borated | | Surfaces | |
| 1 | | | 1 | Water | 1 | [| |

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VII AUXILIARY SYSTEMS

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E4. COOLANT STORAGE/REFUELING WATER SYSTEM (Pressurized Water System)

| Existing | | Further |
|--|---|-----------|
| Aging Management Program (AMP) | Evaluation and Technical Basis | Evaluatio |
| The applicable AMP relies on material | (1) Scope of Program: The program includes preventive | Yes |
| selection guidelines of Regulatory Guide | measures to mitigate stress corrosion cracking (SCC) of | Elements |
| (RG) 1.44 to avoid sensitization of | stainless steel (SS) and inservice inspection (ISI) to | and 5 |
| stainless steels, monitoring and | monitor the effects of SCC on the intended function of the | should be |
| maintaining water chemistry in | component. (2) Preventive Actions: Selection of material | further |
| accordance with the guidelines of EPRI | in compliance with the requirements of Regulatory Guide | evaluated |
| TR 102134 and implemented by the | (RG) 1.44 prevents or mitigates SCC. Control of halogens | |
| plant technical specifications, and | and oxygen in the primary water to less than 5 and | |
| inservice inspection is in conformance with ASME Section XI (edition specified | 0.01 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate | |
| in 10 CFR 50.55a), Table IWD 2500-1, | potential of SCC. However, preventive actions are | |
| test and examination category C-H for | considered inadequate because of inadvertent | |
| pressure retaining Class 2 components. | introduction of contaminants into the coolant system | |
| | either due to unacceptable levels of contaminants in the | |
| | boric acid, or introduced through the free surface of spent | |
| | fuel pool which can be a natural collector of airborne | |
| | contaminants [NRC Information Notice (IN) 84-18]. | |
| | (3) Parameters Monitored/ Inspected: The AMP monitors | |
| | the effects of SCC on intended function of the component | |
| | by detecting leakage by ISI. Inspection requirements of | |
| | ASME Section XI Table IWD 2500-1 category C-H specify | |
| | visual VT-2 (IWA-5240) examination during system | |
| | leakage test and system hydrostatic test of all pressure | |
| | retaining Class 2 components. (4) Detection of Aging | |
| | Effects: Degradation of the component due to SCC cannot | |
| | occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of | |
| | representative components and susceptible locations | |
| | should be undertaken to provide additional assurance that | |
| | significant SCC is not occurring. Based on | |
| | piping/component geometry and fluid flow conditions. | |
| | susceptible locations can be identified and evaluated. | |
| | (5) Monitoring and Trending: System leakage test under | |
| | Section XI is conducted at =40-month intervals. However, | |
| | this may not be sufficiently frequent to detect the effects of | |
| | this ARD, and a supplemental inspection program may be | |
| | needed. (6) Acceptance Criteria: Any relevant conditions | |
| | that may be detected during the leakage and hydrostatic | |
| | tests are evaluated in accordance with IWC-3516. | |
| | (7) Corrective Actions: Repair and replacement are in | |
| | conformance with IWA-4000 and IWB-4000. (8 & 9) | |
| | Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes, and | |
| | administrative controls are implemented in accordance | |
| | with requirements of Appendix B to 10 CFR Part 50 and | |
| | will continue to be adequate for the period of license | |
| | renewal. (10) Operating Experience: Although the primary | |
| | pressure boundary piping of PWRs have generally not been | |
| | found to be affected by SCC because of low dissolved | |
| | oxygen levels and control of primary water chemistry. | |
| | significant potential of SCC exists from inadvertent | |
| | introduction of contaminants into the primary coolant | |
| | system (IN 84-18). SCC has been observed in safety | |
| | injection lines (IN 97-19 and 84-18), charging pump casing | |
| | cladding (INs 80-38 and 94-63). internal bolting in swing | |
| | check valves (IN 89-02), and instrument nozzles in safety | |
| | injection tanks (IN 91-05). | |

VII AUXILIARY SYSTEMS

COOLANT STORAGE/REFUELING WATER SYSTEM (Pressurized Water System) **E4** Structure and Region of Environ-Aging Aging Component Interest Material Effect Mechanism References Item ment E4.5.4 Refueling Heating Coil **SS** Chemically Loss of Crevice and ASME Section XI. Water Tank Treated Material Pitting 1989 Edition. (RWT) Corrosion Borated Water: and Chemically Treated Heating Water E4.5.5 Refueling Manhole Nuts: CS. Air, Loss of Corrosion/ NRC GL 88-05. Water Tank Bolting Bolts/Studs: Material Boric Acid ASME Section XI, Leaking (RWT) Alloy Steel Chemically Wastage of 1989 Edition. Treated External NRC IN 86-108 S3. Borated Surfaces Water Refueling Cold Plastic Loss of Weathering E4.5.6 Perimeter Seal Air Water Tank Coal Tar elasticity (RWT) Pitch (drying out) Flashing moster?? we reall caro If im portant (i.e. vanhein If im portant (i.e. vanhein allow moisture genetration to undenside of RWT to undenside of RWT which in turn sets which in turn sets be advergent to IESCE doesn't this static attention MWS,

E5. Shutdown Cooling System (Older BWR)

- E5.1 Piping
 - E5.1.1 Piping and Fittings
 - E5.1.2 Bolting
- E5.2 Pump
 - E5.2.1 Bowl/Casing
 - E5.2.2 Bolting
- E5.3 Valves
 - E5.3.1 Body and Bonnet
 - E5.3.2 Bolting
- E5.4 Heat Exchanger
 - E5.4.1 Tubes
 - E5.4.2 Tubesheet
 - E5.4.3 Channel and Head
 - E5.4.4 Shell
 - E5.4.5 Bolting

