3.0 AGING MANAGEMENT REVIEW

For those structures and components identified as subject to an aging management review, 10 CFR 54.21(a)(3) requires demonstration that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. This section describes the results of the aging management reviews of the components and structures identified in Section 2, *Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results.*

The aging management reviews were conducted by:

1. Identifying the materials and environments of these structures and components;

2. Determining the applicable aging effect(s) requiring management; and

3. Assigning the appropriate aging management program to those components and structures with materials and environments that were determined to be subject to an aging effect requiring management.

The result of each mechanical and structural aging management review is documented as a unique set of component(s) or subcomponent(s), made of a material, exposed to an environment, with an Aging Effect Requiring Management (AERM), managed by an Aging Management Program (AMP). This unique set of

- component(s) or subcomponent(s)
- material
- environment
- AERM
- AMP

is defined as a FCS Aging Management Group (AMG). The aging management review results for systems, structures, or component groupings are made up of several AMGs.

Four types of aging management review results are discussed in this section of the application. The first of these are the FCS AMGs that credit AMPs evaluated in NUREG-1801. To identify those FCS AMGs that credit AMPs evaluated in NUREG-1801, each FCS AMG was compared to the NUREG-1801, Volume 2 aging management review results using the process documented below. FCS aging management review results were classified as being consistent with NUREG-1801 if the comparison between each FCS AMG and a single row from the tables in NUREG-1801, Volume 2 met the following criteria.

1. The FCS AMG component, material, environment and AERM are determined to be the same, using engineering judgment, as the component, material, environment and AERM documented in NUREG-1801, Volume 2.

2. The FCS AMP is determined to be the same, using engineering judgment, as the AMP documented in NUREG-1801, Volume 2; or NUREG-1801, Volume 2 specifies a plant specific AMP.

FCS AMG aging management review results were classified as consistent with NUREG-1801 with deviation if the comparison between the FCS AMG and a single row from the tables in NUREG-1801, Volume 2 met criterion 1 above, and the FCS AMP deviates from one or more of the acceptance criteria for the AMP documented in Chapters 10 and 11 of NUREG-1801, Volume 2.

The Aging Management Review results for FCS AMGs that credit AMPs evaluated in NUREG-1801 are reported in Tables 3.x.1 of sections 3.1 through 3.6. The process used to develop these tables is described below.

The component, aging effect/mechanism, aging management programs and further evaluation recommended columns from Table 3.x.1 of NUREG-1800 were copied from NUREG-1800 for those rows applicable to a PWR.

A discussion column was added to the four columns. Where applicable, the following information was entered in the discussion column:

- A statement that the FCS AMGs are consistent with NUREG-1801, that the FCS AMGs are consistent with NUREG-1801 with deviation(s), or that the components, materials and environments identified in NUREG-1801 are not applicable to FCS
- Identification of the FCS AMP when NUREG-1801 specifies a plant specific program; the applicable Appendix B section is also identified
- A discussion of the materials and environments included in the FCS AMGs that are consistent with the materials and environments reported in NUREG-1801
- If necessary, a description of component(s) in the FCS AMGs that is not included in NUREG-1801
- If necessary, a description of material(s) in the FCS AMGs that is not included in NUREG-1801

In Table 3.6-1, discussions of a FCS specific AMP and modification are included for electrical cables and connectors not subject to 10 CFR 50.49 EQ requirements.

The second type of aging management review result discussed in Sections 3.1, 3.2, 3.3, 3.4, and 3.5 of the application are the FCS AMGs that do not credit AMPs evaluated in NUREG-1801. These aging management review results are reported in Tables 3.x.2 of Sections 3.1, 3.2, 3.3, 3.4, and 3.5. The entries in Tables 3.x.2 were developed by identifying components with the same material, environment, AERM and AMP, and entering these results as a single row in the table. The AERM column of Tables 3.x.2 includes a discussion of the applicable aging mechanisms for the AERM. The applicable Appendix B section is also identified for each AMP.

