Presentation materials used by Jacque Lingenfelter, Entergy March 9, 2004

Objective of Proposed Changes

- Incorporate lessons learned and past precedent review results to:
  - Improve the efficiency of the licensee's comparison of plant specific aging management review results with the generic results in NUREG-1801, and,
  - Improve the efficiency of the NRC's comparison of generic results in NUREG-1801 with the plant specific results in the license renewal application

Enclosure 3

Changes to Suit Table Specific Needs

- **Reactor Vessel / RCS Tables**
  - Simplify the materials and environments of vessel and internals tables
  - Restructuring the reactor coolant system and steam generator tables
  - Adding MEAP combinations established by precedents
- **Non-class 1 Mechanical Systems Tables**
  - Restructuring all system tables
  - Adding MEAP combinations established by precedents
- **Electrical Systems Tables**
  - Adding MEAP combinations established by precedents
- **Structures Tables**
  - Adding MEAP combinations established by precedents

Restructuring Part 1 - Restate Table Rows

- **Each Row of Tables Restated**
  - Documented in "Proposed Changes to NUREG-1801 Mechanical Systems Tables" - Attachment 1
  - One or more new rows for each existing NUREG-1801 row
  - NUREG-1801 rows shaded, new rows un-shaded
  - New technical criteria hyper-linked to bases for criteria

A.1-a A.1.1 A.1.2 A.1.3	Piping, fittings and branches to miscellaneous items Piping and fittings up to isolation valve Flow orifice/elements Temperature elements/ indicators	Stainless steel	Chemically treated borated water at temperature ≥ 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.1-b A.1.4	Containment spray system Bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

Restructuring Part 1 - Restate Table Rows

- **Minimize List of Specific Components**
  - Aging effects and programs for a material and environment combination are generally independent of the component type
  - Some complex component configurations, such as heat exchangers and reactor internals, can lead to aging effects that would not occur or matter in other less complex configurations
  - Components are listed generally, specific components are listed only where necessary to accommodate a different aging effect or program
  - Generalized components focus comparison on MEAP combination rather than component

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A.1-a A.1.1 A.1.2 A.1.3	Piping, fittings and miscellaneous items Piping and fittings up to isolation valve Flow orifice/elements Temperature elements/ indicators	Stainless steel	Chemically treated borated water at temperature ≤93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.1-b A.1.4	Containment spray system Bolting	Carbon steel low-alloy steel	Air leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A.6-a A.6.1 A.6.2 A.6.3 A.6.4	Containment spray heat exchanger (serviced by open-cycle cooling water) Bonnet/cover Tubing Shell Case/cover	Carbon steel stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Loss of material/ General and microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
A.6-b A.6.2	Containment spray heat exchanger (serviced by open-cycle cooling water) Tubing	Carbon steel stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated borated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Restructuring Part 1 - Restate Table Rows

- **Consolidate Materials**
  - Material types limited to those that are susceptible to different aging effects
  - Material types are grouped into general types
  - Specific material types used only when susceptible to a unique aging effect
  - Composite materials (e.g., carbon steel clad with stainless steel) are listed separately unless the aging effect, such as fatigue, would apply to the composite material
  - Generally, only one material listed per line

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D1.5-b D1.5.3 D1.5.4 D1.5.5	Heat exchangers (RCP seal, HPSI pump seal, LPSI pump seal, RHR or SDC) Shell Case/cover (external surfaces) Bolting	Shell, carbon steel; case/cover, cast iron; nuts, carbon steel; bolts/studs, alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.7-a D1.7.1 D1.7.2 D1.7.3	Safety injection tank (accumulator) Shell Manway Penetrations/ nozzles (all external surface)	Carbon steel with stainless steel cladding	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.7-b D1.7.3	Safety injection tank (accumulator) Penetrations/nozzles	Carbon steel with stainless steel cladding	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.6-b A.6.2	Containment spray heat exchanger (serviced by open-cycle cooling water) Tubing	Carbon steel, stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated borated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Restructuring Part 1 - Restate Table Rows

- **Use Consistent Environments**
  - Environments revised to identify the pertinent aspects that influence the aging effects applicable to the material
  - Environments identify the general chemical content (e.g., treated borated water) and if necessary, a temperature range that determines the applicability of aging effects
  - Table of environment descriptions provided

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A.1-a A.1.1 A.1.2 A.1.3	Piping, fittings and miscellaneous items Piping and fittings up to isolation valve Flow orifice/elements Temperature elements/ indicators	Stainless steel	Chemically treated borated water at temperature ≤ 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.1-b A.1.4	Containment spray system Bolting	Carbon steel low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A.6-a A.6.1 A.6.2 A.6.3 A.6.4	Containment spray heat exchanger (serviced by open-cycle cooling water) Bonnet/cover Tubing Shell Case/cover	Carbon steel stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Loss of material/ General and microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
A.6-b A.6.2	Containment spray heat exchanger (serviced by open-cycle cooling water) Tubing	Carbon steel stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated borated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Restructuring Part 1 - Restate Table Rows

- **Simplify Aging Effects**
  - Aging mechanisms are considered during the plant AMR, but the results are usually reported in terms of aging effects alone
  - Aging mechanisms used to qualify an aging effect only where the particular mechanism is important to the selection of the aging management program

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A.1-a A.1.1 A.1.2 A.1.3	Piping, fittings and miscellaneous items Piping and fittings up to isolation valve Flow orifice/elements Temperature elements/ indicators	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.1-b A.1.4	Containment spray system Bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A.6-a A.6.1 A.6.2 A.6.3 A.6.4	Containment spray heat exchanger (serviced by open-cycle cooling water) Bonnet/cover Tubing Shell Case/cover	Carbon steel, stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Loss of material/ General and microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
A.6-b A.6.2	Containment spray heat exchanger (serviced by open-cycle cooling water) Tubing	Carbon steel, stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated borated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Restructuring Part 2 - Consolidate

- Current NUREG-1801 rows (shaded) deleted
- Revised rows of all systems within supergroup (RCS, ESF, Auxiliary, and S&PC Systems) combined
- Rows sorted
- Duplicate entries deleted
- Documented in Attachment 2

Addition of New MEAP Combinations

- Add MEAP combinations that are common to most applications
- Combinations with different materials or environments than those currently in NUREG-1801
- Some combinations have no aging effects
- The AMR process requires plants to evaluate such combinations whether they are included in NUREG-1801 or not
- Most already addressed by an approved application
- Examples in Attachment 3

Addition of New Program

- Visual inspection of systems (e.g., system walkdown or system monitoring programs) commonly used to monitor loss of material
- NUREG-1801 could include the minimum set of elements of an acceptable generic program to visually monitor systems
- Without incorporation into the tables, benefit would be in review of Appendix B description of "consistent" program
- Program could be incorporated by replacing appropriate "plant specific" listings currently in NUREG

1. Introduction

As part of the AMR results presented in Tables 3.x.2-y of recently completed license renewal applications, comparisons to the generic AMR results of NUREG-1801 were performed and documented in the last three columns of the tables. The comparisons of the plant to NUREG-1801 AMR results have been hampered by the differences in the format and content of the results presentations. The number of individual items of the plant AMR results that had a direct match to the NUREG-1801 AMR results was low, particularly for the non-class 1 mechanical systems.

This document proposes changes to NUREG-1801 in the format and content of the AMR results tables presented in Volume 2. The objective of the proposed changes is to increase the number of direct matches between the AMR results of future plant license renewal applications and NUREG-1801 which should reduce the NRC review time required for the applications.

2. Overview of Changes

Several changes are proposed to achieve the objective. The changes proposed vary for different chapters of the NUREG, depending on the suitability of the current tables for comparisons. The types of changes proposed for the NUREG-1801, Volume 2 tables, is described below.

ESF, Auxiliary, and Steam and Power Conversion Systems, Chapters V, VII and VIII

Comparisons of the non-class 1 mechanical system AMR results are the most difficult. These systems include the majority of the components evaluated and the broadest range of material and environment combinations. The corresponding NUREG tables address many (but by no means all) components but contain relatively few material and environment combinations for those components. Proposed changes to the non-class 1 mechanical systems tables include:

- Restructuring the NUREG tables to maximize the use of the AMR results currently presented in the tables (see Section 3).
- Adding material, environment, aging effect and program (MEAP) combinations established by precedents from earlier applications (see Section 4).

Reactor Vessel, Internals, and Reactor Coolant System, Chapter IV

The NUREG tables for reactor vessels and internals include significantly more detail than the non-class 1 tables. The tables for the reactor coolant system and steam generators are less detailed than the vessel and internals tables but are still more suitable for comparisons than the non-class 1 system tables. Proposed changes to the NUREG Chapter IV tables include:

- Simplifying the materials and environments descriptions in the vessel and internals tables (see Sections 3.3 and 3.4)
- Restructuring the reactor coolant system and steam generator tables to maximize the use of the AMR results currently presented in the tables (see Section 3).
- Adding MEAP combinations established by precedents to all Chapter IV tables(see Section 4).

Containment Structures, and Structures and Component Supports, Chapters II and III

The comparison of structural AMR results has been much better than the mechanical comparisons, primarily because the focus of the structural reviews is more on commodities than on specific components. Although the structural tables in NUREG-1801 can be awkward to use, with criteria for different materials and environments combined in the aging management programs column, the tables generally permit comparisons: however, the NUREG should address a broader range of materials. Proposed changes to the NUREG Chapters II and III tables include:

- Adding MEAP combinations established by precedents (see Section 4).

Electrical Components, Chapter VI

Like structures, the electrical reviews are primarily commodity based and comparisons of AMR results are generally acceptable. Additional materials should also be added to the NUREG electrical tables. Proposed changes to the NUREG Chapter VI tables include:

- Adding MEAP combinations established by precedents (see Section 4).

3. Restructuring of NUREG-1801 AMR Results

For the NUREG-1801 AMR results of the mechanical systems, other than the reactor vessel and internals, various materials, a range of environmental conditions, and an aging effect with a variety of aging mechanisms are typically listed in their respective columns for a given component. In some cases (e.g., heat exchangers), multiple materials exposed to multiple environments and an aging effect with a variety of mechanisms are listed for a single component with a single applicable aging management program.

While this type of detail makes sense for the presentation of AMR results for generic PWRs and BWRs, it does not lend itself to a direct comparison with the AMR results of a specific plant. Plant AMR results are generally presented for component types with a single material exposed to a single environment. Making a match with the NUREG-1801 results (assuming the aging effects and programs match) frequently requires assumptions and interpretations of the NUREG-1801 results.

Many of these problems could be eliminated by restructuring the NUREG-1801 AMR results. The restructuring would align the results more closely with those presented in the standard license renewal application format.

3.1 Proposed Restructuring

The restructuring of the NUREG-1801 mechanical systems tables (other than the reactor vessel and internals tables) is not intended to alter the generic AMR results. The intent is to clarify those results and extend the lessons learned to cover a broader range of results found in a typical plant AMR. Some new technical criteria, such as temperature thresholds for aging effects in common use by the industry, are added to further clarify applicability of the results. The bases for these new criteria are provided as part of the documentation for the proposed changes.

The documentation for the proposed changes is in two parts. In the first part, Attachment 1, Proposed Changes to NUREG-1801 Mechanical Systems Tables, each row of the tables has been rewritten into one or more rows with changes to the components, materials, environment and aging effects to simplify and standardize their presentation. In the modified tables, the shaded rows are

from the existing NUREG-1801 table; the un-shaded row(s) beneath each shaded row is a standardized presentation that maintains the essential information of the AMR. The changes to the components, materials, environment and aging effects are described in more detail in Sections 3.2 through 3.5 below. Where the proposed change may include a new technical criterion, a hyperlink (in blue text) leads to the bases for the criterion. Additional explanation or commentary on the interpretation of a given line of the tables is provided as a comment in the Word document.

In the second part, Restructured Mechanical Systems Tables (see Attachment 2), the revised rows from the tables have been copied to a new document, sorted by component, material and environment, and all duplicate rows have been eliminated. The resulting table contains all the essential information from the original tables in a compact form that can be compared directly to plant AMR results.

The restructured table is similar to the summary tables in Volume 1 of NUREG-1801. In the restructured tables, the first column contains the row number or numbers from Table 2 of Volume 1 (the rows are not currently numbered in NUREG-1801) that correspond to the row of the restructured table.

3.2 Minimize List of Specific Components

The suitability of programs to manage the aging effects of a particular material and environment combination is generally (not always, but generally) independent of the component type. NUREG-1801 acknowledges this fact by grouping some component types such as piping and fittings. But NUREG-1801 also makes separate listings of major components such as pumps and valves that could also be included as part of a general group. The specific listing of some components can lead to the interpretation that the AMR results can only be applied to the specific component types mentioned in the row. To eliminate this impression, components that share common MEAP combinations should be grouped under a general heading.

The complex configuration of some components, such as heat exchangers and reactor internals can lead to aging effects that would not occur or matter in other less complex configurations. For some components, an aging management program applicable to less complex configurations would not be appropriate. Consequently, some components and component types will still have to be listed separately. The objective should be to list components as generally as possible, listing specific components only where necessary to accommodate a different aging effect or aging management program.

3.3 Consolidate Materials

Materials are listed in various ways in NUREG-1801. In most cases, general material types (e.g., stainless steel, carbon steel, nickel alloy) are used, while in others (e.g., reactor vessels and some vendor internals), specific types of steel are specified.

Material types should be limited to those that are susceptible to different aging effects. That is, each material within the general material types should exhibit the same aging effects for a given environment. As a rule, the more general material types should be sufficient. Specific material types should be used only when it is susceptible to a unique aging effect.

Composite materials (e.g., carbon steel clad with stainless steel) should not be included in the list unless the aging effect, such as fatigue, would apply to the composite material. Otherwise, each material of a composite should be evaluated separately with its respective environment. For

example, a carbon steel tank with stainless cladding containing borated water should be evaluated as stainless steel in borated water, and carbon steel in air.

Multiple materials may be listed in a single entry provided the aging effect and program are the same for all materials.

Following is a sample list of general material types that encompasses most materials used at typical plants. This list does not include unique materials (e.g., ferritic stainless steel) that would be added on a plant specific basis.

Material	Includes
Aluminum alloy	
Aluminum/boron carbide	
Copper alloy >15% Zn	Copper, copper nickel and other alloys, brass/bronze <15% Zn, Aluminum bronze > 8% Al
Carbon steel	Carbon steel, low alloy steel, cast iron (other than gray cast iron)
Cast austenitic stainless steel	
Copper alloy < 15 % Zn	Copper, copper nickel and other alloys, brass/bronze <15% Zn, Aluminum bronze < 8% Al
Elastomers	rubber, EPT, EPDM, viton, vitril, neoprene, Silicone elastomer, etc.
Galvanized steel	
Glass	
Gray cast iron	
Masonry block	
Soils	
Nickel-based alloy	Alloy 600, inconel
Porcelain	
Reinforced concrete	
Stainless steel	Wrought Austenitic SS
Titanium alloy	

3.4 Use Consistent Environments

The environments listed in NUREG-1801 describe those typically found in the systems being reviewed. These should be revised to identify the pertinent aspects of the environment that influence the aging effects applicable to the material. The environment should identify the general chemical content (e.g., treated borated water) and if necessary, a temperature range that determines the applicability of aging effects. The table at the end of this section shows a sample list of environments that characterize most plant system and structure environments.

In the following sample table, the possible range of treated water chemistries is represented by two environments (treated water and treated borated water) with a range of temperatures. This simplified list of treated water environments may be used to report AMR results if the specific water

chemistry program (primary/secondary, CCW, auxiliary systems) is identified as part of the AMR results, from which the environment chemistry can be inferred.