AUXILIARY SYSTEMS VII

| E5. SHUTDOWN COOLING SYS | STEM (Old Boiling Water Reactor) | Eusther | |
|--|---|--|---|
| Existing | | Further Evaluation | |
| Aging Management Program (AMP) | Evaluation and Technical Basis | Dididation | |
| | (continued from previous page) evaluated in accordance with IWC-3100 and acceptance | | |
| | standards of IWC-3400 and IWC-3516 for Class 2 | | |
| | components. (7) Corrective Actions: Prior to service, | | |
| | corrective measures are needed to meet the requirements | | |
| | of IWB-3142 and IWA-5250. Repair and replacement are in | | |
| | conformance with IWA-4000. (8 & 9) Confirmation | | |
| | Process and Administrative Controls: Site QA procedures, | | |
| | review and approval processes, and administrative | | |
| | controls are implemented in accordance with | | |
| - | requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. | | |
| | (10) Operating Experience: Localized corrosion is likely to | | 0 |
| | occur at crevice geometry where buildup of impurities can | Datat | |
| | occur. | | |
| | correction scale buildup has been and a state of the | a transfer and a second s | |
| | | | |
| Guidelines of NUREG-0313, Rev. 2 and | (1) Scope of Program: The program includes preventive | No | |
| NRC Generic letter (GL) 88-01 and its | measures to mitigate stress corrosion cracking (SCC) of | | |
| Supplement 1; and based on plant | stainless steel (SS) and inservice inspection (ISI) to | | |
| technical specifications, inservice | monitor the effects of SCC on intended function of the | | |
| inspection in conformance with ASME | valves. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the | | |
| Section XI (edition specified in 10 CFR | problem of IGSCC in BWRs. (2) Preventive Actions: | | |
| 50.55a), Table IWC 2500-1, examination | Mitigation of IGSCC is by selection of material considered | 1 | |
| category C-G for pressure retaining welds in Class 2 valves and testing | resistant to sensitization and IGSCC, e.g., low-carbon | | |
| category C-H for system leakage. Water | grades of cast SSs and weld metal, with a maximum | | |
| chemistry is monitored and maintained | carbon of 0.035% and minimum 7.5% ferrite. Water | | |
| in accordance with EPRI guidelines in | chemistry is monitored and maintained in accordance | | |
| BWRVIP-29 and TR-103515 to minimize | with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and growth. | | |
| the potential of crack initiation and | Also, hydrogen water chemistry and stringent control of | | |
| growth. | conductivity is used to inhibit IGSCC. (3) Parameters | | |
| | Monitored/Inspected: The AMP monitors the effects of | | |
| | SCC on intended function of the values by detection and | | |
| | sizing of cracks by ISI. Inspection requirements of Table | | |
| | TWC 2500-1 for Class 2 valves, category C-G specifies for all | | |
| | valves in each piping run examined under category C-F-1. surface examination of either the inside or outside surface | | |
| | of all welds extending 1/2 in. on either side of the weld. In | | |
| | a group of multiple valves of similar design, size, function, | | |
| | and service in a system, examination of only one valve is | | |
| | required (4) Detection of Aging Effects: Degradation of | | |
| | where due to SCC can not occur without crack initiation | | |
| | or degradation of nump performance: ISI schedule assures | | |
| | detection of cracks or degradation of valve performance | | |
| | before the loss of intended function of the valves. | | |
| | (5) Monitoring and Trending: Inspection schedule in accordance with IWC-2400 should provide timely | | |
| | detection of cracks. All welds are inspected each | | |
| | increation period from at least one valve in each group | | |
| | with similar design and performing similar functions in | | |
| | the system. Visual examination is required only when the | | |
| | valve is disassembled for maintenance, repair, or | | |
| | volumetric examination, but at least once during the | | |
| | | | |

| Л | AUXILIARY | SYSTEMS |
|---|-----------|---------|
|---|-----------|---------|

| Γ | Item | 5. SHUTDOW Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References | |
|---------------|---------------------------------|--|--|---|---|-----------------|--------------------|---|--|
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| | | | | | | 90 | | andra Santa Angla Santa Santa Angla Santa | |
| | E5.4.1 Thru E5.4.4 | Heat Exchanger | Tubes, Tubesheet, Channel & Head, Shell | Tubes: SS Tubesheet: CS (SS Cladding on | Oxygenated Water; and Treated Component Cooling | | MIC | | |
| \mathcal{D} | | | | Channel Side); | Water | | | | |



| ltem | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|--------------------------|----------------------------|--|---|--|---------------------|---------------------------------|---|
| E5.3.1 | Valves | Body and Bonnet | SS Forging | Oxygenated Water | Loss of Material | Crevice Pitting | ASME Section XI |
| E5.4.1 Thru E5.4.4 | Heat Exchanger | Tubes, Tubesheet, Channel & Head, Shell | Tubes: SS Tubesheet: CS (SS Cladding on Channel Side); Channel & Head: CS; Shell: CS | Oxygenated Water; and Treated Component Cooling Water | Loss Of Material | Crevice Pitting Corrosion | ASME Section XI, 1989 Edition Plant Technical Specifications |
| E5.4.1 Thru E5.4.4 | Heat Exchanger | Tubes, Tübesheet, Channel & Head, Shell | Tubes: SS Tubesheet: CS (SS Cladding on Channel Side); Channel & Head: CS; Shell: CS | Oxygenated Water; and Treated Component Cooling Water | | MIC | |

AUXILIARY SYSTEMS E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

VII AUXILIARY SYSTEMS E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor) (Item E5.3.1 Continued)

| Existing Aging Management Program | Evaluation and Technical Basis | Further Evaluation | |
|--------------------------------------|---|-----------------------|--|
| | (10) Operating Experience: Localized corrosion is likely to occur at crevice geometry where buildup of impurities can occur. steam turbine geverner velves due to serrosion scale buildup has coourred in RCIC and AFW systems (NRCIN 90-24) | | |
| (Item E5.4.1 Thru E5.4.4 Continued) | | | |
| | (2) Preventive Actions: The parameters monitored include halogens, sulfates, oxygen, and pH in the primary water, and in addition to these, dissolved copper and iron, and suspended solids, microbiological organisms, and sediment in the component cooling water | No | |