The third type of Aging Management Review results discussed in Sections 3.1, 3.2, 3.3, 3.4, and 3.5 of the application are the FCS AMGs with components or materials not evaluated in NUREG-1801 that rely on aging management programs in NUREG-1801 for FCS License Renewal and the justification for the use of these programs. These aging management review results are reported in Tables 3.x.3 of Sections 3.1, 3.2, 3.3, 3.4, and 3.5.

The fourth type of Aging Management Review results discussed in this section of the application includes the components replaced on the basis of performance or condition. The performance or condition monitoring programs to ensure functionality during the period of extended operation are discussed in Section 3.3 of this application.

3.1 AGING MANAGEMENT OF REACTOR COOLANT SYSTEMS

The FCS reactor coolant systems evaluated in this section of the application consist of the Reactor Coolant System, the Reactor Vessel and the Reactor Vessel Internals and associated components.

The Reactor Coolant System consists of two heat transfer loops connected in parallel to the reactor vessel. Each loop contains one steam generator, two reactor coolant pumps, connecting piping and instrumentation. A pressurizer is connected to one of the reactor vessel outlet (hot leg) pipes by a surge line. All components of the Reactor Coolant System are located within the Containment Building.

The Reactor Vessel is a 140-inch beltline inner diameter two-loop vessel. This configuration has four coolant inlet nozzles and two coolant outlet nozzles. The vessel includes a removable head with multiple penetrations (control element drive mechanisms, in-core instrumentation nozzles, and the reactor vessel vent line). The vessel includes two leakage detection lines. The vessel is an all welded, manganese molybdenum-nickel steel plate and forging construction. The interior surfaces of the vessel in contact with reactor coolant are clad with austenitic stainless steel.

The Reactor Vessel Internals are designed to support and align the fuel assemblies, control element assemblies (CEAs), and in-core instrumentation (ICI) assemblies, and to guide reactor coolant through the reactor vessel. The components of the Reactor Vessel Internals consist of the upper guide structure, core support barrel, thermal shield, core shroud, CEA shroud assemblies, ICI assemblies, lower support structure, and flow skirt.

Operating Experience:

Site: A review of plant specific operating experience was conducted, including the review of Condition Reports and discussions with appropriate site personnel to identify AERM. These reviews concluded that the AERM identified by the FCS specific operating experience were consistent with those identified in NUREG-1801.

Industry: A review of industry-wide operating experience was conducted to identify aging effects requiring management. This included a review of operating experience issued during 2001. This review concluded that the AERM identified by industry operating experience were consistent with those identified in NUREG-1801.

On-Going: The on-going review of plant specific and industry-wide operating experience is conducted in accordance with the FCS Operating Experience Program.

3.1.1 AGING MANAGEMENT PROGRAMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR LICENSE RENEWAL

Table 3.1-1 shows the aging management programs evaluated in NUREG-1801 that are relied on for license renewal of the reactor coolant systems at FCS. Note that this table only includes those components, materials and environments that are applicable to a PWR. Information on FCS specific components and materials, not listed in NUREG-1801 but included in the component group of this application, is included in the discussion column.