In the following table, the environments listed with (Int/Ext) should identify whether the component surface is an internal or external surface. This information is important because it indicates the applicability of direct visual observation of the surface for aging management. For the remaining environments, this distinction need not be made since the environment must be internal to some barrier that precludes direct observation of the surface.

Environment	Description
Air – indoor (Int/Ext)	Indoor air on systems with temperatures higher than the dew point
Air with boric acid leakage (Int/Ext)	Air and untreated borated water leakage on indoor or outdoor systems with temperatures above or below the dew point
Air – outdoor (Int/Ext)	Exposed to air and local weather conditions
Condensation (Int/Ext)	Air and condensation on surfaces of indoor systems with temperatures below the dew point – for exterior surfaces, condensation is considered untreated water due to potential for surface contamination
Condensation with boric acid (Int/Ext)	Air and condensation with boric acid on surfaces of indoor systems with temperatures below the dew point – condensation is considered untreated water due to potential for surface contamination
Gas	Inert gases such as carbon dioxide, freon, halon, nitrogen,
Concrete	Components embedded in concrete
Exhaust gases	Gas present in a diesel engine exhaust
Raw water	Raw untreated fresh or salt water
Raw water >140°F	Raw untreated fresh or salt water above SCC threshold for stainless steel
Fuel oil	Fuel oil used for combustion engines
Lubricating oil	Lubricating oil for plant equipment
Sand and concrete	Sand/concrete base for tanks
Soil	External environment for components buried in the soil, including groundwater in the soil
Steam >220°F	Steam above the thermal fatigue threshold for carbon steel, subject to secondary plant water chemistry program
Steam >270°F	Steam above the thermal fatigue threshold for stainless steel, subject to secondary plant water chemistry program
Treated air	Air that is dried and filtered
Treated borated water	Treated water with boric acid
Treated borated water >140°F	Treated water with boric acid above SCC threshold for stainless steel
Treated borated water >270°F	Treated water with boric acid above thermal fatigue threshold for stainless steel
Treated borated water >482°F	Treated water with boric acid above thermal embrittlement threshold for CASS
Treated water	Treated or demineralized water
Treated water >140°F	Treated water above SCC threshold for stainless steel
Treated water >220°F	Treated water above thermal fatigue threshold for carbon steel

Environment	Description
Treated water >270°F	Treated water above thermal fatigue threshold for stainless steel
Treated water >482°F	Treated water above thermal embrittlement threshold for CASS
Reactor coolant	Primary water in the reactor coolant system and connected systems at or near full operating temperature
Untreated water	Water that may contain contaminants including oil and boric acid depending on the location – includes originally treated water that is not monitored by a chemistry program

3.5 Simplify Aging Effects

NUREG-1801 lists aging effects along with one or more aging mechanisms. The aging mechanisms, while useful to describe the considerations used in the generic aging management review, are generally not useful when comparing the plant AMR results to the NUREG-1801 results. Although aging mechanisms are considered during the plant AMR, the results are reported in terms of aging effects. The suitability of an aging management program is determined primarily on its ability to detect or prevent the overall aging effect rather than the individual aging mechanism.

An aging mechanism should be used to qualify an aging effect only where the particular mechanism will result in a different aging management program for a given component. For example, loss of material may be managed by a water chemistry program, while loss of material due to flow accelerated corrosion requires a separate program. Aging mechanisms in the proposed changes have been reduced to those necessary to support the choice of aging management program.

4. Additional Changes

In addition to the restructuring of the mechanical systems tables, all of the NUREG-1801 tables would benefit from the addition of MEAP combinations that are common to most applications, including those that have already been reviewed. Of particular interest are those with different materials or environments than those currently in NUREG-1801. The AMR process requires plants to evaluate such combinations whether they are included in NUREG-1801 or not. Inclusion in the restructured tables would increase the number of matches between the plant and NUREG-1801 AMR results and shorten the review time. Attachment 3 lists a few such additions.

Another way to reduce the application review effort would be to identify the minimum set of elements of an acceptable generic program to visually monitor systems. This type of aging management program (called system monitoring, system walkdown, etc.) is widely used to monitor systems for loss of material. It would not have to be incorporated into the restructured tables do provide some benefit, since the Appendix B descriptions of such programs consistent with the NUREG elements, would require less review. However, it could be incorporated by replacing some programs currently identified as plant specific.

NUREG-1801 describes generic AMR results for BWR and PWR plants. The component, material and environment columns of the AMR results describe the major components and component environments that are typically found in the systems reviewed. The details in these columns describe the components and environments in a way that clearly identifies the portion of the generic system to which the AMR results apply. The generic plant results are, by necessity, limited to major common components and presented in a way that gives the reader an understanding of the aging management review at the system and major component level.

To support the generic results, various materials, a range of environmental conditions, and an aging effect with a variety of aging mechanisms are typically listed in their respective columns for a given component. In some cases (e.g., heat exchangers), multiple materials exposed to multiple environments and an aging effect with a variety of mechanisms are listed for a single component with a single applicable aging management program.

While this type of detail makes sense for the presentation of AMR results for generic PWRs and BWRs, it does not lend itself to a direct comparison with the AMR results of a specific plant. Using the standard license renewal application format, AMR results are generally presented for component types with a single material exposed to a single environment. Making a match with the NUREG-1801 results (assuming the aging effects and programs match) frequently requires assumptions and interpretations of the NUREG-1801 results.

Many of these problems could be eliminated by restructuring the NUREG-1801 AMR results. The restructuring would make the results look more like those presented in the standard license renewal application format.

To demonstrate one possible approach to the restructuring, the mechanical systems tables of NUREG-1801, Volume 2, have been modified. Each row of the mechanical systems tables has been rewritten into one or more rows with changes to the components, materials, environment and aging effects to simplify and standardize their presentation. The shaded rows are from the existing NUREG-1801 table; the un-shaded row(s) beneath each shaded row is a standardized presentation that maintains the essential information of the AMR. Where the basis for the proposed change may not be self evident, additional explanation is provided by comment fields or by linked text (links in blue font).

IV **Reactor Vessel, Internals, and Reactor Coolant System**
C1. Reactor Coolant Pressure Boundary (Boiling Water Reactor)

(Later)

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.1-a C2.1.1 C2.1.2	Reactor coolant system piping and fittings Cold leg Hot leg	Stainless steel, cast austenitic stainless steel, carbon steel with stainless steel cladding	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.1-b C2.1.3 C2.1.4	Reactor coolant system piping and fittings Surge line Spray line	Surge line: stainless steel, cast austenitic stainless steel; spray line: stainless steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.1-c C2.1.1 C2.1.2 C2.1.3 C2.1.4	Reactor coolant system piping and fittings Cold leg Hot leg Surge line Spray line	Stainless steel, stainless steel cladding on carbon steel	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking (stainless steel piping), cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
36	Class 1 piping, fittings and components	Stainless steel, carbon steel with stainless steel cladding	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
C2.1-d C2.1.1 C2.1.2	Reactor coolant system piping and fittings Cold leg Hot leg (external surfaces)	Carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.1-e C2.1.1 C2.1.2 C2.1.3	Reactor coolant system piping and fittings Cold leg Hot leg Surge line	Cast austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, a plant-specific aging management program is to be evaluated. The program is to include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement.	Yes, plant specific
13	Class 1 piping, fittings and components	Cast austenitic stainless steel	Reactor coolant	Cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, a plant-specific aging management program is to be evaluated. The program is to include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement.	Yes, plant specific

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.1-f C2.1.1 C2.1.2 C2.1.3	Reactor coolant system piping and fittings Cold-leg Hot-leg Surge line	Cast austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
24	Class 1 piping, fittings and components	Cast austenitic stainless steel	Reactor coolant	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.1-g C2.1.5	Reactor coolant system piping and fittings RCS piping, fittings, and branch connections less than NPS 4	Stainless steel	Chemically treated, borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking, thermal and mechanical loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Inspection in accordance with ASME Section XI does not require volumetric examination of pipes less than NPS 4. A plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping is to be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the extended period of operation. The AMPs are to be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. See Chapter XI.M32, "One-Time Inspection" for an acceptable verification method.	Yes, parameters monitored/ inspected and detection of aging effects are to be evaluated

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
7	Class 1 piping, fittings and branch connections less than NPS 4	Stainless steel	Reactor coolant	Crack initiation and growth/ Stress corrosion cracking, thermal and mechanical loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Inspection in accordance with ASME Section XI does not require volumetric examination of pipes less than NPS 4. A plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping is to be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the extended period of operation. The AMPs are to be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. See Chapter XI.M32, "One-Time Inspection" for an acceptable verification method.	Yes, parameters monitored/ inspected and detection of aging effects are to be evaluated

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.2-a C2.2.1 C2.2.2 C2.2.3 C2.2.4	Connected systems piping and fittings Residual heat removal Core flood system High pressure injection system Chemical and volume control system	Stainless steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.2-b C2.2.5 C2.2.6	Connected systems piping and fittings Sampling system Drains and instrument lines	Carbon steel with stainless steel cladding, stainless steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.2-c C2.2.7	Connected systems piping and fittings Nozzles and safe ends	Stainless steel, cast austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
C2.2-d C2.2.5 C2.2.6	Connected systems piping and fittings Sampling system Drains and instrument lines (external surfaces)	Carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
C2.2-e C2.2.7	Connected systems piping and fittings Nozzles and safe ends	Cast austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
24	Class 1 piping, fittings and components	Cast austenitic stainless steel	Reactor coolant	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
C2.2-f C2.2.1 C2.2.2 C2.2.3 C2.2.4 C2.2.5 C2.2.6 C2.2.7	Connected systems piping and fittings Residual heat removal Core flood system High pressure injection system Chemical and volume control system Sampling system Drains and instrument lines Nozzles and safe ends	Stainless steel	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
36	Class 1 piping, fittings and components	Stainless steel, carbon steel with stainless steel or nickel-alloy cladding	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.2-g C2.2.7	Connected systems piping and fittings Nozzles and safe ends	Cast austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, a plant-specific aging management program is to be evaluated. The program is to include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement.	Yes, plant specific
13	Class 1 piping, fittings and components	Cast austenitic stainless steel	Reactor coolant	Cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, a plant-specific aging management program is to be evaluated. The program is to include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement.	Yes, plant specific

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.2-h C2.2.8	Connected systems piping and fittings Small-bore piping, fittings, and branch connections less than NPS 4 in connected systems	Stainless steel, carbon steel	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking, thermal and mechanical loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Inspection in accordance with ASME Section XI does not require volumetric examination of pipes less than NPS 4. A plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping is to be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the period of extended operation. The AMPs are to be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. See Chapter XI.M32, "One-Time Inspection" for an acceptable verification method.	Yes, parameters monitored/ inspected and detection of aging effects are to be evaluated

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
7	Class 1 piping, fittings and branch connections less than NPS 4	Stainless steel	Reactor coolant	Crack initiation and growth/ Stress corrosion cracking, thermal and mechanical loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Inspection in accordance with ASME Section XI does not require volumetric examination of pipes less than NPS 4. A plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping is to be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the extended period of operation. The AMPs are to be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. See Chapter XI.M32, "One-Time Inspection" for an acceptable verification method.	Yes, parameters monitored/ inspected and detection of aging effects are to be evaluated

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.3-a C2.3.1 C2.3.2	Reactor coolant pump Casing Cover	Bowl: cast austenitic stainless steel CF-8 or CF-8M, carbon steel with stainless steel cladding; cover: stainless steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.3-b C2.3.1-c	Reactor coolant pump casing	Cast austenitic stainless steel CF-8 or CF-8M, carbon steel with stainless steel cladding	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, see Chapter XI.M1, "ASME Section XI, Subsections IWB, IWC, and IWD."	No
36	Class 1 components	Cast austenitic stainless steel	Reactor coolant	Cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, see Chapter XI.M1, "ASME Section XI, Subsections IWB, IWC, and IWD."	No
36	Class 1 piping, fittings and components	Stainless steel, carbon steel with stainless steel cladding	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No

Comment: This line added to address carbon steel clad with stainless included in NUREG-1801 material list but not clearly addressed by programs