VII

F1. Control Room Area Ventilation System

F1.1 Duct

| F1 | .1. | 1 Duct. | Fittings, | and | Access | Doors |
|-----------|-----|---------|-----------|-----|--------|-------|
|-----------|-----|---------|-----------|-----|--------|-------|

- F1.1.2 Equipment Frames and Housing
- F1.1.3 Flexible Collars between Ducts and Fans
- F1.1.4 Seals in Dampers and Doors
- F1.2 Air Handler Heating/Cooling
 - F1.2.1 Heating/Cooling Coils
- F1.3 Piping
 - F1.3.1 Piping and Fittings

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F1. Control Room Area Ventilation System

F1.1 Duct

F1.1.1 Duct, Fittings, and Access Doors

F1.1.2 Equipment Frames and Housing

F1.1.3 Flexible Collars between Ducts and Fans

F1.1.4 Seals in Dampers and Doors

F1.2 Air Handler Heating/Cooling

F1.2.1 Heating/Cooling Coils

F1.3 Piping

COMMENTS:

Piping and Fittings F1.3.1 1. Consider adding these passive F1.4 Pamps (Casing) components in The safety -related F1.5 Values (Bodies) chilled Water system (CWS) which F1.6 Tanks often is a subsystem of System F1 (Control Room Area Ventilation System). At some plants, CWS is a separate system. Note that CWS is not included anywhere else in the GALL report. If not included here, address CWS separately else where in the GALL report. Other pessive component q CWS is piping, which is already here (F1.3). 2. Modify the F1 table to address all atributes (the 9 stems in top row) for each of added components (F1.4,5, and 6). 3. Consider comments 1. and 2. above for the other Three ventilation systems in The GALL report. (Section VII F2, F3, and F4), some plants have CWS as subsystem for these three systems or as supporting the ventilation (see Comment 1), Sada Pullani, 3/2/2000 RES DET | ERAB Tel: (301) - 415-6843 Email, SVP ENRC. GOV DRAFT - 12/06/99 VII F1-1

F2. Auxiliary and Radwaste Area Ventilation System

F2.1 Duct

| F2.1.1 | Duct, | Fittings, | and | Access | Doors |
|--------|-------|-----------|-----|--------|-------|
|--------|-------|-----------|-----|--------|-------|

- F2.1.2 Equipment Frames and Housing
- F2.1.3 Flexible Collars between Ducts and Fans
- F2.1.4 Seals in Dampers and Doors

F2.2 Air Handler Heating/Cooling

F2.2.1 Heating/Cooling Coils

F2.3 Piping

F2.3.1 Piping and Fittings

F3. Engineered Safety Feature Ventilation System (Primary Containment Area)

- F3.1 Duct
 - F3.1.1 Duct, Fittings, and Access Doors
 - F3.1.2 Equipment Frames and Housing
 - F3.1.3 Flexible Collars between Ducts and Fans
 - F3.1.4 Seals in Dampers and Doors
- F3.2 Air Handler Heating/Cooling
 - F3.2.1 Heating/Cooling Coils
- F3.3 Piping
 - F3.3.1 Piping and Fittings

F4. Diesel Generator Building Ventilation System

F4.1 Duct

| | F4.1.1 | Duct, Fittings, and Access Doors | |
|------|-----------------------------|---|--|
| | F4.1.2 | Equipment Frames and Housing | |
| | F4.1.3 | Flexible Collars between Ducts and Fans | |
| | F4.1.4 | Seals in Dampers and Doors | |
| F4.2 | Air Handler Heating/Cooling | | |
| | F4.2.1 | Heating/Cooling Coils | |
| F4.3 | Piping | | |

F4.3.1 Piping and Fittings

G. Fire Protection

- G.1 Intake Structure
 - G.1.1 Fire Barrier Penetration Seals
 - G.1.2 Fire Barrier Walls, Ceiling, and Floors
 - G.1.3 Fire Rated Doors
- G.2 Turbine Building
 - G.2.1 Fire Barrier Penetration Seals
 - G.2.2 Fire Barrier Walls, Ceiling, and Floors
 - G.2.3 Fire Rated Doors
- G.3 Auxiliary Building
 - G.3.1 Fire Barrier Penetration Seals
 - G.3.2 Fire Barrier Walls, Ceiling, and Floors
 - G.3.3 Fire Rated Doors
- G.4 Diesel Generator Building
 - G.4.1 Fire Barrier Penetration Seals
 - G.4.2 Fire Barrier Walls, Ceiling, and Floors
 - G.4.3 Fire Rated Doors
- G.5 Primary Containment
 - G.5.1 Fire Barrier Walls, Ceiling, and Floors
 - G.5.2 Fire Rated Doors
- G.6 High-Pressure Service Water System
 - G.6.1 Piping and Fittings
 - G.6.2 Filter, Fire Hydrants, Mulsifier, Pump Casing, Sprinkler, Strainer, and Valve Bodies
- G.7 Reactor Coolant Pump Oil Collect System

- G.7.1 Tank
- G.7.2 Piping, Tubing, Valve Bodies
- G.8 Diesel Fire System
 - G.8.1 Diesel-Driven Fire Pump and Fuel Supply Line

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G. Fire Protection

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System, Structures, and Components

The system, structure, and components included in this table comprise the fire protection system for both boiling water reactors (BWRs) and pressurized water reactors (PWRs) and consist of several Class 1 structures and mechanical systems. The Class 1 structures include intake structure, turbine building, auxiliary building, diesel generator building, and primary containment, and structural components include fire barrier wall, ceiling, floor, fire door, and penetration seal. Mechanical systems include high pressure service water system, reactor coolant pump oil collect system, and diesel fire system, and mechanical components include piping and fittings, filter, fire hydrant, mulsifyer, pump, valves, sprinkler, and strainer. All the mechanical components are classified as Group C Quality Standards.