TABLE 3.1-1
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.01	Reactor coolant pressure boundary components	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801 except as noted in item 4 below. 2. The metal fatigue time limited aging analyses are discussed in Section 4.3. 3. Consistent with NUREG-1801, this group includes the low alloy steel and carbon steel with stainless steel cladding, stainless steel, CASS, and nickel alloy in borated treated water; and low alloy steel in deoxygenated water and steam at FCS. 4. Cumulative fatigue damage is not an aging effect requiring management for control element assembly shroud bolts and core support barrel snubber assembly socket head cap screws. These components are preloaded to prevent fatigue cycles.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.02	Steam generator shell assembly	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry	Yes, detection of aging effects is to be further evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. This aging effect is managed by the Inservice Inspection Program (B.1.6), the Chemistry Program (B.1.2) and the Steam Generator Program (B.2.9). The Steam Generator Program includes methods to detect general, crevice and pitting corrosion discussed in NUREG-1801, Volume 2, IV.D1.1-c. These programs are described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes carbon steel in deoxygenated treated water at FCS.
3.1.1.03	Pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E>1 MeV)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99	Yes, TLAA	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The reactor vessel neutron embrittlement time limited aging analyses are discussed in Section 4.2. 3. Consistent with NUREG-1801, this group includes low alloy steel with stainless steel cladding in borated treated water.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.04	Reactor vessel beltline shell and welds	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Reactor Vessel Integrity Program (B.1.7) manages this aging effect. This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes low alloy steel with stainless steel cladding in borated treated water.
3.1.1.05	Westinghouse and B&W baffle/former bolts	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant specific	Yes, plant specific	This item is not applicable since FCS is a Combustion Engineering designed and manufactured reactor.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.06	Small-bore reactor coolant system and connected systems piping	Crack initiation and growth due to SCC, intergranular SCC, and thermal and mechanical loading	Inservice inspection; water chemistry; one-time inspection	Yes, parameters monitored/ inspected and detection of aging effects are to be further evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. This aging effect is managed by the Inservice Inspection Program (B.1.6), the Chemistry Program (B.1.2) and the One-Time Inspection Program (B.3.5). These programs are described in Appendix B of this application. The One-Time Inspection Program verifies that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. 3. Consistent with NUREG-1801, this group includes stainless steel in borated treated water at FCS.
3.1.1.07	Vessel shell	Crack growth due to cyclic loading	TLAA	Yes, TLAA	Underclad crack growth due to cyclic loading was not identified as a TLAA for FCS.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.08	Reactor internals	Changes in dimension due to void swelling	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801 with the exception noted in item 4 below. 2. This aging effect is managed by the Reactor Vessel Internals Inspection Program (B2.8). FCS will continue to participate in industry programs to investigate aging effects and determine appropriate aging management programs. This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes stainless steel in borated treated water at FCS. 4. Changes in dimension due to void swelling are not an aging effect requiring management for some reactor internals components because the intended function of the component is not affected. As noted in the Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 1, the specific impacts of concern for void swelling are constriction of flow paths, interference with control rod insertion and excessive baffle bolt loading.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					This is consistent with NUREG-1705, Safety Evaluation Report Related to the License Renewal of Calvert Cliffs Nuclear Power Plant, Units 1 and 2 (Final Report), and NUREG-1723, Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station, Units 1, 2 and 3. Swelling of certain components does not impact the noted concerns. These components are the core support barrel alignment key, core support barrel fasteners, core support barrel locking collar, core support barrel spacer, core support barrel upper flange, upper guide structure alignment lug (NUREG-1801 FAP guide lug), upper guide structure fasteners, upper guide structure guide pins, hold down ring, upper guide structure locking strip, upper guide structure plate (a support for an instrument tube), upper guide structure shim ring, upper guide structure tab, thermal shield positioning pins and screws, thermal shield pins, thermal shield shim, lower internals anchor block,