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.3-c C2.3.1	Reactor coolant pump Casing	Cast austenitic stainless steel CF-8 or CF-8M	Chemically treated borated water up to 340°C (644°F)	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components For pump casings, screening for susceptibility to thermal aging is not required.	No
23	Class 1 components	Cast austenitic stainless steel	Reactor coolant	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components For pump casings and valve bodies, screening for susceptibility to thermal aging is not required.	No
C2.3-d C2.3.3	Reactor coolant pump Closure bolting	High-strength low-alloy steel SA540 GrB23, SA193 GrB7	Air with metal temperature up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, carbon steel	System temperature up to 340°C (644°F)	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.3-e C2.3.3	Reactor coolant pump Closure bolting	High-strength low-alloy steel SA540 GrB23, SA193 GrB7	Air, leaking chemically treated borated water or steam up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No
26	Closure bolting	High-strength low-alloy steel, stainless steel	Air with boric acid and steam leakage (Ext)	Cracking	Chapter XI.M18, "Bolting Integrity"	No
C2.3-f C2.3.3	Reactor coolant pump Closure bolting	High-strength low-alloy steel SA540 GrB23, SA193 GrB7	Air, leaking chemically treated borated water or steam up to 340°C (644°F)	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
C2.3-g C2.3.3	Reactor coolant pump Closure bolting	High-strength low-alloy steel SA540 GrB23, SA193 GrB7	Air with metal temperature up to 340°C (644°F)	Loss of preload/ Stress relaxation	Chapter XI.M18, "Bolting Integrity"	No
26	Closure bolting	High-strength low-alloy steel, stainless steel	Air with boric acid and steam leakage (Ext)	Loss of preload	Chapter XI.M18, "Bolting Integrity"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.4-a C2.4.1 C2.4.2	Valves (check, control, hand, motor operated, relief, and containment isolation) Body Bonnet	Cast austenitic stainless steel CF-8M, SA182 F316, SA582 Type 416	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report, for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.4-b C2.4.1	Valves (check, control, hand, motor operated, relief, and containment isolation) Body	Cast austenitic stainless steel CF-8M	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, see Chapter XI.M1, "ASME Section XI, Subsections IWB, IWC, and IWD."	No
36	Class 1 components	Cast austenitic stainless steel	Reactor coolant	Cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, see Chapter XI.M1, "ASME Section XI, Subsections IWB, IWC, and IWD."	No
C2.4-c C2.4.1	Valves (check, control, hand, motor operated, relief, and containment isolation) Body	Cast austenitic stainless steel CF-8M	Chemically treated borated water up to 340°C (644°F)	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components For valve body, screening for susceptibility to thermal aging is not required.	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
23	Class 1 components	Cast austenitic stainless steel	Reactor coolant	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components For pump casings and valve bodies, screening for susceptibility to thermal aging is not required.	No
C2.4-d C2.4.3	Valves Closure bolting	High-strength low-alloy steel, stainless steel	Air with metal temperature up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, carbon steel	System temperature up to 340°C (644°F)	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
C2.4-e C2.4.3	Valves Closure bolting	High-strength low-alloy steel, stainless steel	Air, leaking chemically treated borated water or steam	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
26	Closure bolting	High-strength low-alloy steel, stainless steel	Air with boric acid and steam leakage (Ext)	Cracking	Chapter XI.M18, "Bolting Integrity"	No
C2.4-f C2.4.3	Valves Closure bolting	High-strength low-alloy steel	Air, leaking chemically treated borated water or steam	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
C2.4-g C2.4.3	Valves Closure bolting	High-strength low-alloy steel, stainless steel	Air with metal temperature up to 340°C (644°F)	Loss of preload/ Stress relaxation	Chapter XI.M18, "Bolting Integrity"	No
26	Closure bolting	High-strength low-alloy steel, stainless steel	Air with boric acid and steam leakage (Ext)	Loss of preload	Chapter XI.M18, "Bolting Integrity"	No
C2.5-a C2.5.1	Pressurizer Shell/heads	Low-alloy steel with stainless steel or alloy 600 cladding	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
C2.5-b C2.5.1	Pressurizer Shell/heads (outer surfaces)	Low-alloy steel	Air, leaking chemically treated borated water or steam up to 340°C (644°F)	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-c C2.5.1	Pressurizer: Shell/heads	Low-alloy steel with type 308, 308L, or 309 stainless steel or alloy 82 or 182 cladding	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Crack initiation and growth/ Stress corrosion cracking, cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components. and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Cracks in the pressurizer cladding could propagate from cyclic loading into the ferrite base metal and weld metal. However, because the weld metal between the surge nozzle and the vessel lower head is subjected to the maximum stress cycles and the area is periodically inspected as part of the ISI program, the existing AMP is adequate for managing the effect of pressurizer clad cracking.	No
36	Pressurizer components	Carbon steel with stainless steel or nickel-alloy cladding; or stainless steel	Reactor coolant	Cracking/ Stress corrosion cracking, cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Cracks in the pressurizer cladding could propagate from cyclic loading into the ferrite base metal and weld metal. However, because the weld metal between the surge nozzle and the vessel lower head is subjected to the maximum stress cycles and the area is periodically inspected as part of the ISI program, the existing AMP is adequate for managing the effect of pressurizer clad cracking.	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-d C2.5.2 C2.5.4	Pressurizer Spray line nozzle Spray head	Nozzle: carbon steel or low-alloy steel with stainless steel cladding; spray head: alloy 600, stainless steel, cast austenitic stainless steel	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-e C2.5.3	Pressurizer, Surge line nozzle	Carbon steel or low-alloy steel with stainless steel cladding, cast austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-f C2.5.5 C2.5.6 C2.5.7	Pressurizer Thermal sleeves Instrument penetrations Safe ends	Thermal sleeves: alloy 600; penetrations: Alloy 600, stainless steel; safe ends: stainless steel	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-g C2.5.2 C2.5.3 C2.5.6	Pressurizer Spray line nozzle Surge line nozzle Instrument penetrations	Carbon steel or low-alloy steel with stainless steel cladding; or stainless steel	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M1; "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Cracks in the pressurizer cladding could propagate from cyclic loading into the ferrite base metal and weld metal. However, because the weld metal between the surge nozzle and the vessel lower head is subjected to the maximum stress cycles and the area is periodically inspected as part of the ISI program, the existing AMP is adequate for managing the effect of pressurizer clad cracking.	No
36	Pressurizer components	Carbon steel with stainless steel or nickel-alloy cladding; or stainless steel	Reactor coolant	Cracking/ Stress corrosion cracking, cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 Cracks in the pressurizer cladding could propagate from cyclic loading into the ferrite base metal and weld metal. However, because the weld metal between the surge nozzle and the vessel lower head is subjected to the maximum stress cycles and the area is periodically inspected as part of the ISI program, the existing AMP is adequate for managing the effect of pressurizer clad cracking.	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-h C2.5.7	Pressurizer Safe ends	Stainless steel	Chemically treated borated water or saturated steam. 290-343°C (554-650°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
36	Class 1 piping, fittings and components	Stainless steel, carbon steel with stainless steel or nickel-alloy cladding	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
C2.5-i C2.5.3	Pressurizer Surge line nozzle	Cast austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, a plant-specific aging management program is to be evaluated. The program is to include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement.	Yes, plant specific

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
13	Class 1 piping, fittings and components	Cast austenitic stainless steel	Reactor coolant	Cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later revisions or update) minimize the potential of SCC, and material selection according to the NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite has reduced susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, a plant-specific aging management program is to be evaluated. The program is to include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement.	Yes, plant specific
C2.5-j C2.5.4	Pressurizer Spray head	Alloy 600, stainless steel, cast austenitic stainless steel	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Crack initiation and growth/ Primary water stress corrosion cracking, stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
12	Pressurizer Spray head	Nickel-alloy, stainless steel, cast austenitic stainless steel	Reactor coolant	Cracking/ Primary water stress corrosion cracking, stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-k C2.5.6	Pressurizer Instrument penetrations	Alloy 600	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Crack initiation and growth/ Primary water stress corrosion cracking (PWSCC)	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components, Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 and the applicant is to provide a plant-specific AMP or participate in industry programs to determine appropriate AMP for PWSCC of Inconel 182 weld.	Yes, an AMP for PWSCC of Inconel 182 weld is to be evaluated
14	Class 1 fittings and components	Nickel-alloy	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components, Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 and the applicant is to provide a plant-specific AMP or participate in industry programs to determine appropriate AMP for PWSCC of Inconel 182 weld.	Yes, AMP for PWSCC of Inconel 182 weld is to be evaluated
C2.5-l C2.5.3 C2.5.4	Pressurizer Surge line nozzle Spray head	Cast austenitic stainless steel	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
24	Class 1 piping, fittings and components	Cast austenitic stainless steel	Reactor coolant	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-m C2.5.8	Pressurizer Manway and flanges	Low-alloy steel with type 308, 308L, or 309 stainless steel cladding; or alloy 82 or 182 cladding	Chemically treated borated water or saturated steam 290-343°C (554-650°F)	Crack initiation and growth/ Stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
36	Class 1 piping, fittings and components	Stainless steel, carbon steel with stainless steel or nickel-alloy cladding	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
C2.5-n C2.5.9	Pressurizer Manway and flange bolting	High-strength low-alloy steel	Air, leaking chemically treated borated water or steam up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No
26	Closure bolting	High-strength low-alloy steel, stainless steel	Air with boric acid and steam leakage (Ext)	Cracking	Chapter XI.M18, "Bolting Integrity"	No
C2.5-o C2.5.8 C2.5.9	Pressurizer Manway and flanges Manway and flange bolting	Low-alloy steel, High-strength low-alloy steel	Air, leaking chemically treated borated water or steam up to 340°C (644°F)	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-p C2.5.9	Pressurizer Manway and flange bolting	High-strength low-alloy steel	Air, leaking chemically treated borated water or steam up to 340°C (644°F)	Loss of preload/ Stress relaxation	Chapter XI.M18, "Bolting Integrity"	No
26	Closure bolting	High-strength low-alloy steel, stainless steel	Air with boric acid and steam leakage (Ext)	Loss of preload	Chapter XI.M18, "Bolting Integrity"	No
C2.5-q C2.5.10	Pressurizer Heater sheaths and sleeves	Alloy 600 or austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	Class 1 piping, fittings and components	Stainless steel, cast austenitic stainless steel, carbon steel with nickel-alloy or stainless steel cladding, nickel-alloy	Reactor coolant	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii), and for addressing environmental effects on fatigue. See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
C2.5-r C2.5.10	Pressurizer Heater sheaths and sleeves	Austenitic stainless steel	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
36	Class 1 piping, fittings and components	Stainless steel, carbon steel with stainless steel or nickel-alloy cladding	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.5-s C2.5.10	Pressurizer Heater sheaths and sleeves	Alloy 600	Chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Primary water stress corrosion cracking (PWSCC)	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components, Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 and the applicant is to provide a plant-specific AMP or participate in industry programs to determine appropriate AMP for PWSCC of Inconel 182 weld.	Yes, AMP for PWSCC of Inconel 182 weld is to be evaluated
14	Class 1 fittings and components	Nickel-alloy	Reactor coolant	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components, Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 and the applicant is to provide a plant-specific AMP or participate in industry programs to determine appropriate AMP for PWSCC of Inconel 182 weld.	Yes, AMP for PWSCC of Inconel 182 weld is to be evaluated
C2.5-t C2.5.11	Pressurizer Support keys, skirt, and shear lugs	Carbon steel, low-alloy steel	Air, with metal temperatures up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	Class 1 piping, fittings and components	Stainless steel, carbon steel	System temperature up to 340°C (644°F)	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
C2.5-u C2.5.12	Pressurizer Integral support	Carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
C2.5-v C2.5.12	Pressurizer Integral support	Carbon steel, stainless steel	Air	Crack initiation and growth/ Cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No
41	Class 1 piping, fittings and components	Stainless steel, carbon steel	System temperature up to 340°C (644°F)	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No
C2.5-w C2.5.12	Pressurizer Integral support	Carbon steel, stainless steel	Air	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	Class 1 piping, fittings and components	Stainless steel, carbon steel	System temperature up to 340°C (644°F)	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA
C2.6-a C2.6.1 C2.6.2	Pressurizer relief tank Tank shell and heads Flanges and nozzles	Carbon steel with type 304 stainless steel cladding	Chemically treated borated water at 93°C (200°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report, for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes; TLAA
1	General piping and components	Carbon steel with type 304 stainless steel cladding	Treated borated water > 270°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.M1 of this report, for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

IV Reactor Vessel, Internals, and Reactor Coolant System
C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.6-b C2.6.1	Pressurizer relief tank: Tank shell and heads (external surfaces)	Carbon steel	Air, leaking chemically treated borated water at 93°C (200°F)	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
38	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
C2.6-c C2.6.1 C2.6.2	Pressurizer relief tank: Tank shell and heads Flanges and nozzles	Carbon steel with type 304 stainless steel cladding	Chemically treated borated water at 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 2 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI-TR-105714	No
36	General piping, fittings and components	Stainless steel, carbon steel with stainless steel cladding	Treated borated water >140°F	Cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No

IV Reactor Vessel, Internals, and Reactor Coolant System
D1. Steam Generator (Recirculating)

(Later

IV Reactor Vessel, Internals, and Reactor Coolant System
D2. Steam Generator (Once-Through)

(Later

V Engineered Safety Features

A. Containment Spray System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A.1-a A.1.1 A.1.2 A.1.3	Piping, fittings and miscellaneous items Piping and fittings up to isolation valve Flow orifice/elements Temperature elements/ indicators	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.1-b A.1.4	Containment spray system Bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A.1-c A.1.5	Containment spray system Eductors	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.2-a A.2.1 A.2.2 A.2.3 A.2.4	Headers and spray nozzles Piping and fittings Flow orifice Headers Spray nozzles	Carbon steel	Air	Loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components internal surfaces	Carbon steel	Air – indoor (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Comment: This may need to be made more component specific if a component specific program is required to examine the internal surfaces of the spray piping/components

V Engineered Safety Features
A. Containment Spray System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
A.3-a A.3.1	Pump Bowl/casing	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.3-b A.3.2	Pump Bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A.4-a A.4.1	Valves (hand, control, check, motor-operated, and containment isolation) in containment spray system Body and bonnet	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A.4-b A.4.2	Valves (hand, control, check, motor-operated, and containment isolation) in containment spray system Bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

V Engineered Safety Features
A. Containment Spray System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A.5-a A.5.1	Valves (hand, control and containment isolation) in headers and spray nozzles Body and bonnet	Carbon Steel	Air	Loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components internal surfaces	Carbon steel	Air – indoor (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
A.5-b A.5.2	Valves (hand, control and containment isolation) in headers and spray nozzles Bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A.6-a A.6.1 A.6.2 A.6,3 A.6.4	Containment spray heat exchanger (serviced by open-cycle cooling water) Bonnet/cover Tubing Shell Case/cover	Carbon steel, stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Loss of material/ General and microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Comment: This may need to be made more component specific if a component specific program is required to examine the internal surfaces of the spray piping/components

Comment: Aging effects for parts not covered in the next two lines are covered by the general entries elsewhere in this table.

Comment: This includes shell side of tubes. Tube side of Hx will be stainless in treated borated water

V Engineered Safety Features
A. Containment Spray System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A.6-b A.6.2	Containment spray heat exchanger (serviced by open-cycle cooling water) Tubing	Carbon steel, stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated borated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
A.6-c A.6.1 A.6.2 A.6.3 A.6.4	Containment spray heat exchanger (serviced by closed-cycle cooling water) Bonnet/cover Tubing Shell Case/cover	Carbon steel, stainless steel	Chemically treated borated water on tube side and closed-cycle cooling water on shell side	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
A.6-d A.6.3 A.6.4 A.6.5	Containment spray heat exchanger Shell Case/cover (external surfaces) Bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

Comment: Not clear why carbon steel used for tubes which would see borated water.

Comment: Fouling on treated water side is assumed to be managed by heat transfer monitoring of OCCW program

V Engineered Safety Features
B. Standby Gas Treatment Systems (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
B.1-a B.1.1 B.1.2	Ductwork Fittings, access doors, and closure bolts Equipment frames and housing	Carbon steel	Internal: occasional exposure to moist air; external: ambient plant air environment	Loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components internal surfaces	Carbon steel	Condensation	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
B.1-b B.1.3 B.1.4	Ductwork Seals between ducts and fan Seals in dampers and doors	Elastomer (Neoprene)	Internal: occasional exposure to moist air; external: ambient plant air environment	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
7	Elastomer seals	Elastomer	Condensation	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
7	Elastomer seals	Elastomer	Air – indoor (Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
B.2-a B.2.1	Filters Housing and supports	Carbon steel	Internal: occasional exposure to moist air; external: ambient plant air environment	Loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific

3	Piping and components internal surfaces	Carbon steel	Condensation	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
B.2-b B.2.2	Filters Elastomer seals	Elastomers (Neoprene and similar materials)	Occasional exposure to moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
7	Elastomer seals	Elastomer	Condensation	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Engineered Safety Features
C. Containment Isolation Components

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C.1-a C.1.1 C.1.2	BWR and PWR isolation barriers Valve body and bonnet Pipe penetrations (piping between two isolation valves)	Carbon steel and low-alloy steel	Inside surface: treated or raw water, liquid waste; outside surface: ambient air	Loss of material/ General, pitting, crevice and microbiologically influenced corrosion and biofouling	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
3, 5, 6	Piping and components internal surfaces	Carbon steel	Treated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
3, 5, 6	Piping and components internal surfaces	Carbon steel	Untreated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
3, 5, 6	Piping and components external surfaces	Carbon steel	Condensation	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
C.1-b C.1.1 C.1.2	BWR and PWR isolation barriers Valve body and bonnet Pipe penetrations (piping between two isolation valves)	Stainless steel	Inside surface: treated or raw water, liquid waste; outside surface: ambient air	Loss of material/ Pitting, crevice and microbiologically influenced corrosion and biofouling	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
5, 6	Piping and components internal surfaces	Stainless steel	Treated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
5, 6	Piping and components internal surfaces	Stainless steel	Untreated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific

Comment: Treated water and untreated water cover the liquid environments in systems with containment penetrations that are otherwise out of scope

Comment: Treated water and untreated water cover the liquid environments in systems with containment penetrations that are otherwise out of scope. Outside surface of stainless not covered since NUREG-1801 typically ignores stainless in air or condensation.