Pumps and valves are considered to be active components and pump internals and seats, discs, bolting, and other valve items should be covered by the plant maintenance program.

System Interfaces

The systems that interface with the fire protection system include various Class 1 structures and component supports (Chapter III), closed cycle cooling water system (Table VII C2) and the Diesel Fuel Oil System (Table VII H1).

* cethat about electrical systems components associated with fire protection? Even of they are addressed in chapter VI en Electrical Components, they showed be recognized and cross. referenced. J. VORA .

H1. Diesel Fuel Oil System

| H1 | .1 | . 1 | Pip | ing |
|----|----|-----|-----|-----|
| | | | | |

| | H1.1.1 | Aboveground Pipe and Fittings |
|------|--------|-------------------------------|
| | H1.1.2 | Underground Pipe and Fittings |
| H1.2 | Valves | |
| | H1.2.1 | Body and Bonnet |
| | H1.2.2 | Closure Bolting |
| H1.3 | Pump | |
| | H1.3.1 | Casing |
| | H1.3.2 | Closure Bolting |
| H1.4 | Tank | |
| | H1.4.1 | Tank Internal Surfaces |
| | H1.4.2 | Tank External Surfaces |
| | H1.4.3 | Caulking and Sealant |

H1. Diesel Fuel Oil System

System, Structures, and Components

The system, structures, and components included in this table comprise the diesel fuel oil system and consist of above ground and underground piping, valves, pump, and tank. 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 diesel fuel oil system are classified as Group C Quality Standards.

System Interfaces

The system that interfaces with the diesel fuel oil system is the emergency diesel generator system (Table VII H2).

Greneral comments for consideration, as appropriate.

For large underground fuel oil tanks whose capacity is such that with normal usage fuel can remain for more than 2 years and where there is no system to assure homogeneity of the stored fuel, there shall be an aging management program to verify (1) the deterioration of aged fuel oil and (2) the periodicity of required filter changes based on the available reserve engine filter capacity with the actual aged fuel, in order to assure the ability of plants to perform a design basis run of their emergency diesels without fuel starvation.

H2. Emergency Diesel Generator System

- H2.1 Diesel Engine Cooling Water Subsystem
 - H2.1.1 Pipe and Fittings
- H2.2 Diesel Generator Air Starting Subsystem
 - H2.2.1 Pipe and Fittings
 - H2.2.2 Hand Valve
 - H2.2.3 Check Valve
 - H2.2.4 Drain Trap
 - H2.2.5 Air Accumulator Vessel
- H2.3 Diesel Generator Combustion Air Intake Subsystem
 - H2.3.1 Piping and Fittings
 - H2.3.2 Filter
 - H2.3.3 Muffler
- H2.4 Diesel Generator Combustion Exhaust Air Subsystem
 - H2.4.1 Piping and Fittings
 - H2.4.2 Muffler
- H2.5 Diesel Generator Fuel Oil Subsystem
 - H2.5.1 Day Tank
 - H2.5.2 Dip Tank
 - H2.5.3 Strainer

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H2. Emergency Diesel Generator System

System, Structures, and Components

The system, structures, and components included in this table comprise the emergency diesel generator system and contain piping, valves, filter, muffler, strainer, day tank, and dip tank for cooling water, starting air, combustion air intake, combustion exhaust air, and diesel fuel oil subsystems. 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 emergency diesel generator system are classified as Group C Quality Standards.

System Interfaces

The systems that interface with the emergency diesel generator system include the diesel fuel oil system (Table VII H1) and the closed cycle cooling water system (Table VII C2).

- 1. In some plants, the opencycle contry system, also in turfaces with EDG system. Such as Haddam Neck plant in which the EDG Coving writer heat exchanged USes Sev Ser Cooling
- 2. Deselengine Jacket Water heat exchanges should be also included in the aging management review
- 3. Vibrition IVas identified as a significant aging dependation factor (NUREGICR-5057), Such as futigue failures B. Small bore pipings due to engined-induced Vibration. Crackings of small bore pipings have resulted in inoperability of EDGs. The cracked lines have found in EDG lube oil, fuel oil, and cooling water systems. Many B three cracks were not detected by ISI, but only chiscovered after the cracks propagated completely through the tube wall and Huid IVAS abserved leating from the pipes.

VII H2-3

L Liquid Waste Disposal System

- I.1 Piping
- I.2 Pumps
- I.3 Valves
- I.4 Tanks
- I.5 Evaporators
- I.6 Demineralizers
- I.7 Gas Strippers

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Liquid Waste Disposal System L

- I.1 Piping
- I.2 Pumps
- I.3 Valves
- I.4 Tanks
- I.5 Evaporators
- I.6 Demineralizers
- I.7 Gas Strippers

COMMENT:

1. Consider edding Filters (Item I.8 above). Similar to tenks, evaportors, and demineralizers (Items I.4, I.5, and I.b above), filters are also common passive components of this system, 2, Modify the table in Section I to æddress all ættributes (The 9 ctems in top row) for the edded component (I.8),

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VII I-1

CHAPTER VIII (10/15/99)

STEAM AND POWER CONVERSION SYSTEM

Major Plant Sections

- A Steam Turbine System
- B1. Main Steam System (PWR)
- B2. Main Steam System (BWR)
- C. Extraction Steam System
- D1. Feedwater Systems (PWR)
- D2. Feedwater Systems (BWR)
- E. Condensate System
- F. Steam Generator Blowdown System (PWR)
- G. Auxiliary Feedwater (AFW) System (PWR)