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					lower internals fasteners, lower vessel internals dowel pins, core shroud fasteners, control element assembly shroud nuts and bolts, in-core instrumentation guide tubes (above instrumentation support plate), in-core instrumentation guide tube fasteners, incore instrumentation support plate and gussets.
3.1.1.09	PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains	Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. This aging effect is managed by the Alloy 600 Program (B.3.1). This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes Alloy 600 in borated treated water at FCS. The vessel flange leak detection line at FCS is made of Alloy 600.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.10	Cast austenitic stainless steel (CASS) reactor coolant system piping	Crack initiation and growth due to SCC	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. This aging effect is managed by the Chemistry Program (B.1.2), the Inservice Inspection Program (B.1.6) and the Thermal Embrittlement of Cast Austenitic Stainless Steel Program (B.3.7). These programs are described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes cast austenitic stainless steel (CASS) reactor coolant system piping.
3.1.1.11	Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry	Yes, AMP for PWSCC of Inconel 182 welds is to be evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. This aging effect is managed by the Alloy 600 Program (B.3.1), Chemistry Program (B.1.2) and Inservice Inspection Program (B.1.6) These programs are described in Appendix B of this application. The Alloy 600 Program manages the AERM of PWSCC in Inconel 182 welds. 3. Consistent with NUREG-1801, this group includes Alloy 600 and nickel alloys in borated treated water at FCS.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.12	Westinghouse and B&W baffle former bolts	Crack initiation and growth due to SCC and IASCC	Plant specific	Yes, plant specific	This item is not applicable since FCS is a Combustion Engineering designed and manufactured reactor.
3.1.1.13	Westinghouse and B&W baffle former bolts	Loss of preload due to stress relaxation	Plant specific	Yes, plant specific	This item is not applicable since FCS is a Combustion Engineering designed and manufactured reactor.
3.1.1.14	Steam generator feedwater impingement plate and support	Loss of section thickness due to erosion	Plant specific	Yes, plant specific	The components identified in NUREG-1801, Volume 2, IV.D1.1-e are not applicable to FCS.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.15	(Alloy 600) Steam generator tubes, repair sleeves, and plugs	Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry	Yes, effectiveness of a proposed AMP is to be evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. This aging effect is managed by the Steam Generator Program (B1.7) and Chemistry Program (B.1.2). These programs are described in Appendix B of this application. The FCS Technical Specifications have already incorporated the NRC-approved basis for steam generator degradation management. 3. Consistent with NUREG-1801, this group includes Alloy 600 in borated treated and deoxygenated treated water. 4. Combustion Engineering (Westinghouse) mechanical and welded steam generator tube plugs are installed at FCS. 5. NUREG-1801 IV.D 1.2-f is not pertinent to FCS, as phosphate chemistry has never been used. Regarding NUREG-1801 IV.D 1.2-g, FCS did not require analysis in accordance with NRC Bulletin 88-02.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.16	Tube support lattice bars made of carbon steel	Loss of section thickness due to FAC	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The inspection of the tube support lattice bars for loss of thickness is included in the Steam Generator Program (B.2.9) described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes carbon steel in deoxygenated water.
3.1.1.17	Carbon steel tube support plate	Ligament cracking due to corrosion	Plant specific	Yes, effectiveness of a proposed AMP is to be evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. This aging effect is managed by the Steam Generator Program (B.2.9) and Chemistry Program (B.1.2). These programs are described in Appendix B of this application. The FCS Technical Specifications have already incorporated NRC-approved guidance for steam generator degradation management. 3. Consistent with NUREG-1801, this group includes carbon steel in deoxygenated water.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.18	Steam generator feedwater inlet ring and supports	Loss of material due to flow-corrosion	Combustion Engineering (CE) steam generator feedwater ring inspection	Yes, plant specific	As stated in NUREG-1801, Volume 2, VI.D1.3-a, this effect is only applicable to certain CE System 80 steam generators. Because of differences in design between the FCS steam generators and the System 80 steam generators, this effect is not applicable to FCS.
3.1.1.19	Reactor vessel closure studs and stud assembly	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes low alloy steel in air possibly exposed to borated treated water. 3. The Reactor Head Closure Studs Program is incorporated into the Bolting Integrity Program at FCS.
3.1.1.20	CASS pump casing and valve body	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes CASS in borated treated water.
3.1.1.21	CASS piping	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes CASS in borated treated water.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.22	BWR piping and fittings; steam generator components	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in deoxygenated treated water.
3.1.1.23	Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high pressure and high temperature systems	Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/ or SCC	Bolting integrity	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel, low alloy steel and carbon steel in air possibly exposed to borated treated water.
3.1.1.24	CRD nozzle	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes Alloy 600 in borated treated water.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.25	Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting) *Note: NUREG-1801, Volume 2, items IV.C2.3-b and IV.C2.4-b that include CASS are included in this group.*	Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC	Inservice inspection; water chemistry	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel, austenitic stainless steel, Alloy 600 and carbon or low alloy steel clad with stainless steel in borated treated water.
3.1.1.26	Reactor vessel internals CASS components	Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling	Thermal aging and neutron irradiation embrittlement	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes CASS in borated treated water.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.27	External surfaces of carbon steel components in reactor coolant system pressure boundary	Loss of material due to boric acid corrosion	Boric acid corrosion	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in air possibly exposed to borated treated water.
3.1.1.28	Steam generator secondary manways and handholds (CS)	Loss of material due to erosion	Inservice inspection	No	This item is not applicable since FCS is a Combustion Engineering designed and manufactured reactor.
3.1.1.29	Reactor internals, reactor vessel closure studs, and core support pads	Loss of material due to wear	Inservice inspection	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes low alloy steel and stainless steel in borated treated water.
3.1.1.30	Pressurizer integral support	Crack initiation and growth due to cyclic loading	Inservice inspection	No	The component identified in NUREG-1801 is not applicable to FCS.
3.1.1.31	Upper and lower internals assembly (Westinghouse)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring	No	These items are not applicable since FCS is a Combustion Engineering designed and manufactured reactor.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.32	Reactor vessel internals in fuel zone region (except Westinghouse and Babcock & Wilcox [B&W] baffle bolts)	Loss of fracture toughness due to neutron irradiation embrittlement, and void swelling	PWR vessel internals; water chemistry	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel and nickel alloys in borated treated water at FCS.
3.1.1.33	Steam generator upper and lower heads; tubesheets; primary nozzles and safe ends	Crack initiation and growth due to SCC, PWSCC. IASCC	Inservice inspection; water chemistry	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel in borated treated water.
3.1.1.34	Vessel internals (except Westinghouse and B&W baffle former bolts)	Crack initiation and growth due to SCC and IASCC	PWR vessel internals; water chemistry	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel, nickel alloys and CASS in borated treated water.
3.1.1.35	Reactor internals (B&W screws and bolts)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	No	These items are not applicable since FCS is a Combustion Engineering designed and manufactured reactor.