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D1.1-a D1.1.1 D1.1.2 D1.1.3 D1.1.4 D1.1.5 D1.1.6	Piping and fittings Core flood system Residual heat removal or shutdown cooling High-pressure safety injection Low-pressure safety injection Connecting lines to chemical and volume control system Spent fuel pool cooling lines to emergency sump	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
D1.1-b D1.1.1 D1.1.2 D1.1.3 D1.1.4 D1.1.5 D1.1.6	Piping and fittings Core flood system Residual heat removal or shutdown cooling High-pressure safety injection Low-pressure safety injection Connecting lines to chemical and volume control system Spent fuel pool cooling lines to emergency sump	Cast austenitic stainless steel	Chemically treated borated water at temperature 25–340°C (77-644°F)	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
11	General piping and components	Cast austenitic stainless steel	Treated borated water > 482°F	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
D1.1-c D1.1.1 D1.1.2 D1.1.3 D1.1.4	Piping and fittings Core flood system Residual heat removal or shutdown cooling High-pressure safety injection Low-pressure safety injection	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Stainless steel	Treated borated water > 270°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
D1.1-d D1.1.7	Piping and fittings Bolting for flange connections in items D1.1.1 through D1.1.6	Nuts: carbon steel; bolts/studs: alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.2-a D1.2.1	HPSI and LPSI pumps Bowl/casing	Stainless steel, carbon steel with stainless steel cladding	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
D1.2-b D1.2.1 D1.2.2	HPSI and LPSI pumps Bowl/casing (external surfaces) Bolting	Casing: carbon steel with stainless steel cladding; nuts: carbon steel; bolts/studs: alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.2-c D1.2.3	HPSI and LPSI pumps Orifice (miniflow recirculation)	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Loss of material/ Erosion	A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. See LER 50-275/94-023 for evidence of erosion.	Yes, plant specific
8	Orifice (miniflow recirculation)	Stainless steel	Treated borated water	Loss of material/ Erosion	A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. See LER 50-275/94-023 for evidence of erosion.	Yes, plant specific
D1.3-a D1.3.1	RWT circulation pump Bolting	Nuts: carbon steel; bolts/studs: alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.4-a D1.4.1	Valves (check, control, hand, motor operated, and relief valves) Body and bonnet	Stainless steel, carbon steel with stainless steel cladding	Chemically treated borated water at temperature < 93°C (200°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Stainless steel	Treated borated water > 270°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
D1.4-b D1.4.1	Valves (check, control, hand, motor operated, and relief valves) Body and bonnet	Stainless steel, carbon steel with stainless steel cladding	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
D1.4-c D1.4.1 D1.4.2	Valves (check, control, hand, motor operated, and relief valves) Body and bonnet (external surfaces) Bolting	Body and bonnet: carbon steel; nuts: carbon steel; bolts/studs: alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D1.5-a D1.5.1 D1.5.2 D1.5.3 D1.5.4	Heat exchangers (reactor coolant pump seal, HPSI pump seal, LPSI pump seal, RHR or SDC) Bonnet/cover Tubing Shell Case/cover	Bonnet/ cover and tubing: stainless steel; shell: carbon steel; case/cover: cast iron	Chemically treated borated water; and treated component cooling water	Loss of material/ Pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
D1.5-b D1.5.3 D1.5.4 D1.5.5	Heat exchangers (RCP seal, HPSI pump seal, LPSI pump seal, RHR or SDC) Shell Case/cover (external surfaces) Bolting	Shell: carbon steel; case/cover: cast iron; nuts: carbon steel; bolts/studs: alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.6-a D1.6.1 D1.6.2 D1.6.3	Heat exchanger (RWT heating) serviced by closed-cycle cooling water Bonnet/cover Tubing Shell	Bonnet/ cover and tubing: stainless steel; shell: carbon steel	Chemically treated borated water and treated component cooling water	Loss of material/ Pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

Comment: LOM for inside of tubes (stainless in treated borated water not addressed.

Comment: LOM for inside of tubes (stainless in treated borated water not addressed.

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D1.6-b D1.6.1 D1.6.2 D1.6.3	Heat exchanger (RWT Heating) serviced by open-cycle cooling water Bonnet/cover Tubing Shell	Carbon steel, stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Loss of material/ General (carbon steel only), pitting, crevice, and microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
D1.6-c D1.6.2	Heat exchanger (RWT heating) serviced by open-cycle cooling water Tubing	Carbon steel, stainless steel	Chemically treated borated water on one side and open-cycle cooling water (raw water) on the other side	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated borated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Comment: Effects of fouling assumed covered in next line of NUREG

Comment: LOM for inside of tubes (stainless in treated borated water not addressed.

Comment: Not clear why carbon steel listed for tubes here

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D1.6-d D1.6.3 D1.6.4	Heat exchanger (RWT heating) Shell (external surface) Bolting	Shell: carbon steel; nuts: carbon steel; bolts/studs: alloy steel	Air, leaking chemically treated borated water	Loss of Material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.7-a D1.7.1 D1.7.2 D1.7.3	Safety injection tank (accumulator) Shell Manway Penetrations/ nozzles (all external surface)	Carbon steel with stainless steel cladding	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.7-b D1.7.3	Safety injection tank (accumulator) Penetrations/nozzles	Carbon steel with stainless steel cladding	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
D1.8-a D1.8.1 D1.8.2 D1.8.3	Refueling water tank (RWT) Shell Manhole Penetrations/nozzles	Stainless steel	Chemically treated borated water at temperature < 93°C (200°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No

V Engineered Safety Features
D1. Emergency Core Cooling System (Pressurized Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
D1.8-b D1.8.4	Refueling water tank (RWT) Bolting	Nuts: carbon steel; bolts/studs: alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
D1.8-c D1.8.5	Refueling water tank (RWT) Buried portion of tank (outer surface)	Stainless steel	Moisture, water	Loss of material/ Pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottom because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes, plant specific
5	Buried and partially buried tanks	Stainless steel	Soil	Loss of material	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottom because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes, plant specific

Engineered Safety Features
D2. Emergency Core Cooling system (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D2.1-a D2.1.1 D2.1.2 D2.1.3 D2.1.4 D2.1.5 D2.1.6 D2.1.7	Piping and fittings High-pressure coolant injection Reactor core isolation cooling High-pressure core spray Low-pressure core spray Low-pressure coolant injection and residual heat removal Lines to suppression chamber Lines to drywell and suppression chamber spray system	Carbon steel	25–288°C (77-550°F) demineralized water	Loss of material/ General, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2, 4	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
D2.1-b D2.1.1	Piping and fittings HPCI	Carbon steel, stainless steel	25–288°C (77-550°F) demineralized water	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

Engineered Safety Features
D2. Emergency Core Cooling system (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Carbon steel	Treated water > 220°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
1	General piping and components	Stainless steel	Treated water > 270°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
D2.1-c D2.1.1 HPCI D2.1.2 RCIC D2.1.3 HPCS D2.1.4 LPCS D2.1.5 LPCI and RHR D2.1.6 Lines to SC D2.1.7 Lines to DSCSS	Piping and fittings	Stainless steel	25–288°C (77-550°F) demineralized water	Crack initiation and growth/ Stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
16	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
D2.1-d D2.1.1 HPCI D2.1.2 RCIC D2.1.3 HPCS D2.1.4 LPCS D2.1.5 LPCI and RHR D2.1.6 Lines to SC D2.1.7 Lines to DSCSS	Piping and fittings	Cast austenitic stainless steel	25–288°C (77-550°F) demineralized water	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

Engineered Safety Features
D2. Emergency Core Cooling system (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
11	General piping and components	Cast austenitic stainless steel	Treated water > 482°F	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
D2.1-e D2.1,8	Piping and fittings Automatic depressurization system	Carbon steel, stainless steel	Moist containment atmosphere (air/nitrogen), steam, or demineralized water	Loss of material/ General (carbon steel only), pitting, and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3, 5	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
3, 5	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
3, 5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3, 5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Comment: It was not clear that a plant specific program would be applied to all parts of this subsystem. Water chemistry was assumed appropriate for internal surfaces upstream of the valves

Engineered Safety Features
D2. Emergency Core Cooling system (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D2.1-f D2.1.9 D2.1.10	Piping and fittings Lines to HPCI and RCIC pump turbine Lines from HPCI and RCIC pump turbine to torus or wetwell	Carbon steel	Air and steam up to 320°C (608°F)	Wall thinning/ Flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
14	General piping and components	Carbon steel	Air and steam	Loss of material/ Flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
D2.2-a D2.2.1 D2.2.2 D2.2.3	Pumps HPCS or HPCI main and booster, LPCS, LPCI or RHR, and RCIC Bowl/casing Suction head Discharge head	Carbon steel casting, carbon steel	25–288°C (77-550°F) demineralized water	Loss of material/ General, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2, 4	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
D2.3-a D2.3.1	Valves (check, control, hand, motor operated, and relief valves) Body and bonnet	Carbon steel forging, carbon steel casting	25–288°C (77-550°F) demineralized water	Wall thinning/ Flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
14	General piping and components	Carbon steel	Treated water	Loss of material/ Flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No

Engineered Safety Features
D2. Emergency Core Cooling system (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D2.3-b D2.3.1	Valves (check, control, hand, motor operated, and relief valves) Body and bonnet	Carbon steel forging, carbon steel casting	25–288°C (77-550°F) demineralized water	Loss of material/ General, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verification of its effectiveness of the water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2, 4	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
D2.3-c D2.3.1	Valves (check, control, hand, motor operated, and relief valves) Body and bonnet	Stainless steel forging, stainless steel casting	25–288°C (77-550°F) demineralized water	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
16	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
D2.4-a D2.4.1 D2.4.2 D2.4.3 D2.4.4	Heat exchangers (RHR and LPCI) (serviced by open-cycle cooling water) Tubes Tubesheet Channel head Shell	Carbon steel, stainless steel	Demineralized water on one side; open-cycle cooling water (raw water) on the other side	Loss of material/ General (carbon steel only), pitting, crevice, and microbiologically influenced corrosion, and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Engineered Safety Features
D2. Emergency Core Cooling system (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
12	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
D2.4-b D2.4.1	Heat exchangers (RHR and LPCI) (serviced by open-cycle cooling water) Tubes	Carbon steel, stainless steel	Demineralized water on one side; open-cycle cooling water (raw water) on the other side	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
D2.4-c D2.4.1 D2.4.2 D2.4.3 D2.4.4	Heat exchangers (RHR and LPCI) (serviced by closed-cycle cooling water) Tubes Tubesheet Channel head Shell	Carbon steel, stainless steel	Demineralized water on one side; closed-cycle cooling water (treated water) on the other side	Loss of material/ General (carbon steel only), pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
D2.5-a D2.5.1 D2.5.2 D2.5.3 D2.5.4	Drywell and suppression chamber spray system Piping and fittings Flow orifice Headers Spray nozzles	Carbon steel	Air	Loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components internal surfaces	Carbon steel	Air – indoor (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Comment: These two lines also assume the tubes are stainless. If the tubes can be carbon steel, carbon steel should be added to both lines

Comment: This may need to be made more component specific if a component specific program is required to examine the internal surfaces of the spray piping/components

Engineered Safety Features
D2. Emergency Core Cooling system (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
D2.5-b D2.5.1 D2.5.2 D2.5.3 D2.5.4	Drywell and suppression chamber spray system Piping and fittings Flow orifice Headers Spray nozzles	Carbon steel	Air	Plugging of flow orifice and spray nozzles/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
9	Drywell and suppression chamber spray system (internal surfaces Flow orifice Spray nozzles	Carbon steel	Air – indoor (Int)	Macrofouling	A plant-specific aging management program is to be evaluated.	Yes, plant specific

V Engineered Safety Features
E. Carbon Steel Components

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E.1-a E.1.1	Carbon steel components (PWRs) External surfaces	Carbon steel, low-alloy steel	Air, leaking and dripping chemically treated borated water up to 340°C (644°F)	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E.1-b E.1.1	Carbon steel components (PWRs and BWRs) External surfaces	Carbon steel, low-alloy steel	Air, moisture, and humidity < 100°C (212°F)	Loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
10	Piping and components external surfaces and bolting	Carbon steel	Condensation	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
E.2-a E.2.1	Closure bolting In high-pressure or high-temperature systems	Carbon steel, low-alloy steel	Air, moisture, humidity, and leaking fluid	Loss of material/ General corrosion	Chapter XI.M18, "Bolting Integrity"	No
18	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Condensation	Loss of material	Chapter XI.M18, "Bolting Integrity"	No
E.2-b E.2.1	Closure bolting In high-pressure or high-temperature systems	Carbon steel, low-alloy steel	Air, moisture, humidity, and leaking fluid	Crack initiation and growth/ Cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No
18	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Condensation	Cracking	Chapter XI.M18, "Bolting Integrity"	No

VII Auxiliary Systems
A1. New Fuel Storage

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A1.1-a A1.1.1	New fuel rack New fuel rack assembly	Carbon steel	Indoors: exposed to variable temperature and humidity inside the auxiliary building or fuel handling building	Loss of material/ General, pitting, and crevice corrosion	Chapter XI.S6, "Structures Monitoring Program"	No
11	Structural Steel	Carbon steel	Air – indoor (Int)	Loss of material	Chapter XI.S6, "Structures Monitoring Program"	No

Comment: The temperature of the material (ambient) is expected to be higher than the dew point. I.e., Internal room conditions rarely ever result in condensation on walls and equipment, especially the racks which are typically well protected.

VII Auxiliary Systems
A2. Spent Fuel Storage

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A2.1-a A2.1.1	Spent fuel storage racks Neutron-absorbing sheets	Boraflex	Chemically treated oxygenated (BWR) or borated (PWR) water	Reduction of neutron-absorbing capacity/ Boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No
12	Spent fuel storage racks Neutron-absorbing sheets	Boraflex	Treated water	Reduction of neutron-absorbing capacity/ Boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No
12	Spent fuel storage racks Neutron-absorbing sheets	Boraflex	Treated borated water	Reduction of neutron-absorbing capacity/ Boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No
A2.1-b A2.1.1	Spent fuel storage racks Neutron-absorbing sheets	Boral, boron steel	Chemically treated oxygenated (BWR) or borated (PWR) water	Reduction of neutron-absorbing capacity and loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
10	Spent fuel storage racks Neutron-absorbing sheets	Boral, boron steel	Treated water	Reduction of neutron-absorbing capacity and loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
10	Spent fuel storage racks Neutron-absorbing sheets	Boral, boron steel	Treated borated water	Reduction of neutron-absorbing capacity and loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific

A2.1-c A2.1.2	Spent fuel storage racks Storage racks	Stainless steel	Chemically treated oxygenated (BWR) or borated (PWR) water	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515), or PWR primary water in EPRI TR-105714	No
13	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
13	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A3.1-a A3.1.1	Piping Closure bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A3.2-a A3.2.1	Filter Housing	Carbon steel with elastomer lining	Chemically treated borated water	Loss of material/ Pitting and crevice corrosion (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
1	General piping and components	Carbon steel with elastomer lining	Treated borated water	Loss of material (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2	Elastomer lining	Elastomers	Treated borated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A3.2-b A3.2.1	Filter Housing (external surface)	Carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

Comment: This line does not belong here necessarily (copied from below), but it might make sense to cover the elastomer separately.

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A3.2-c A3.2.2	Filter Closure bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A3.2-d A3.2.3	Filter Elastomer lining	Elastomers	Chemically treated borated water	Hardening, cracking/ Elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer lining	Elastomers	Treated borated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A3.3-a A3.3.1	Valves (check and hand valves) Body and bonnet	Carbon steel with elastomer lining	Chemically treated borated water	Loss of material/ Pitting and crevice corrosion (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714. *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
1	General piping and components	Carbon steel with elastomer lining	Treated borated water	Loss of material (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2	Elastomer lining	Elastomers	Treated borated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific

Comment: This line does not belong here necessarily (copied from above), but it might make sense to cover the elastomer separately.