A. Steam Turbine System

- A.1 Piping and Fittings
 - A.1.1 HP Turbine to MSR
 - A.1.2 MSR to LP Turbine

A. Steam Turbine System

A.1 Piping and Fittings

A.1.1 HP Turbine to MSR A.1.2 MSR to LP Turbine ndd > A.2 Valves A.3 Moisture Separator/Reheater

VIII STEAM AND POWER CONVERSION SYSTEMS

| Г | A | Structure and | BINE SYSTEM Region of | | Environ- | Aging Effect | Aging Mechanism | References |
|----|-------|--|---|----------|------------------|------------------|--------------------|------------|
| | Item | Component | Interest | Material | ment | Ellect | - | |
| | Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| \⊢ | | Valves (Stop, Control or Governor, Intermediate Stop and Control or Combined Intermediate, Bypass or Steam Dumps, Atmospheric Dumps, Main Steam Safety, or Safety/Relief) | Body | | | Wall Thinning | Erosion/Corrosio | on |
| | A.3.1 | Moisture Separator Moisture Separator/ Reheater | Tubes, Tubesheet Channel Head Shell | | | Wall Thinning | Erosion/Corrosi | on |
| | A.3.1 | Moisture Separator Moisture Separator/ Reheater | Tubes, Tubesheet Channel Head Shell | | | | MIC | |

New Constant

B1. Main Steam System (PWR)

- B1.1 Piping and Fittings
 - B1.1.1 Steam Lines to Main Turbine
 - B1.1.2 Lines to FW and AFW Pump Turbines
 - B1.1.3 Lines to Moisture Separator/Reheater
 - B1.1.4 Turbine Bypass
 - B1.1.5 Steam Drains
- B1.2 Valves (Check, Control, Hand, Motor Operated Valves)

B1.2.1 Body

B1. Main Steam System (PWR)

- Piping and Fittings B1.1
 - Steam Lines to Main Turbine B1.1.1
 - Lines to FW and AFW Pump Turbines B1.1.2
 - Lines to Moisture Separator/Reheater Tor is redundent with B1.1.3
 - Turbine Bypass B1.1.4
 - Steam Drains B1.1.5

Valves (Check, Control, Hand, Motor Operated Valves) B1.2

> Body B1.2.1

B1.3 Main Condenser

VIII STEAM AND POWER CONVERSION SYSTEMS

| B | Structure and | AM SYSTEM (Pro | | Environ- | Aging Effect | Aging Mechanism | References |
|-----------------|---|--|----------|------------------|------------------|-----------------------|---|
| Item | Component | Interest | Material | ment | Ellect | VICCIALITY | |
| | | | | | | - | |
| | | | | | | | |
| | Valves | Body | CS | 320°C | Wall | E/C | NUREG-1344. NRC GL 89-08. |
| B1.2.1 | Valves (Check Valves, Control Valves, Hand Valves, Motor Operated Valves) | | | Steam | Thinning | | NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC- 202L-R2. EPRI TR-102134 Rev. 3. |
| | | | | | <u></u> | | |
| Item | Structure and Component | Region of | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| B1. 3 .1 | Main Condenser | Tubes, Tubesheet, Channel Head, Shell | | | Wall Thinning | Erosion/ Corrosion | |
| B1. 3 .1 | Main Condenser | Tubes, Tubesheet, Channel Head, Shell | | | | MIC | |

B2. Main Steam System (BWR)

- B2.1 Piping and Fittings
 - B2.1.1 Steam Lines to Main Turbine (Group B)
 - B2.1.2 Steam Lines to Main Turbine (Group D)
 - B2.1.3 Lines to FW Pump Turbines
 - B2.1.4 Lines to Moisture Separator/Reheater
 - B2.1.5 Turbine Bypass
 - B2.1.6 Steam Drains
- B2.2 Valves (Check, Control, Hand, Motor-Operated Valves)
 - B2.2.1 Body
 - B2.2.2 Bolting

B2. Main Steam System (BWR)

Piping and Fittings B2.1

- Steam Lines to Main Turbine (Group B) B2.1.1
- Steam Lines to Main Turbine (Group D) B2.1.2
- Lines to FW Pump Turbines B2.1.3
- Lines_to Moisture Separator/Reheater B2.1.4
- **Turbine Bypass** B2.1.5
- Steam Drains B2.1.6
- B2.1.7 Steam Line to HPCI turbine operated Valves)
- B2.1.8 Steam Line to RCIC turbine
- B2.2.2 Bolting
- INSERT B2.3 Main Condenser

| item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|--------|-------------------------------|--|----------|------------------|------------------|-----------------------|------------|
| B2.1.7 | Steam Line to HPCI Turbine | Piping and Fittings | | | | | |
| B2.1.8 | Steam Line to RCIC Turbine | Piping and Fittings | | | | | |
| B2.2 | Condenser | Tubes, Tubesheet, Channel Head, Shell | | | Wall Thinning | Erosion/ Corrosion | |
| B2.2 | Condenser | Tubes, Tubesheet, Channel Head, Sheil | | | | MIC | |

VIII STEAM AND POWER CONVERSION SYSTEMS B2 MAIN STEAM SYSTEM (Boiling Water Reactor)

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VIII 82-4./6

| | Item | 32. MAIN STEA Structure and Component | M SYSTEM (Be Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
|-----|--------|---|---------------------------------------|----------|------------------|-----------------|--------------------|------------|
| | | Component | | | | | | |
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| / | | | | | | | _ <u></u> | 770000 |
| GET | B2.1.7 | Steam Line to HPCI Turbine | Piping and Fittings | | | | | |
| | B2.1.8 | Steam Line to RCIC Turbine | Piping and Fittings | | | | | |
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VIII STEAM AND POWER CONVERSION SYSTEMS

VIII STEAM AND POWER CONVERSION SYSTEMS B2 MAIN STEAM SYSTEM (Boiling Water Reactor)

| - | SZ. MAIN SIE | AM SISIEM (IA | | | 1 | A stat | |
|--------------|----------------------------|--|----------|------------------|------------------|-----------------------|------------|
| Item | Structure and Component | Region of Interest | Material | Environ- ment | Aging Effect | Aging Mechanism | References |
| | | | | | | | |
| | | | | | | | |
| | | | | | | - | |
| B2. 3 | Condenser | Tubes, Tubesheet, | | | Wall Thinning | Erosion/ Corrosion | |
| | | Channel Head, Shell | | | | | |
| B2.3 | Condenser | Tubes, Tubesheet, Channel Head, Shell | | | | MIC | |

C. Extraction Steam System

Jore .

C.1 Piping and Fittings

- C.1.1 Lines to Feedwater Heaters
- C.1.2 Steam Drains
- C.2 Valves
 - C.2.1 Body

D1. Feedwater Systems (PWR)

D1.1 Main Feedwater Line

D1.1.1 Pipe and Fittings

D1.2 Valves (Control, Check, and Hand Valves)

D1.2.1 Body

D1.3 Feedwater Pump (Steam Turbine- and Motor-Driven)

D1.3.1 Casing

D1.3.2 Suction and Discharge Lines

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D1. Feedwater Systems (PWR)

Main Feedwater Line D1.1

> Pipe and Fittings D1.1.1

D1.2 Valves (Control, Check, and Hand Valves)

D1.2.1 Body

D1.3 Feedwater Pump (Steam Turbine- and Motor-Driven)

D1.3.1 Casing

D1.3.2 Suction and Discharge Lines

Addi I. Feedwaren Hearens

2. Fredwater pump Lude oil Coster

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VIII STEAM AND POWER CONVERSION SYSTEM D1. Feedwater System (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the main feedwater system for pressurized water reactors (PWRs) extending from the condensate system to the outermost feedwater isolation valve on the feedwater lines to the steam generator, and consist of the main feedwater lines, feedwater pumps, and valves. 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 feedwater system are classified as Group D Quality Standards. Portion of the feedwater system extending from the secondary side of the steam generator up to the second isolation valve outside the containment is classified as Group B or C standards and is covered in Tables IV D1 and D2. The aging management program for isolation valves in the feedwater system is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).and(in')

System Interfaces

.2.

The systems that interface with the feedwater system include the steam generator (Table IV D1 and D2), main steam system (Table VIII B1), extraction steam system (Table VIII C), condensate system (Table VIII E), and auxiliary feedwater system (Table VIII G).

should in cluster, "Freedwate"

D2. Feedwater Systems (BWR)

- D2.1 Main Feedwater Line
 - D2.1.1 Pipe and Fittings
 - D2.1.2 Bolting for Flange Connections
- D2.2 Valves (Control, Check, and Hand Valves)

D2.2.1 Body

D2.3 Feedwater Pump (Steam Turbine- and Motor-Driven)

D2.3.1 Casing

D2.3.2 Suction and Discharge Lines

D2. Feedwater Systems (BWR)

- D2.1 Main Feedwater Line
 - D2.1.1 Pipe and Fittings
 - D2.1.2 Bolting for Flange Connections
- D2.2 Valves (Control, Check, and Hand Valves)

D2.2.1 Body

D2.3 Feedwater Pump (Steam Turbine- and Motor-Driven)

D2.3.1 Casing

D2.3.2 Suction and Discharge Lines

Add 1. Feedwaren heaths

2. Fredwith pump Lube oil Conter

VIII STEAM AND POWER CONVERSION SYSTEM D2. Feedwater System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the main feedwater system for boiling water reactors (BWRs) extending from the condensate and condensate booster system to the outermost feedwater isolation valve on the feedwater lines to the reactor vessel, and consist of the main feedwater lines, feedwater pumps, and valves. 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," portions of the feedwater system extending from the outermost containment isolation valves up to and including the shutoff valve or the first valve that is either normally closed or capable of closure during all modes of normal reactor operation are classified as Group B quality standards, and the remainder as Group D. Portion of the feedwater system extending from the containment is classified as Group A standards and is covered in Table IV C1. The aging management program for isolation valves in the feedwater system is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i)...d(ii))

System Interfaces

The systems that interface with the feedwater system include the reactor coolant pressure boundary (Table IV C1), main steam system (Table VIII B2), extraction steam system (Table VIII C), and condensate system (Table VIII E).

14.11.2.14

Should include

E. Condensate System

- E.1 Condensate Lines
 - E.1.1 Piping and Fittings
- E.2 Valves
 - E.2.1 Body
- E.3 Condensate Pumps (Main and Booster Pumps)

E.3.1 Casing

- E.4 Condensate Coolers/Condensers
 - E.4.1 Tubes
 - E.4.2 Tubesheet
 - E.4.3 Channel Head
 - E.4.4 Shell

E.5 Condensate Storage

E.5.1 Tank

- E.6 Condensate Cleanup System
 - E.6.1 Piping and Fittings
 - E.6.2 Demineralizer
 - E.6.3 Strainer
 - E.6.4 Filter

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F. Steam Generator Blowdown System (PWR)

- F.1 Blowdown Lines
 - F.1.1 Pipe and Fittings (Group B)
 - F.1.2 Pipe and Fittings (Group D)
- F.2 Valves
 - F.2.1 Body
- F.3 Blowdown Pump
 - F.3.1 Casing
- F.4 Blowdown Heat Exchanger
 - F.4.1 Tubes
 - F.4.2 Tubesheet
 - F.4.3 Channel Head
 - F.4.4 Shell