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A3.3-b A3.3.1	Valves (check and hand valves) Body and bonnet	Carbon steel with stainless steel cladding	Chemically treated borated water	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
13	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
A3.3-c A3.3.1 A3.3.2	Valves (check and hand valves) Body and bonnet (external surface) Closure bolting	Body: carbon steel; bolting: carbon steel or low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A3.3-d A3.3.3	Valves (hand valve only) Elastomer lining	Elastomers	Chemically treated borated water	Hardening, cracking/ Elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer lining	Elastomers	Treated borated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A3.4-a A3.4.1 A3.4.2	Heat exchanger (serviced by closed-cycle cooling water system) Shell and access cover Channel head and access cover	Carbon steel	Shell side: closed-cycle cooling water (treated water)	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A3.4-b A3.4.1 A3.4.2 A3.4.3	Heat exchanger (serviced by closed-cycle cooling water system) Shell and access cover Channel head and access cover (external surface) Closure bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A3.5-a A3.5.1 A3.5.2	Ion exchanger (demineralizer) Shell Nozzles	Carbon steel with elastomer lining	Chemically treated borated water	Loss of material/ Pitting and crevice corrosion (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
1	General piping and components	Carbon steel with elastomer lining	Treated borated water	Loss of material (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2	Elastomer lining	Elastomers	Treated borated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A3.5-b A3.5.1 A3.5.2 A3.5.3	Ion exchanger (demineralizer) Shell (external surface) Nozzles (external surface) Closure bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

Comment: This line does not belong here necessarily (copied from above), but it might make sense to cover the elastomer separately.

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
A3.5-c A3.5.4	Ion exchanger (demineralizer) Elastomer lining	Elastomers	Chemically treated borated water	Hardening, cracking/ Elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer lining	Elastomers	Treated borated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A3.6-a A3.6.1	Pump Closure bolting	Carbon steel, low-alloy steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A4.1-a A4.1.1	Piping Piping, fittings, and flanges	Stainless steel	Chemically-treated oxygenated water up to 50°C (125°F)	Loss of material/ Pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
1	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
A4.2-a A4.2.1	Filter Housing	Stainless steel; carbon steel with elastomer lining; or stainless steel cladding	Chemically treated oxygenated water up to 50°C (125°F)	Loss of material/ Pitting and crevice corrosion (only for carbon steel after lining/cladding degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated

Comment: Note that GALL does not include SCC in this lower temperature environment. Also interesting that GALL recognizes loss of material for stainless in oxygenated water but not borated water

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Carbon steel with elastomer lining, or stainless steel cladding	Treated water	Loss of material (only for carbon steel after lining/cladding degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2	Elastomer lining	Elastomers	Treated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A4.2-b A4.2.2	Filter Elastomer lining	Elastomers	Chemically treated oxygenated water up to 50°C (125°F)	Hardening, cracking/ Elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer lining	Elastomers	Treated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A4.3-a A4.3.1	Valves (check and hand valves) Body and bonnet	Stainless steel; carbon steel with elastomer lining, or stainless steel cladding	Chemically treated oxygenated water up to 50°C (125°F)	Loss of material/ Pitting and crevice corrosion (only for carbon steel after lining/cladding degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated

Comment: Stainless excluded as independent material since effect only applies to carbon steel. Stainless otherwise covered by previous entry.

Comment: This line does not belong here necessarily (copied from above), but it might make sense to cover the elastomer separately.

Comment: This is assumed to mean that stainless by itself has no aging effects.

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Carbon steel with elastomer lining, or stainless steel cladding	Treated water	Loss of material (only for carbon steel after lining/cladding degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2	Elastomer lining	Elastomers	Treated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A4.3-b A4.3.2	Valves (hand valve only) Elastomer lining	Elastomers	Chemically treated oxygenated water up to 50°C (125°F)	Hardening, cracking/ Elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer lining	Elastomers	Treated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A4.4-a A4.4.1 A4.4.2 A4.4.3	Heat exchanger (serviced by closed-cycle cooling water system) Shell and access cover Channel head and access cover Tubes	Carbon steel	Shell side: closed-cycle cooling water	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

Comment: This line does not belong here necessarily (copied from above), but it might make sense to cover the elastomer separately.

Comment: The next GALL entry lists only stainless for tubes which seems more reasonable. Will address carbon steel tubes anyway

Comment: This includes all components wetted by CCCW. Tubes are not split out since fouling is not addressed here. Theoretically, this could be lumped with general piping and components.

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A4.4-b A4.4.2 A4.4.3 A4.4.4	Heat exchanger (serviced by closed-cycle cooling water system) Channel head and access cover Tubes Tubesheet	Channel head and access cover: stainless steel, carbon steel with stainless steel cladding; tubes and tubesheet: stainless steel	Demineralized oxygenated water	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
1	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
A4.5-a A4.5.1 A4.5.2	Ion exchanger (demineralizer) Shell Nozzles	Stainless steel, carbon steel with elastomer lining	Demineralized oxygenated water	Loss of Material/ Pitting and crevice corrosion (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated

Comment: Not clear why stainless listed here given qualifier in aging effect

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Carbon steel with elastomer lining	Treated water	Loss of material (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
2	Elastomer lining	Elastomers	Treated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A4.5-b A4.5.3	Ion exchanger (demineralizer) Elastomer lining	Elastomers	Chemically treated oxygenated water up to 50°C (125°F)	Hardening, cracking/ Elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer lining	Elastomers	Treated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
A4.6-a A4.6.1	Pump Casing	Stainless steel, carbon steel (with stainless steel cladding)	Demineralized oxygenated water	Loss of material/ Pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated

Comment: This line does not belong here necessarily (copied from above), but it might make sense to cover the elastomer separately.

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII Auxiliary Systems

B. Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
B.1-a B.1.1	Cranes including bridge and trolley (for cranes that fall within the scope of 10 CFR 54) Structural girders	Structural steel A-36, A-7, or A-285	Air at 100% relative humidity and 49°C (120°F)	Cumulative fatigue damage/ Fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54. See the Standard Review Plan, Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21 (c).	Yes, TLAA
3	Cranes - Structural girders	Carbon Steel	Air – indoor (ext)	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54. See the Standard Review Plan, Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21 (c).	Yes, TLAA
B.1-b B.1.1	Cranes including bridge and trolley (for cranes that fall within the scope of 10 CFR 54) Structural girders	Structural steel A-36, A-7, or A-285	Air at 100% relative humidity and 49°C (120°F)	Loss of material/ General corrosion	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No
16	Cranes - Structural girders	Carbon Steel	Condensation (ext)	Loss of material	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No
B.2-a B.2.1	Rail system Rail	Structural steel A-759	Air at 100% relative humidity and 49°C (120°F)	Loss of material/ Wear	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No
16	Cranes - rails	Carbon Steel	Air – indoor (ext)	Loss of material/ wear	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No

Comment: Environment not important for cyclic loading fatigue

Comment: Not clear that condensation would be applicable, but will be applied

VII Auxiliary Systems

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C1.1-a C1.1.1	Piping Piping and fittings (with or without internal lining or coating)	Carbon steel (for fresh water only) aluminum-bronze, brass, copper-nickel, stainless steel	Raw, untreated salt water or fresh water	Loss of material/ General (only for carbon steel without lining/coating or with degraded lining/coating), selective leaching (only for aluminum-bronze, brass, and copper-nickel), pitting, crevice, galvanic, microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
17, 29	General piping and components	Carbon steel (without lining/coating or with degraded lining/coating)	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy >15% Zn	Raw water	Macrofouling and loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No

Comment: Not clear what aspect of biofouling was considered here. Have assumed macrofouling

VII Auxiliary Systems
C1. Open-Cycle Cooling Water System (Service Water System)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C1.1-b C1.1.2	Piping Underground piping and fittings (external surface, with or without organic coating or wrapping)	Carbon steel	Soil	Loss of material/ General, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M28, "Buried Piping and Tanks Surveillance," or Chapter XI.M34, "Buried Piping and Tanks Inspection"	No Yes, detection of aging effects and operating experience are to be further evaluated
18	Buried piping and components	Carbon steel (with or without coating or wrapping)	Soil	Loss of material	Chapter XI.M28, "Buried Piping and Tanks Surveillance," or Chapter XI.M34, "Buried Piping and Tanks Inspection"	No Yes, detection of aging effects and operating experience are to be further evaluated
C1.1-c C1.1.2	Piping Underground piping and fittings (external surface, with or without organic coating or wrapping)	Cast iron	Soil	Loss of material/ selective leaching and general corrosion	Chapter XI.M33, "Selective Leaching of Materials"	No
29	Buried piping and components	Gray cast iron	Soil	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No

VII Auxiliary Systems
C1. Open-Cycle Cooling Water System (Service Water System)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C1.2-a C1.2.1	Valves (check, hand, control, and containment isolation valves) Body and bonnet (with or without internal lining or coating)	Bronze, aluminum-bronze, stainless steel, carbon steel (fresh water only)	Raw, untreated salt water or fresh water	Loss of material/ General (only carbon steel without lining/coating or with degraded lining/coating), selective leaching (only for bronze, aluminum-bronze), pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System," and Chapter XI.M33, "Selective Leaching of Materials"	No
17, 29	General piping and components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy >15% Zn	Raw water	Macrofouling and loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No

VII Auxiliary Systems
C1. Open-Cycle Cooling Water System (Service Water System)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C1.3-a C1.3.1 C1.3.2 C1.3.3 C1.3.4 C1.3.5	Heat exchanger (between open-cycle and closed-cycle cooling water systems) Shell Channel Channel head and access cover Tube sheet Tubes	Shell; channel, channel head and access cover: carbon steel; tube sheet: aluminum-bronze; tubes: copper-nickel, aluminum brass	Shell side: treated water; tube side: raw untreated salt or fresh water	Loss of material/ General (only for carbon steel), selective leaching (only for aluminum-bronze, copper-nickel, and aluminum brass), galvanic, pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
17, 29	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	Heat exchanger shell side components	Copper alloy <15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	Heat exchanger shell side components	Copper alloy >15% Zn	Raw water	Macrofouling and loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
C1.3-b C1.3.5	Heat exchanger (between open-cycle and closed-cycle cooling water systems) Tubes	Copper-nickel, aluminum brass	Shell side: treated water/ tube side: raw untreated salt or fresh water	Buildup of deposit/ Biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	Heat exchanger tubes	Copper alloy <15% Zn	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	Heat exchanger tubes	Copper alloy >15% Zn	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	Heat exchanger tubes	Copper alloy <15% Zn	Treated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Comment: This GALL item addresses loss of material using open cycle cooling program. Since loss of material on the tube side would be handled by closed cooling water chemistry program, I assume this GALL item does not address the tube side, even though the tube side environment is given for descriptive purposes. Tube side loss of material will be addressed with the tube side system, whatever it happens to be. This is different from the next GALL item which addresses loss of heat transfer, since the open cycle cooling program is assumed to monitor heat exchanger heat transfer and thus fouling on both sides of the tubes

Comment: Is there any reason not to make this General piping and components?

VII Auxiliary Systems
C1. Open-Cycle Cooling Water System (Service Water System)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
17	Heat exchanger tubes	Copper alloy >15% Zn	Treated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
C1.4-a C1.4.1	Flow orifice Body	Stainless steel	Raw, untreated salt water or fresh water	Loss of material/ Pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
C1.5-a C1.5.1	Pump Casing	Cast steel, Carbon steel	Raw, untreated salt water or fresh water	Loss of material/ General, selective leaching (for cast steel), pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System," and Chapter XI.M33, "Selective Leaching of Materials"	No
17, 29	General piping and components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Gray cast iron	Raw water	Macrofouling and loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
C1.6-a C1.6.1	Basket strainer Body	Carbon steel, stainless steel	Raw, untreated salt water or fresh water	Loss of material/ General (for carbon steel only), pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

VII Auxiliary Systems
C1. Open-Cycle Cooling Water System (Service Water System)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
17	General piping and components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

VII Auxiliary Systems
C2. Closed-Cycle Cooling Water System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C2.1-a C2.1.1	Piping Pipe, fittings, and flanges	Carbon steel	35°C (95°F) treated water	Loss of material/ General, pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
C2.2-a C2.2.1	Valves (check, hand, control, relief, solenoid, and containment isolation valves) Body and bonnet	Carbon steel, stainless steel	35°C (95°F) treated water	Loss of material/ General (only for carbon steel), pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
C2.3-a C2.3.1	Pump Casing	Carbon steel, cast iron	35°C (95°F) treated water	Loss of material/ General (only for carbon steel), selective leaching (for cast iron only), pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System," and Chapter XI.M33, "Selective Leaching of Materials"	No
15, 29	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15, 29	General piping and components	Gray cast iron	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System," and Chapter XI.M33, "Selective Leaching of Materials"	No
C2.4-a C2.4.1	Tank Shell	Carbon steel	35°C (95°F) treated water	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

C2.5-a C2.5.1	Flow orifice Body	Carbon steel	35°C (95°F) treated water	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

VII Auxiliary Systems
C3. Ultimate Heat Sink

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
C3.1-a C3.1.1	Piping Piping and fittings (with or without internal lining or coating)	Carbon steel, brass, copper-nickel	Raw, untreated fresh water	Loss of material/ General (only for carbon steel without internal lining or coating), selective leaching (only for brass, copper-nickel), pitting, crevice and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System," and Chapter XI.M33, "Selective Leaching of Materials"	No
17, 29	General piping and components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy >15% Zn	Raw water	Loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
C3.2-a C3.2.1	Valves (check, hand, and control) Body and bonnet (with or without internal lining or coating)	Bronze, stainless steel, carbon steel	Raw, untreated fresh water	Loss of material/ General (only for carbon steel), selective leaching (for bronze), pitting, crevice and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System," and Chapter XI.M33, "Selective Leaching of Materials"	No

Comment: Assuming that any inspection for selective leaching will also identify corrosion from other mechanisms so the latter are not mentioned

17, 29	General piping and components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy >15% Zn	Raw water	Loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
C3.3-a C3.3.1	Pump Casing (with or without internal lining or coating)	Carbon steel	Raw, untreated fresh water	Loss of material/ General, pitting, crevice and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	General piping and components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

VII Auxiliary Systems
D. Compressed Air System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
D.1-a D.1.1 D.1.2	Piping Piping and fittings Closure bolting	Carbon steel and low-alloy steel	Saturated air	Loss of material/ General and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No
19	General piping and components	Carbon steel	Condensation (Int)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
19	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
D.2-a D.2.1 D.2.2	Valves (including check valves and containment isolation valves) Body and bonnet Closure bolting	Carbon steel	Saturated air	Loss of material/ General and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No
19	General piping and components	Carbon steel	Condensation (Int)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
19	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
D.3-a D.3.1 D.3.2	Air receiver Shell and access cover Closure bolting	Carbon steel	Saturated air	Loss of material/ General and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No
19	General piping and components	Carbon steel	Condensation (Int)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
19	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
D.4-a D.4.1	Pressure regulators Body and bonnet	Carbon steel	Saturated air	Loss of material/ General and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No
19	General piping and components	Carbon steel	Condensation (Int)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
19	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
D.5-a D.5.1 D.5.2	Filter Shell and access cover Closure bolting	Carbon steel	Saturated air	Loss of material/ General and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No
19	General piping and components	Carbon steel	Condensation (Int)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No

Comment: Closure bolting is listed in most of these entries. It is not clear whether the saturated air environment is supposed to apply to both interior and exterior surfaces. Will assume intent was both surfaces even though condensation (saturated air) is not a major environmental factor in typical air systems.