G. Auxiliary Feedwater (AFW) System (PWR)

| G.1 Aux | iliary Feedwate | r Piping |
|---------|-----------------|----------|
|---------|-----------------|----------|

- G.1.1 Pipe and Fittings (Above Ground)
- G.1.2 Pipe and Fittings (Buried)
- G.2 AFW Pumps (Steam Turbine- and Motor-Driven)
 - G.2.1 Casing
 - G.2.2 Suction and Discharge Lines
 - G.2.3 Bolting
- G.3 Valves (Control, Check, Hand Valves)

G.3.1 Body

G.4 Condensate Storage (Emergency)

G.4.1 Tank

G.5 Bearing Oil Coolers

- G.5.1 Shell
- G.5.2 Tubes
- G.5.3 Tubesheet

VIII STEAM AND POWER CONVERSION SYSTEM

G. Auxiliary Feedwater System (Pressurized Water Reactor)

System, Structures, and Components Auxiliary fact water lines also Connect to Main freduc

The system, structures, and components included in this table comprise the auxiliary feedwater (AFW) system for pressurized water reactors (PWRs) extending from the condensate storage system to the outermost containment isolation valve on the auxiliary feedwater lines to the steam generator, and consist of auxiliary feedwater piping, auxiliary feedwater pumps, valves, and pump turbine oil coolers. 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," portions of the auxiliary feedwater system that are required for their safety functions and that either do not operate during any mode of normal reactor operation or cannot be tested adequately, should be classified as Group B quality standards, and the remainder classified as Group C. Portion of the auxiliary feedwater system extending from the secondary side of the steam generator up to the second isolation valve outside the containment is classified as Group B standard, and is covered in Tables IV D1 and D2. The aging management program for isolation valves in the auxiliary feedwater system is reviewed in Table V C.

line

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the auxiliary feedwater system include the steam generator (Tables IV D1 and D2), main steam system (Table VIII B1), and condensate system (Table VIII E).

- 1. Cavitation Contributed to Serier Wear of the Afin pump Casing and Should be Considered to An aging mechanism for the pamp casing: (a). Operation of pumps at 1000 - flow conditions for extended periods of time (an cause cavitation damage (inlet flow recirculation) independent of Available NPSH. - NUREG/CRASSOT "Aging mid survice wear of Afin pumps the purps in pumps in
 - (b) Monitoring for Steam binching of AFW pump: Back leakage of Annin feedwater past the isolation check Valles in the AFW system can cause steam binding of AFW pumps and lead to pump cavitation when the pumps are subsequently started up NRC Buildetine SSOOI Vegaires monitoring the AFW pump discharge line for inchication of the presence of Steam and hot water. VIII G-3 DRAFT - 10/15/99

except for PWRS with preserve wis write a sum pro B the Main feedwater is diverted through AFW lines during numal equation. This portion of AFW lines have experied Significant wall thinking. (exposed to hot MFW flowing at high Velocity)

| |) SYSTEM (Pressurized Water Reactor) | Further |
|---------------------------------------|--|------------|
| Existing | Evaluation and Technical Basis | Evaluation |
| Aging Management Program (AMP) | () toward from previous page | |
| | Los a b) Confirmation Process and Adminustrative | 1 |
| | A A A A A A A A A A A A A A A A A A A | 1 |
| | I and administrative controls are improved | |
| | I The second the second frements of ADDCINIX D to to the | |
| | | |
| | tioned becaused (10) Operating Experiesces that theme- | |
| | | 1 |
| | i inthe and condengate systems inku Dulluli inv. V | |
| | reedwater and conditional of the state of th | 1 |
| | | 1 |
| | deep conditions are unlikely to cause cavitations | |
| | erosion; it is limited to locations downstream of flow | |
| | in NUREG-1344 and | |
| | implemented through GL 89-08 has provided effective | |
| | means of ensuring the structural integrity of all high- | |
| | means of clisting the structure and gratems | 1 |
| | energy carbon steel systems. | Yes, |
| the program relies on preventive | (1) Scope of Program: The program relies on monitoring | Element |
| measures to mitigate corrosion by | (1) Scope of Program. The program (2) and control of water chemistry (EPRI TR 102134 Rev. 3) for and control of water chemistry (EPRI TR 102134 Rev. 3) for | should be |
| manifesting and control of water | and control of water citizenergy managing the effects of loss of material due to general, managing the effects of loss of material due to general, | further |
| chemistry in accordance with the EPRI | crevice, or pitting corrosion. (2) Preventive Actions: | evaluated |
| guidelines of TR-102134, Rev. 3. | Stringent control of system water chemistry by frequent | |
| guidelines of TRATOLIC I TRATO | in any taring and timely corrective action when operation | |
| | I make imple are exceeded DIEVENLUI Intugate | |
| | corrosion. The program includes specifications for | |
| | corrosion. The program instand analysis frequencies, and chemical species, sampling and analysis frequencies, and | |
| | corrective actions for control of secondary and | 1 |
| | demineralized water chemistry. (3) Parameters | |
| | demineralized water chemistry arameters monitored are the Monitored/Inspected: The parameters monitored are the | |
| | water pH and concentration of corrosive impurities | |
| | (chlorides, sulfates, dissolved oxygen, sodium, silica). | |
| | (4) Detection of Aging Effects: An one-time inspection of | |
| | (4) Detection of Aging 20 other system population and most representative sample of the system population and most | |
| | representative sample of the system provide the conducted to susceptible locations in the system should be conducted to | |
| | susceptible locations in the opening root or | 4 |
| | to ensure that significant degradation is not occurring or | |
| | to ensure that signification of the CLB and the component that it would not affect the CLB and the component | |
| | intended function will be maintained during the extended | 1 |
| | period. Follow up actions are based on the inspection | 1 |
| | period. Follow up actions are sufficient on inspection is results and plant technical specification. Inspection is performed in accordance with the requirements of ASME performed in accordance with the requirements using a | |
| | code, 10CFR50 Appendix B, and ASTM standards, using a | |
| | Code, 10CFR50 Appendix B, and restriction visual, | |
| | variety of nondestructive techniques including visual, | |
| | variety of homest doct techniques. Selection of ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, | |
| | susceptible locations is based of several and time of service, and lowest design margin. Requirements | |
| | time of service, and lowest design magnet require | |
| • | for training and qualification of personnel and | |
| | performance demonstration for procedures and equipment is in conformance with Appendices VII and VII equipment is in conformance with appendices VII and VII | I |
| | | |
| | of ASME Section XI, or any other formal program | |
| | of ASME Section XI, of any outer intermediate Treading: The approved by the NRC. (5) Monitoring and Treading: The | 1 |
| | | 1 |
| | Jath, maakky or as reninicu bascu on process | 1 |
| | I whenever conference whenever confective weather | 1 |
| | | r I |
| | taken to address an abnormal chamber of the effectiveness of increased sampling is utilized to verify the effectiveness of these actions. (6) Acceptance Criteria: Maximum levels | |
| | these actions (6) Acceptance Criteria: Maximum levels | |