19	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
D.6-a D.6.1 D.6.2	Dryer Shell and access cover Closure bolting	Carbon steel	Moist air	Loss of material/ General and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No
19	General piping and components	Carbon steel	Condensation (Int)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
19	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E1.1-a E1.1.1 E1.1.2	High-pressure piping (1500-psig rating) Pipe, fittings, and flanges Closure bolting	Pipe, fittings, and flanges: stainless steel; closure bolting: low-alloy steel, carbon steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Stainless steel	Treated borated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Carbon steel	System temperature >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
E1.1-b E1.1.2	High-pressure piping (1500-psig rating) Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of Material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E1.2-a E1.2.1	Low-pressure piping (150-psig rating) Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E1.3-a E1.3.1 E1.3.2	High-pressure valves (check, control, hand, motor operated, pressure control, and relief valves) Body and bonnet Closure bolting	Body and bonnet: stainless steel; closure bolting: carbon steel, low-alloy steel	Chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Stainless steel	Treated borated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Carbon steel	System temperature >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
E1.3-b E1.3.2	High-pressure valves (check, control, hand, motor operated, pressure control, and relief valves) Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E1.4-a E1.4.1	Low-pressure valves (check, control, hand, motor operated, pressure control, and relief valves) Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E1.5-a E1.5.1 E1.5.2	High-pressure pump Casing Closure bolting	Casing: stainless steel; closure bolting: carbon steel, low-alloy steel	Chemically treated borated water	Crack initiation and growth/ cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
4	High-pressure pump Casing and closure bolting	Stainless steel, carbon steel	Treated borated water	Cracking/cyclic loading	A plant-specific aging management program is to be evaluated.	Yes, plant specific
E1.5-b E1.5.2	High-pressure pump Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E1.6-a E1.6.1	Low-pressure pump Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E1.7-a E1.7.1 E1.7.2 E1.7.3 E1.7.4 E1.7.5	Regenerative heat exchanger Channel head (including channel weld) and access cover Tubesheet Tubes Shell and access cover Closure bolting	Stainless steel; closure bolting (low-alloy steel, carbon steel)	Tube and shell side: chemically treated borated water up to 340°C (644°F)	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA

Comment: I believe this GALL item is specifically looking at cracking in the pump due to cyclic stresses from its operation. Consequently, the pump casing and closure bolting are considered together and should be addressed by a common program cracking from SCC is covered by water chemistry elsewhere

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	General piping and components	Stainless steel	Treated borated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Carbon steel	System temperature >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
E1.7-b E1.7.5	Regenerative heat exchanger Closure bolting	Low-alloy steel, carbon steel	Both sides: chemically treated borated water up to 340°C (644°F)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E1.7-c E1.7.1 E1.7.2 E1.7.3 E1.7.4	Regenerative heat exchanger Channel head (including channel weld) and access cover Tubesheet Tubes Shell and access cover	Stainless steel	Both sides: chemically treated borated water up to 340°C (644°F)	Crack initiation and growth/ Stress corrosion cracking, cyclic loading	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading, or loss of material due to pitting and crevice corrosion. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes, plant specific

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
9	Regenerative heat exchanger tube and shell side components	Stainless steel	Treated borated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading, or loss of material due to pitting and crevice corrosion. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes, plant specific
E1.8-a E1.8.1 E1.8.2 E1.8.3 E1.8.4 E1.8.5	Letdown heat exchanger (serviced by closed-cycle cooling water) Channel head (including channel weld) and access cover Tubesheet Tubes Shell and access cover Closure bolting	Stainless steel, carbon steel	Tube side: chemically treated borated water up to 340°C (644°F); shell side: closed-cycle cooling water (treated water)	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Stainless steel	Treated borated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	General piping and components	Carbon steel	System temperature >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
E1.8-b E1.8.1 E1.8.2 E1.8.3	Letdown heat exchanger (serviced by closed-cycle cooling water) Channel head (including channel weld) and access cover Tubesheet Tubes	Stainless steel	Tube side: chemically treated borated water up to 340°C (644°F); shell side: closed-cycle cooling water	Crack initiation and growth/ Stress corrosion cracking, cyclic loading	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading, or loss of material due to pitting and crevice corrosion. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes. (See Oconee operating experience, License Renewal Application, Revision 2, June 1998, p. 3.4-26)	Yes, plant specific

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
9	Heat exchanger tube side components	Stainless steel	Treated borated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading, or loss of material due to pitting and crevice corrosion. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes. (See Oconee operating experience, License Renewal Application, Revision 2, June 1998, p. 3.4-26)	Yes, plant specific
E1.8-c E1.8.4	Letdown heat exchanger (serviced by closed-cycle cooling water) Shell and access cover	Carbon steel	Closed-cycle cooling water	Loss of material/ Pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
E1.8-d E1.8.5	Letdown heat exchanger (serviced by closed-cycle cooling water) Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
E1.9-a E1.9.1	Basket strainer Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

Comment: Based on material and aging effect of GALL item, this is the only line needed. Plant AMR would also typically consider stainless tubes in treated water for LOM. No fouling since cooling not an IF here.

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

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E1.10-a E1.10-1	Volume control tank Closure bolting	Low-alloy steel, carbon steel	Air, leaking chemically treated borated water	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

VII Auxiliary Systems
E2. Standby Liquid Control System (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E2.1-a E2.1.1	Piping Piping and fittings in contact with sodium pentaborate solution	Stainless steel	Sodium pentaborate solution at 21 - 32 °C (70 - 90°F) (~24,500 ppm B)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
25	General piping and components	Stainless steel	Treated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
E2.2-a E2.2.1 E2.2.2	Solution storage Tank Tank heaters	Stainless steel	Sodium pentaborate solution at 21 - 32 °C (70 - 90°F) (~24,500 ppm B)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
25	General piping and components	Stainless steel	Treated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
E2.3-a E2.3.1	Valves (pump suction, relief, injection, containment isolation, and explosive actuated discharge valves) Body and bonnet	Stainless steel	Sodium pentaborate solution at 21 - 32 °C (70 - 90°F) (~24,500 ppm B)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
25	General piping and components	Stainless steel	Treated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
E2.4-a E2.4.1	Injection pumps Casing	Stainless steel	Sodium pentaborate solution at 21 - 32 °C (70 - 90°F) (~24,500 ppm B)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No

Comment: According to EPRI mechanical tools, sodium pentaborate solution is relatively benign for stainless. Assumed to be basic treated water.

25	General piping and components	Stainless steel	Treated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No

VII Auxiliary Systems
E3. Reactor Water Cleanup System (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E3.1-a E3.1.1	Piping Piping and fittings (beyond second isolation valve)	Stainless steel: types 304, 316, or 316NG	Oxygenated water 93°C -288°C (200°F-550°F)	Crack initiation and growth/ Stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M25, "BWR Reactor Water Cleanup System"	No
26	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M25, "BWR Reactor Water Cleanup System"	No
E3.1-b E3.1.1	Piping Piping and fittings (beyond second isolation valve)	Stainless steel: types 304, 316, or 316NG	Oxygenated water 93°C -288°C (200°F-550°F)	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Stainless steel	Treated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
E3.2-a E3.2.1	Reactor water cleanup (RWCU) pump Casing	Cast austenitic stainless steel	Oxygenated water 93°C -288°C (200°F-550°F)	Crack initiation and growth/ Stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M25, "BWR Reactor Water Cleanup System"	No
26	General piping and components	Cast austenitic stainless steel	Treated water > 140°F	Cracking	Chapter XI.M25, "BWR Reactor Water Cleanup System"	No

VII Auxiliary Systems
E3. Reactor Water Cleanup System (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E3.2-b E3.2.1	RWCU pump Casing	Cast austenitic stainless steel, stainless steel	Oxygenated water 93°C -288°C (200°F-550°F)	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Stainless steel	Treated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Cast austenitic stainless steel	Treated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
E3.2-c E3.2.2	RWCU pump Closure bolting	High strength low-alloy steel	Air, Leaking oxygenated water	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Carbon steel	System temperature >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA

Comment: Fatigue is dependent on temperature of internal environment so external environment not mentioned. Corrosion will be addressed elsewhere.

VII Auxiliary Systems
E3. Reactor Water Cleanup System (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E3.3-d E3.3.1 E3.3.2 E3.3.3 E3.3.4	Regenerative heat exchanger Channel head and access cover Tubesheet Tubes Shell and access cover	Channel head and access cover, tubesheet, tubes: stainless steel; Shell and access cover: high strength low-alloy steel with stainless steel cladding	Oxygenated water at 288°C (550°F) and 10 MPa max.	Crack initiation and growth/ Stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
4	Regenerative heat exchanger tube and shell side components	Stainless steel	Treated water >140°F	Cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
E3.4-a E3.4.1 E3.4.2 E3.4.3 E3.4.4	Non-regenerative heat exchanger (serviced by closed-cycle cooling water) Channel head and access cover Tubesheet Tubes Shell and access cover	Channel head and access cover, tubesheet, tubes: stainless steel; Shell and access cover: high strength low-alloy steel with stainless steel cladding	Reactor coolant water at 288°C (550°F) and 10 MPa max.	Crack initiation and growth/ Stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
4	Heat exchanger shell side components	Stainless steel	Treated water >140°F	Cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
4	Heat exchanger tube side components	Stainless steel	Treated water >140°F	Cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Comment: Carbon steel not susceptible to SCC

Comment: Carbon steel not susceptible to SCC

VII Auxiliary Systems
E3. Reactor Water Cleanup System (Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E3.4-b E3.4.4	Non-regenerative heat exchanger (serviced by closed-cycle cooling water) Shell and access cover	High strength low-alloy steel with stainless steel cladding	Reactor coolant water at 10 MPa max.	Loss of material/ Microbiologically influenced corrosion (for portions of the RWCU system <93°C [200°F])	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

Comment: This is CCCW rather than RCS water as stated in GALL

VII Auxiliary Systems
E4. Shutdown Cooling System (Older Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
E4.1-a E4.1.1	Piping Piping and fittings	Carbon steel, stainless steel	Oxygenated water, up to 288°C (550°F)	Loss of material/ Pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
8	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
8	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
E4.1-b E4.1.1	Piping Piping and fittings	Carbon steel, stainless steel	Oxygenated water, up to 288°C (550°F)	Cumulative fatigue damage/ Fatigue	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA

VII Auxiliary Systems
E4. Shutdown Cooling System (Older Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	General piping and components	Carbon steel	Treated water >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Stainless steel	Treated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
E4.1-c E4.1.1	Piping Piping and fittings	Stainless steel	Oxygenated water, up to 288°C (550°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking" and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
27	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking" and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
E4.2-a E4.2.1	Pump Casing	Carbon steel	Oxygenated water, up to 288°C (550°F)	Loss of material/ Pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated

VII Auxiliary Systems
E4. Shutdown Cooling System (Older Boiling Water Reactor)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
8	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
E4.3-a E4.3.1	Valves (check, control, hand, motor operated, and relief valves) Body and bonnet	Stainless steel forging; stainless steel casting	Oxygenated water, up to 288°C (550°F)	Crack initiation and growth/ Stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking" and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
27	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking" and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
E4.4-a E4.4.1 E4.4.2 E4.4.3 E4.4.4	Heat exchanger (serviced by closed-cycle cooling water system) Channel head and access cover Tubesheet Tubes Shell and access cover	Channel head and access cover: carbon steel; tubesheet: carbon steel (stainless steel cladding on channel side; Tubes: stainless steel; Shell: carbon steel	Reactor coolant water, and closed-cycle cooling water	Loss of material/ Pitting, crevice and microbiologically influenced corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No **Comment:** LOM of tube side components not covered by CCCW
28	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No **Comment:** This is CCCW not RCS water
28	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

VII Auxiliary Systems
F1. Control Room Area Ventilation System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
F1.1-a F1.1.1 F1.1.2	Duct Duct fittings, access doors, and closure bolts Equipment frames and housing	Carbon steel (galvanized or painted) bolts: plated carbon steel	Warm, moist air	Loss of material/ General, pitting, crevice corrosion, and microbiologically influenced corrosion (for duct [drip-pan] and piping for moisture drainage)	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Galvanized steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Galvanized steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F1.1-b F1.1.3 F1.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F1.1-c F1.1.3 F1.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Comment: Galvanized steel is listed separately here because some plants credit coating

VII Auxiliary Systems
F1. Control Room Area Ventilation System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
F1.2-a F1.2.1	Air handler heating/ cooling Heating/ cooling coils	Copper/ nickel	Warm, moist air	Loss of material/ Pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy >15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy <15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F1.3-a F1.3.1	Piping, Piping and fittings	Carbon steel	Hot or cold treated water	Loss of material/ General, pitting, crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
F1.4-a F1.4.1	Filters, Housing and supports	Carbon steel, stainless steel	Warm, moist air	Loss of material/ General (only for carbon steel), pitting, and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Stainless steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Stainless steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F1.4-b F1.4.2	Filters Elastomer seals	Elastomers (Neoprene and similar materials)	Warm, moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific

VII Auxiliary Systems
F2. Auxiliary and Radwaste Area Ventilation System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
F2.1-a F2.1.1 F2.1.2	Duct Duct fittings, access doors, and closure bolts Equipment frames and housing	Carbon steel (galvanized or painted) bolts; plated carbon steel	Warm, moist air	Loss of material/ General, pitting, crevice corrosion, and microbiologically influenced corrosion (for duct [drip-pan] and piping for moisture drainage)	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Galvanized steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Galvanized steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F2.1-b F2.1.3 F2.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F2.1-c F2.1.3 F2.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific

VII Auxiliary Systems
F2. Auxiliary and Radwaste Area Ventilation System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F2.2-a F2.2.1	Air handler heating/ cooling Heating/ cooling coils	Copper/ nickel	Warm, moist air	Loss of material/ Pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy >15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy <15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F2.3-a F2.3.1	Piping Piping and fittings	Carbon steel	Hot or cold treated water	Loss of material/ General, pitting, crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
F2.4-a F2.4.1	Filters Housing and supports	Carbon steel, stainless steel	Warm, moist air	Loss of material/ General (only for carbon steel), pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Stainless steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Stainless steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F2.4-b F2.4.2	Filters Elastomer seals	Elastomers (Neoprene and similar materials)	Warm, moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific

VII Auxiliary Systems
F3. Primary Containment Heating and Ventilation System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
F3.1-a F3.1.1 F3.1.2	Duct Duct fittings, access doors and closure bolts Equipment frames and housing	Carbon steel (galvanized or painted) bolts; plated carbon steel	Warm, moist air	Loss of material/ General, pitting, crevice corrosion, and microbiologically influenced corrosion (for duct [drip-pan] and piping for moisture drainage)	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Galvanized steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Galvanized steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F3.1-b F3.1.3 F3.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F3.1-c F3.1.3 F3.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific

VII Auxiliary Systems
F3. Primary Containment Heating and Ventilation System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
F3.2-a F3.2.1	Air handler heating/ cooling Heating/ cooling coils	Copper/nickel	Warm, moist air	Loss of material/ Pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy >15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy <15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F3.3-a F3.3.1	Piping Piping and fittings	Carbon steel	Hot or cold treated water	Loss of material/ General, pitting, crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
F3.4-a F3.4.1	Filters Housing and supports	Carbon steel, stainless steel	Warm, moist air	Loss of material/ General (only for carbon steel), pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Stainless steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Stainless steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F3.4-b F3.4.2	Filters Elastomer seals	Elastomers (Neoprene and similar materials)	Warm, moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific

VII Auxiliary Systems
F4. Diesel Generator Building Ventilation System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
F4.1-a F4.1.1 F4.1.2	Duct Duct fittings, access doors, and closure bolts Equipment frames and housing	Carbon steel (galvanized or painted); Bolts: plated carbon steel	Warm, moist air	Loss of material/ General, pitting, crevice corrosion, and microbiologically influenced corrosion (for duct [drip-pan] and piping for moisture drainage)	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Galvanized steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Galvanized steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F4.1-b F4.1.3 F4.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Hardening and loss of strength/ Elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F4.1-c F4.1.3 F4.1.4	Duct Flexible collars between ducts and fans Seals in dampers and doors	Elastomer (Neoprene)	Warm, moist air	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific

F4.2-a F4.2.1	Air handler heating/cooling Heating/cooling coils	Copper/nickel	Warm, moist air	Loss of material/ Pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy >15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Copper alloy <15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
F4.3-a F4.3.1	Piping Piping and fittings	Carbon steel	Hot or cold treated water	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

VII Auxiliary Systems
G. Fire Protection

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
G.1-a G.1.1	Intake structure Fire barrier penetration seals (for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint)	Sealant	Indoors: air; outdoors: sun, weather, humidity, and moisture	Increased hardness and shrinkage/ Weathering	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - indoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - outdoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
G.1-b G.1.2	Intake structure Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Concrete cracking and spalling/ Freeze-thaw, aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.1-c G.1.2	Intake structure Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No

VII Auxiliary Systems
G. Fire Protection

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
G.1-d G.1.3	Intake structure Fire rated doors	Steel	Indoor and outdoor environments	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - indoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - outdoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
G.2-a G.2.1	Turbine building Fire barrier penetration seals (for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint)	Sealant	Indoors: air; outdoors: sun, weather, humidity, and moisture	Increased hardness and shrinkage/ Weathering	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - indoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - outdoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
G.2-b G.2.2	Turbine building Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Concrete cracking and spalling/ Freeze-thaw, aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.2-c G.2.2	Turbine building Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No

VII Auxiliary Systems
G. Fire Protection

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.2-d G.2.3	Turbine building Fire rated doors	Steel	Indoor and outdoor environments	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - indoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - outdoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
G.3-a G.3.1	Auxiliary building Fire barrier penetration seals (for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint)	Sealant	Indoors: air; outdoors: sun, weather, humidity, and moisture	Increased hardness and shrinkage/ Weathering	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - indoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - outdoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
G.3-b G.3.2	Auxiliary building Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Concrete cracking and spalling/ Freeze-thaw, aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No

VII Auxiliary Systems
G. Fire Protection

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.3-c G.3.2	Auxiliary building Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.3-d G.3.3	Auxiliary building Fire rated doors	Steel	Indoor and outdoor environments	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - indoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - outdoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
G.4-a G.4.1	Diesel generator building Fire barrier penetration seals (for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint)	Sealant	Indoors: air; outdoors: sun, weather, humidity, and moisture	Increased hardness and shrinkage/ Weathering	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - indoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - outdoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No

VII Auxiliary Systems
G. Fire Protection

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
G.4-b G.4.2	Diesel generator building Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Concrete cracking and spalling/ Freeze-thaw, aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.4-c G.4.2	Diesel generator building Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor and outdoor environments	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.4-d G.4.3	Diesel generator building Fire rated doors	Steel	Indoor and outdoor environments	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - indoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - outdoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
G.5-a G.5.1	Primary containment Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor	Concrete cracking and spalling/ Aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring Program"	No

VII Auxiliary Systems
G. Fire Protection

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G,5-b G.5.1	Primary containment Fire barrier walls, ceilings, and floors	Concrete and reinforcement	Indoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
G.5-c G.5.2	Primary containment Fire rated doors	Steel	Indoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - indoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
G.6-a G.6.1	Water-based fire protection system Piping and fittings	Carbon steel, cast iron, and stainless steel	Raw water	Loss of material/ General, galvanic, pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M27, "Fire Water System"	No
21	General piping and components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
21	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
G.6-b G.6.2	Water-based fire protection system Filter, fire hydrant, mulsifier, pump casing, sprinkler, strainer, and valve bodies (including containment isolation valves)	Carbon steel, cast iron, bronze, copper, stainless steel	Raw water	Loss of material/ General, galvanic, pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M27, "Fire Water System"	No
21	General piping and components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
21	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No

VII Auxiliary Systems
G. Fire Protection

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
21	General piping and components	Copper alloy >15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
21	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
G.7-a G.7.1	Reactor coolant pump oil collection system Tank	Carbon steel	Lubricating oil (with contaminants and/or moisture)	Loss of material/ General, galvanic, pitting and crevice corrosion	A plant specific aging management program that determines the thickness of the lower portion of the tank is to be evaluated. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
6	Reactor coolant pump oil collection system Tank	Carbon steel	Lubricating oil	Loss of material	A plant specific aging management program that determines the thickness of the lower portion of the tank is to be evaluated. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
G.7-b G.7.2	Reactor coolant pump oil collection system Piping, tubing, valve bodies	Piping and valve bodies: carbon steel; tubing: copper, brass	Lubricating oil (with contaminants and/or moisture)	Loss of material/ General, galvanic, pitting and crevice corrosion	A plant specific aging management program that monitors the degradation of the components is to be evaluated. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
6	Reactor coolant pump oil collection system Piping, tubing, valve bodies	Carbon steel, copper alloy	Lubricating oil	Loss of material	A plant specific aging management program that monitors the degradation of the components is to be evaluated. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
G.8-a G.8.1	Diesel fire system Diesel-driven fire pump (pump casing) and fuel oil supply line	Carbon steel	Fuel oil	Loss of material/ General, galvanic, pitting and crevice corrosion	Chapter XI.M26, "Fire Protection," and Chapter XI.M30, "Fuel Oil Chemistry"	No
22	General piping and components	Carbon steel	Fuel oil	Loss of material	Chapter XI.M26, "Fire Protection," and Chapter XI.M30, "Fuel Oil Chemistry"	No

VII Auxiliary Systems
H1. Diesel Fuel Oil System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
H1.1-a H1.1.1	Piping Aboveground piping and fittings	Carbon steel	Outdoor ambient conditions	Loss of material/ General, pitting, and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Carbon steel	Air – outdoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
H1.1-b H1.1.2	Piping Underground piping and fittings	Carbon steel	Soil and groundwater	Loss of material/ General, galvanic, pitting, crevice and microbiologically influenced corrosion	Chapter XI.M28, "Buried Piping and Tanks Surveillance," or Chapter XI.M34, "Buried Piping and Tanks Inspection"	No Yes, detection of aging effects and operating experience are to be further evaluated
18	Buried piping and components	Carbon steel	Soil	Loss of material	Chapter XI.M28, "Buried Piping and Tanks Surveillance," or Chapter XI.M34, "Buried Piping and Tanks Inspection"	No Yes, detection of aging effects and operating experience are to be further evaluated
H1.2-a H1.2.1 H1.2.2	Valves Body and bonnet Closure bolting	Carbon steel or low-alloy steel	Outdoor ambient conditions	Loss of material/ General, pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific

VII Auxiliary Systems
H1. Diesel Fuel Oil System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
5	General piping and components	Carbon steel	Air – outdoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
H1.3-a H1.3.1 H1.3.2	Pump Casing Closure bolting	Carbon steel or low-alloy steel	Outdoor ambient conditions	Loss of material/ General, pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Carbon steel	Air – outdoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
H1.4-a H1.4.1	Tank Internal surface	Carbon steel	Fuel oil, water (as contaminant)	Loss of material/ General, pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M30, "Fuel Oil Chemistry" The AMP is to be augmented by verifying the effectiveness of fuel oil chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
7	General piping and components	Carbon steel	Fuel oil	Loss of material and macrofouling	Chapter XI.M30, "Fuel Oil Chemistry" The AMP is to be augmented by verifying the effectiveness of fuel oil chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
H1.4-b H1.4.2	Tank External surface	Carbon steel	Outdoor ambient conditions	Loss of material/ General, pitting and crevice corrosion	Chapter XI.M29, "Aboveground Carbon Steel Tanks"	No
23	Tank	Carbon steel	Air – outdoor (Ext)	Loss of material	Chapter XI.M29, "Aboveground Carbon Steel Tanks"	No

VII Auxiliary Systems
H2. Emergency Diesel Generator System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
H2.1-a H2.1.1	Diesel engine cooling water subsystem (serviced by closed-cycle cooling water system) Piping and fittings	Carbon steel	Chemically treated, demineralized water ≤90°C (194°F)	Loss of Material/ General, pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
15	General piping and components	Carbon steel	Treated water	Loss of Material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
H2.1-b H2.1.1	Diesel engine cooling water subsystem (serviced by open-cycle cooling water system) Piping and fittings	Carbon steel	Raw, untreated salt water or fresh water	Loss of Material/ General, pitting, crevice, microbiologically influenced corrosion and biofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	General piping and components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
H2.2-a H2.2.1 H2.2.2 H2.2.3 H2.2.4	Diesel engine starting air subsystem Piping and fittings Valves (hand and check) Drain trap Air accumulator vessel	Carbon steel	Moist air	Loss of material/ General, pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Carbon steel	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
H2.3-a H2.3.1 H2.3.2 H2.3.3	Diesel engine combustion air intake subsystem Piping and fittings Filter Muffler	Carbon steel	Moist air	Loss of material/ General, pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Carbon steel	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific

VII Auxiliary Systems
H2. Emergency Diesel Generator System

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
H2.4-a, H2.4.1 H2.4.2	Diesel engine combustion air exhaust subsystem Piping and fittings Muffler	Carbon steel	Hot diesel engine exhaust gases containing moisture and particulates	Loss of material/ General, pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	General piping and components	Carbon steel	Exhaust gases	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
H2.5-a, H2.5.1	Diesel engine fuel oil subsystem Tanks (day and drip)	Carbon steel	Diesel fuel oil	Loss of Material/ General, pitting, crevice and microbiologically influenced corrosion	Chapter XI.M30, "Fuel Oil Chemistry" The AMP is to be augmented by verifying the effectiveness of fuel oil chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
7	General piping and components	Carbon steel	Fuel oil	Loss of material	Chapter XI.M30, "Fuel Oil Chemistry" The AMP is to be augmented by verifying the effectiveness of fuel oil chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII Auxiliary Systems
I. Carbon Steel Components

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
I.1-a I.1.1	Carbon steel components (PWRs) External surfaces	Carbon steel, low-alloy steel	Air, leaking and dripping chemically treated borated water up to 340°C (644°F)	Loss of material/ Boric acid corrosion of external surfaces	Chapter XI.M10, "Boric Acid Corrosion"	No
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
I.1-b I.1.1	Carbon steel components (PWRs and BWRs) External surfaces	Carbon steel, low-alloy steel	Air, moisture, and humidity ≤ 100°C (212°F)	Loss of material/ General corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Air – outdoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
I.2-a I.2.1	Closure bolting In high-pressure or high-temperature systems	Carbon steel, low-alloy steel	Air, moisture, humidity, and leaking fluid	Loss of material/ General corrosion	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – indoor (Ext)	Loss of material	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M18, "Bolting Integrity"	No

24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – outdoor (Ext)	Loss of material	Chapter XI.M18, "Bolting Integrity"	No
I.2-b I.2.1	Closure bolting In high-pressure or high-temperature systems	Carbon steel, low-alloy steel	Air, moisture, humidity, and leaking fluid	Crack initiation and growth/ Cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – indoor (Ext)	Cracking	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – outdoor (Ext)	Cracking	Chapter XI.M18, "Bolting Integrity"	No

(Later)

Material Changes

Material	Description
Copper alloy >15% Zn	Copper, copper nickel and other alloys, brass/bronze >15% Zn, Aluminum bronze > 8% Al – These materials are susceptible to selective leaching. (Reference ?)
Carbon steel	Carbon steel, low alloy steel, cast iron (other than gray cast iron) all exhibit the same aging effects for a given environment. (Reference ?)
Cast austenitic stainless steel	
Copper alloy < 15 % Zn	Copper, copper nickel and other alloys, brass/bronze <15% Zn, Aluminum bronze < 8% Al – These materials are not susceptible to selective leaching. (Reference ?)
Elastomers	rubber, EPT, EPDM, viton, vitril, neoprene, Silicone elastomer, etc.
Galvanized steel	
Gray cast iron	This material is susceptible to selective leaching. (Reference ?)
Soils	
Nickel-based alloy	Alloy 600, inconel
Reinforced concrete	
Stainless steel	Wrought Austenitic SS

Environment Changes

Environment	Description
Air – indoor (Int/Ext)	Indoor air on systems with temperatures higher than the dew point – This environment has been applied where NUREG-1801 environment did not imply condensation was an issue.
Air with boric acid leakage (Int/Ext)	Air and untreated borated water leakage on indoor or outdoor systems with temperatures above or below the dew point
Air – outdoor (Int/Ext)	Exposed to air and local weather conditions
Air and steam	Exposed normally to air and periodically to steam
Condensation (Int/Ext)	Air and condensation on surfaces of indoor systems with temperatures below the dew point – for exterior surfaces, condensation is considered untreated water due to potential for surface contamination. – This environment has been applied where NUREG-1801 environment implies condensation was an issue.
Condensation with boric acid (Int/Ext)	Air and condensation with boric acid on surfaces of indoor systems with temperatures below the dew point – condensation is considered untreated water due to potential for surface contamination
Gas	Inert gases such as carbon dioxide, freon, halon, nitrogen
Concrete	Components embedded in concrete
Exhaust gases	Gas present in a diesel engine exhaust
Raw water	Raw untreated fresh or salt water
Raw water >140°F	Raw untreated fresh or salt water above SCC threshold for stainless steel
Fuel oil	Fuel oil used for combustion engines

Lubricating oil	Lubricating oil for plant equipment
Sand and concrete	Sand/concrete base for tanks
Soil	External environment for components buried in the soil, including groundwater in the soil
Steam >220°F	Steam above the thermal fatigue threshold for carbon steel, subject to secondary plant water chemistry program
Steam >270°F	Steam above the thermal fatigue threshold for stainless steel, subject to secondary plant water chemistry program
Treated air	Air that is dried and filtered
Treated borated water	Treated water with boric acid
Treated borated water >140°F	Treated water with boric acid above SCC threshold for stainless steel
Treated borated water >270°F	Treated water with boric acid above thermal fatigue threshold for stainless steel
Treated borated water >482°F	Treated water with boric acid above thermal embrittlement threshold for CASS
Treated water	Treated or demineralized water – This environment is used where the context of the MEAP combination makes the type of treated water apparent; e.g., if the program is for closed cycle cooling water chemistry, the treated water is from the closed cycle cooling system.
Treated water >140°F	Treated water above SCC threshold for stainless steel
Treated water >220°F	Treated water above thermal fatigue threshold for carbon steel
Treated water >270°F	Treated water above thermal fatigue threshold for stainless steel
Treated water >482°F	Treated water above thermal embrittlement threshold for CASS

Untreated water	Water that may contain contaminants including oil and boric acid depending on the location – includes originally treated water that is not monitored by a chemistry program

Temperature Thresholds

Temperature	Threshold	Basis
140°F	SCC for stainless steel	In general, SCC very rarely occurs in austenitic stainless steels below 140°F (Reference 1, 2]. Although SCC has been observed in stagnant, oxygenated borated water systems at lower temperatures than this 140°F threshold, all of these instances have identified a significant presence of contaminants (halogens, specifically chlorides) in the failed components. With a harsh enough environment (significant contamination), SCC can occur in austenitic stainless steel at ambient temperature. However, these conditions are considered event driven, resulting from a breakdown of chemistry controls.
220°F	Fatigue for carbon steel	This value is applicable to non-class 1 piping and in line components and is based on recommendations in the EPRI Fatigue Management Handbook, Volume 2, Section 4.2 (Reference 3).
270°F	Fatigue for stainless steel	This value is applicable to non-class 1 piping and in line components and is based on recommendations in the EPRI Fatigue Management Handbook, Volume 2, Section 4.2 (Reference 3).
482°F	Thermal embrittlement for CASS	CASS materials subjected to sustained temperatures below 250°C (482°F) will not result in a reduction of room temperature Charpy impact energy below 50 ft-lb for exposure times of approximately 300,000 hours (for CASS with ferrite content of 40%) and approximately 2,500,000 hours for CASS with ferrite content of 14%) [Figure 1; Reference 4]. For a maximum exposure time of approximately 420,000 hours (48 EFPY), a screening temperature of 482°F is conservatively chosen because (1) the majority of nuclear grade materials are expected to contain a ferrite content well below 40%, and (2) the 50 ft-lb limit is very conservative when applied to cast austenitic materials. It is typically applied to ferritic materials (e.g., 10 CFR 50 Appendix G).