CHAPTER IX

SUMMARY AND CONCLUSIONS

(To be developed)

Draft — December 6, 1999

APPENDIX

QUALITY ASSURANCE FOR AGING MANAGEMENT PROGRAMS

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QUALITY ASSURANCE FOR AGING MANAGEMENT PROGRAMS

The license renewal applicant is required to demonstrate that the effects of aging on structures and components subject to an aging management review will be adequately managed to assure that their intended functions will be maintained consistent with the current licensing basis (CLB) for the period of extended operation. The applicant's aging management programs forlicense renewal should contain the elements of corrective actions, confirmation process, and administrative controls. The licensee's existing program to address these elements are the quality assurance (QA) program as required by 10 CFR Part 50, Appendix B must be continued in its entirety during the preparations for extended operating life, and for the operations themselves. In addition, the licensee's QA program should have demonstrated continued effectiveness as measured by generally accepted performance measures.

Finally, the licensee must address how the unique requirements of evaluating and testing of the plant passive systems and components will be addressed. Particular attention must be paid to the qualifications of individuals performing and reviewing work that has not been part of plant operations during the normal lifetime of the plant.

Corrective action is an element addressed by the applicant's QA program. Criteria 16 of 10 CFR Part 50, Appendix B, requires measures be established to assure that conditions adverse to quality, such as failures, malfunctions, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. Should the nonconformance be considered significant, measures must be implemented that assure the cause of the nonconformance. In addition, the cause of the condition and the corrective action implemented must be documented and reported to the appropriate level of management.

The applicant's QA program contains effective corrective actions when the specified acceptance criteria has not been met. The applicant's QA program ensures that corrective actions, including root cause determination and prevention of recurrence, will be timely. The corrective action must recommend or provide solutions to the nonconformance. If corrective actions permit analysis without repair or replacement, the basis of the analysis ensures that the intended function(s) for the structure and components will be maintained consistent with the CLB.

Confirmation process is an element addressed by the applicant's QA program. Criteria 16 of 10 CFR Part 50, Appendix B, requires measures to be taken that preclude repetition of a nonconformance. In addition, follow-up action must be taken to verify implementation of the proposed corrective action. Verification of corrective action implementation is an essential step in the confirmation process. The confirmation process ensures that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

For prevention and mitigation programs, the effectiveness of these programs should be periodically verified. For example, in managing internal corrosion of piping, a mitigation program (water chemistry) may be used to minimize susceptibility to corrosion. However, it may also be necessary to have a condition monitoring program (ultrasonic inspection) to verify that corrosion is indeed insignificant. When corrective actions are necessary, there should be followup activities to confirm that the corrective actions are completed, root cause determination is performed, and recurrence is prevented.

Administrative controls are also addressed by the applicant's QA program. Administrative controls are the provisions relating to organization and management, policies, orders, instructions, procedures, record keeping, and designations of authority and responsibility, which are necessary to assure operation of the facility in a safe manner. The requirement to include administrative controls in the applicant's QA program is specified in 10 CFR §50.34(b)(6)(ii) and §50.36(c)(5) and Appendix B of 10 CFR Part 50. In addition, Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operations)," provides guidance in the application of administrative controls. Regulatory Guide 1.33 describes proper application of administrative controls and provides examples of typical administrative control procedures. For example, the requirement to prepare procedures for in service inspection, for repairs that are necessitated by the inspection, and for records and reports is considered to be administrative controls will provide a formal review and approval process.

In summary, corrective actions, confirmation process, and administrative controls are addressed by the applicant's QA program as required by 10 CFR Part 50, Appendix B. Nofurther evaluation is recommended for the applicant's 10 CFR 50, Appendix B, QA program. However, 10 CFR

Part 50, Appendix B, covers safety related structures and components. There are non safetyrelated structures and components subject to aging management review for license renewal.

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Thus, further evaluation is recommended for aging management programs that apply to nonsafety related structures and components regarding corrective actions, confirmation process, and administrative controls. The applicant has an option to commit to include non-safety related structures and components in the approved Appendix B QA Program. Any revisions to the approved QA program will be processed in accordance with 10 CFR 50.54(a). Should the applicant choose to have a separate license renewal QA program for non-safety related structures and components, this separate program should address corrective actions, confirmation process, and administrative controls, and is subject to a case by case review by the staff.

RES REVIEW OF DRAFT GALL - 2 REPORT

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RES Coordinator: Jitendra P. Vora E-mail: JPV Ext: 415-5833

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