Aging Effect Changes

Change in material properties	This effect covers all degradation of a material's properties considered important for its intended function
Fouling	Fouling applies to the reduction of heat transfer due to buildup (from whatever source) on the heat transfer surface.
Macrofouling	Biofouling listed in NUREG-1801 as aging mechanism is assumed to be the plugging of components due to biological growth or material. Although plugging of a component affects only flow, an active intended function outside the purview of license renewal, the term macrofouling is used to address fouling that causes plugging as opposed to fouling that causes loss of heat transfer, and includes plugging from any source, including biological.

References

1. D. Peckner and I. M. Bernstein, Eds., Handbook of Stainless Steels, McGraw-Hill, New York, 1977.
2. Metals Handbook, Ninth Edition, Volume 13, Corrosion, American Society of Metals, Copyright 1987.
3. EPRI Fatigue Management Handbook, TR-104534-V1, -V2, and -V3, Research Project 3321-01, December 1994
4. R. Nickell, M. A. Rinckel, "Evaluation of Thermal Aging Embrittlement for Cast Austenitic Stainless Steel Components," TR-106092, Research Project 2643-33, Final Report, March 1996.

Comment: Available reference?

(Later)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Carbon steel	Treated water > 220°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
1	General piping and components	Stainless steel	Treated borated water > 270°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
1	General piping and components	Stainless steel	Treated water > 270°F	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
2, 3, 4, 5	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
3	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components internal surfaces	Carbon steel	Air – indoor (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components internal surfaces	Carbon steel	Air – indoor (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3	Piping and components internal surfaces	Carbon steel	Air – indoor (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3, 5, 6	Piping and components external surfaces	Carbon steel	Condensation	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3, 5, 6	Piping and components internal surfaces	Carbon steel	Treated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
3, 5, 6	Piping and components internal surfaces	Carbon steel	Untreated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
3, 5	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
3, 5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
3, 5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Buried and partially buried tanks	Stainless steel	Soil	Loss of material	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottom because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes, plant specific
5, 6	Piping and components internal surfaces	Stainless steel	Treated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
5, 6	Piping and components internal surfaces	Stainless steel	Untreated water	Loss of material	A plant-specific aging management program is to be evaluated. See IN 85-30 for evidence of microbiologically influenced corrosion.	Yes, plant specific
7	Elastomer seals	Elastomer	Air – indoor (Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
7	Elastomer seals	Elastomer	Condensation	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
8	Orifice (miniflow recirculation)	Stainless steel	Treated borated water	Loss of material/ Erosion	A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. See LER 50-275/94-023 for evidence of erosion.	Yes, plant specific
9	Drywell and suppression chamber spray system (internal surfaces Flow orifice Spray nozzles	Carbon steel	Air – indoor (Int)	Macrofouling	A plant-specific aging management program is to be evaluated.	Yes, plant specific
10	Piping and components external surfaces and bolting	Carbon steel	Condensation	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
11	General piping and components	Cast austenitic stainless steel	Treated borated water > 482°F	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
11	General piping and components	Cast austenitic stainless steel	Treated water > 482°F	Loss of fracture toughness/ Thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
12	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger shell side components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated borated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
12	Heat exchanger tubes (serviced by open-cycle cooling water)	Stainless steel	Treated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
13	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
14	General piping and components	Carbon steel	Air and steam	Loss of material/ Flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
14	General piping and components	Carbon steel	Treated water	Loss of material/ Flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
15	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No
16	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
17	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
18	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Condensation	Loss of material	Chapter XI.M18, "Bolting Integrity"	No
18	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Condensation	Cracking	Chapter XI.M18, "Bolting Integrity"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
18	Buried piping and components	Carbon steel (with or without coating or wrapping)	Soil	Loss of material	Chapter XI.M28, "Buried Piping and Tanks Surveillance," or Chapter XI.M34, "Buried Piping and Tanks Inspection"	No Yes, detection of aging effects and operating experience are to be further evaluated
29	Buried piping and components	Gray cast iron	Soil	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – indoor (Ext)	Loss of material	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – indoor (Ext)	Cracking	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – outdoor (Ext)	Loss of material	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Air – outdoor (Ext)	Cracking	Chapter XI.M18, "Bolting Integrity"	No
24	Closure bolting In high-pressure or high-temperature systems	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M18, "Bolting Integrity"	No
16	Cranes - rails	Carbon Steel	Air – indoor (ext)	Loss of material/ wear	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	Cranes - Structural girders	Carbon Steel	Air – indoor (ext)	Cumulative fatigue damage	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54. See the Standard Review Plan, Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21 (c).	Yes, TLAA
16	Cranes - Structural girders	Carbon Steel	Condensation (ext)	Loss of material	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No
2	Elastomer lining	Elastomers	Treated borated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer lining	Elastomers	Treated water	Change in material properties	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Change in material properties	A plant-specific aging management program is to be evaluated.	Yes, plant specific
2	Elastomer seals and components	Elastomers	Condensation (Int or Ext)	Loss of material/ Wear	A plant-specific aging management program is to be evaluated.	Yes, plant specific
20	Fire barrier penetration seals	Elastomer	Air - indoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
20	Fire barrier penetration seals	Elastomer	Air - outdoor	Change in material properties	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - indoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
20	Fire doors	Carbon steel	Air - outdoor	Loss of material/ Wear	Chapter XI.M26, "Fire Protection"	No
5	General piping and components	Carbon steel	Air – outdoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
5	General piping and components	Carbon steel	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
19	General piping and components	Carbon steel	Condensation (Int)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
5	General piping and components	Carbon steel	Exhaust gases	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
22	General piping and components	Carbon steel	Fuel oil	Loss of material	Chapter XI.M26, "Fire Protection," and Chapter XI.M30, "Fuel Oil Chemistry"	No
7	General piping and components	Carbon steel	Fuel oil	Loss of material	Chapter XI.M30, "Fuel Oil Chemistry" The AMP is to be augmented by verifying the effectiveness of fuel oil chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
7	General piping and components	Carbon steel	Fuel oil	Loss of material and macrofouling	Chapter XI.M30, "Fuel Oil Chemistry" The AMP is to be augmented by verifying the effectiveness of fuel oil chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
17, 29	General piping and components	Carbon steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Carbon steel (without lining/coating or with degraded lining/coating)	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
21	General piping and components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	General piping and components	Carbon steel	System temperature >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
3	General piping and components	Carbon steel	Treated water >220°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
15, 29	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
8	General piping and components	Carbon steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) *The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.*	Yes, detection of aging effects is to be evaluated
1	General piping and components	Carbon steel with elastomer lining	Treated borated water	Loss of material (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
1	General piping and components	Carbon steel with elastomer lining	Treated water	Loss of material (only for carbon steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
1	General piping and components	Carbon steel with elastomer lining, or stainless steel cladding	Treated water	Loss of material (only for carbon steel after lining/cladding degradation)	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
26	General piping and components	Cast austenitic stainless steel	Treated water > 140°F	Cracking	Chapter XI.M25, "BWR Reactor Water Cleanup System"	No
3	General piping and components	Cast austenitic stainless steel	Treated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
5	General piping and components	Copper alloy <15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
17, 29	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
21	General piping and components	Copper alloy <15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
5	General piping and components	Copper alloy >15% Zn	Condensation (Int or Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
21	General piping and components	Copper alloy >15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
17, 29	General piping and components	Copper alloy >15% Zn	Raw water	Loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
17, 29	General piping and components	Copper alloy >15% Zn	Raw water	Macrofouling and loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
17, 29	General piping and components	Gray cast iron	Raw water	Macrofouling and loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
15, 29	General piping and components	Gray cast iron	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System," and Chapter XI.M33, "Selective Leaching of Materials"	No
15	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
17, 29	General piping and components	Stainless steel	Raw water	Loss of material	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
21	General piping and components	Stainless steel	Raw water	Loss of material and macrofouling	Chapter XI.M27, "Fire Water System"	No
13	General piping and components	Stainless steel	Treated borated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
3	General piping and components	Stainless steel	Treated borated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
1, 8	General piping and components	Stainless steel	Treated water	Loss of material	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515) The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
13	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
25	General piping and components	Stainless steel	Treated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
26	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M25, "BWR Reactor Water Cleanup System"	No
27	General piping and components	Stainless steel	Treated water > 140°F	Cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking" and Chapter XI.M2, "Water Chemistry," for BWR water in BWRVIP-29 (EPRI TR-103515)	No
3	General piping and components	Stainless steel	Treated water >270°F	Cumulative fatigue damage	*Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).*	Yes, TLAA
17, 29	Heat exchanger shell side components	Carbon steel	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
15, 28	Heat exchanger shell side components	Carbon steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
17, 29	Heat exchanger shell side components	Copper alloy <15% Zn	Raw water	Loss of material and macrofouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17, 29	Heat exchanger shell side components	Copper alloy >15% Zn	Raw water	Macrofouling and loss of material/ selective leaching	Chapter XI.M20, "Open-Cycle Cooling Water System" and Chapter XI.M33, "Selective Leaching of Materials"	No
15, 28	Heat exchanger shell side components	Stainless steel	Treated water	Loss of material	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
4	Heat exchanger shell side components	Stainless steel	Treated water >140°F	Cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
9	Heat exchanger tube side components	Stainless steel	Treated borated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading, or loss of material due to pitting and crevice corrosion. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes. (See Oconee operating experience, License Renewal Application, Revision 2, June 1998, p. 3.4-26)	Yes, plant specific
4	Heat exchanger tube side components	Stainless steel	Treated water >140°F	Cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
17	Heat exchanger tubes	Copper alloy <15% Zn	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	Heat exchanger tubes	Copper alloy <15% Zn	Treated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
17	Heat exchanger tubes	Copper alloy >15% Zn	Raw water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
17	Heat exchanger tubes	Copper alloy >15% Zn	Treated water	Fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
4	High-pressure pump Casing and closure bolting	Stainless steel, carbon steel	Treated borated water	Cracking/cyclic loading	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Galvanized steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces	Stainless steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components external surfaces and bolting	Carbon steel	Air – indoor (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
14	Piping and components external surfaces and bolting	Carbon steel	Air with boric acid leakage (Ext)	Loss of material/ Boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
19	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	Chapter XI.M24, "Compressed Air Monitoring"	No
5	Piping and components external surfaces and bolting	Carbon steel	Condensation (Ext)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Carbon steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Galvanized steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
5	Piping and components internal surfaces	Stainless steel	Condensation (Int)	Loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
6	Reactor coolant pump oil collection system Tank	Carbon steel	Lubricating oil	Loss of material	A plant specific aging management program that determines the thickness of the lower portion of the tank is to be evaluated. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
6	Reactor coolant pump oil collection system Piping, tubing, valve bodies	Carbon steel, copper alloy	Lubricating oil	Loss of material	A plant specific aging management program that monitors the degradation of the components is to be evaluated. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
9	Regenerative heat exchanger tube and shell side components	Stainless steel	Treated borated water >140°F	Cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water in EPRI TR-105714 The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading, or loss of material due to pitting and crevice corrosion. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes, plant specific
4	Regenerative heat exchanger tube and shell side components	Stainless steel	Treated water >140°F	Cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific
12	Spent fuel storage racks Neutron-absorbing sheets	Boraflex	Treated borated water	Reduction of neutron-absorbing capacity/ Boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No
12	Spent fuel storage racks Neutron-absorbing sheets	Boraflex	Treated water	Reduction of neutron-absorbing capacity/ Boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No
10	Spent fuel storage racks Neutron-absorbing sheets	Boral, boron steel	Treated borated water	Reduction of neutron-absorbing capacity and loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
10	Spent fuel storage racks Neutron-absorbing sheets	Boral, boron steel	Treated water	Reduction of neutron-absorbing capacity and loss of material	A plant-specific aging management program is to be evaluated.	Yes, plant specific
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - indoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Concrete cracking and spalling	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
30	Structural fire barriers – walls, ceilings and floors	Reinforced concrete	Air - outdoor	Loss of material/ Corrosion of embedded steel	Chapter XI.M26, "Fire Protection" and Chapter XI.S6, "Structures Monitoring Program"	No
11	Structural Steel	Carbon steel	Air – indoor (Int)	Loss of material	Chapter XI.S6, "Structures Monitoring Program"	No
23	Tank	Carbon steel	Air – outdoor (Ext)	Loss of material	Chapter XI.M29, "Aboveground Carbon Steel Tanks"	No

(Later)

Table IV.A2

Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)
Vessel internal component	Nickel based alloy	Treated borated water	Loss of material	Water chemistry
Vessel internal component	Stainless steel	Treated borated water	Loss of material	Water chemistry
Vessel external surfaces and bolting	Stainless steel	Air with leaking boric acid	Fatigue	TLAA
Vessel external surfaces and bolting	Stainless steel	Air with leaking boric acid	Loss of preload	Bolting integrity
Vessel external surfaces and bolting	High strength low alloy steel	Air with leaking boric acid	Cracking - SCC	ISI
CRDM components	Nickel based alloy	Treated borated water	Loss of material	Water chemistry
CRDM components	Nickel based alloy	Treated borated water	Fatigue	TLAA
CRDM components	Nickel based alloy	Treated borated water	Cracking - SCC	Water chemistry and ISI

Comment: Or add material to existing entry

ESF and Auxiliary Systems Tables

Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)
General piping and components	Carbon steel	Nitrogen	None	None
General piping and components	Copper alloy	Air	None	None
General piping and components	Copper alloy	Nitrogen	None	None
General piping and components	Stainless steel	Air	None	None
General piping and components	Stainless steel	Nitrogen	None	None
General piping and components	Stainless steel	Treated borated water	Loss of material	Water chemistry

Structures Tables

Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)
Structural steel and support members	Galvanized Steel	Exposed to weather	Loss of material	Structures Monitoring
Cable trays, conduits, support members	Galvanized Steel	Protected from weather	Loss of material	Structures Monitoring
Flood Barriers	Elastomers	Protected from weather	Change in material property	Structures Monitoring
Outdoor structural components (duct bank manhole covers, roof drain pipes, etc.)	Carbon steel (cast iron)	Exposed to weather	Loss of material	Structures Monitoring