TABLE 3.1-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1.36	Reactor vessel closure studs and stud assembly	Loss of material due to wear	Reactor head closure studs	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes high strength steel in air possibly exposed to borated treated water at FCS. 3. The Reactor Head Closure Studs Program is incorporated into the Bolting Integrity Program (B.1.1) at FCS.
3.1.1.37	Reactor internals (Westinghouse upper and lower internal assemblies; CE bolts and tie rods)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801 with the deviation that FCS does not credit the Loose Parts Monitoring Program as discussed in NUREG-1801, Volume 2, IV.B3.2-g and IV.B3.4-h. 2. The Reactor Vessel Internals Inspection Program (B.2.8) manages this aging effect. This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes nickel alloy and stainless steel in borated treated water.

3.1.2 COMPONENTS OR AGING EFFECTS THAT ARE NOT ADDRESSED IN NUREG-1801

Table 3.1-2 contains the reactor coolant systems aging management review results that are not addressed in NUREG-1801. This table includes the component types, materials, environments, aging effects requiring management and the programs and activities for managing aging. Table 3.1-3 contains components and materials in reactor coolant systems not evaluated in NUREG-1801 that rely on aging management programs in NUREG-1801 for FCS License Renewal and the justification for the use of these programs.

TABLE 3.1-2
FCS REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.1.2.01	External surfaces of stainless steel components in reactor coolant system pressure boundary	Stainless Steel	Ambient Air	None	Not Applicable
3.1.2.02	Pressurizer heater sleeves, steam generator - tubes, ICI nozzles, nozzle safe ends, CEDM and incore instrument housings, reactor head vent pipe, pressurizer bottom head plate cladding, steam generator primary head cladding and shock suppressors & supports, nozzle welds, thermal sleeves	Nickel Based Alloy including Alloy 600	Borated Treated Water	Loss of Material Crevice corrosion in the presence of sufficient levels of oxygen, halogens, sulfates, or copper	Chemistry Program (B.1.2)
3.1.2.03	External surfaces of nickel based alloy components in reactor coolant system pressure boundary	Nickel Based Alloy including Alloy 600	Ambient Air	None	Not Applicable
3.1.2.04	Steam generator lower head and manway cladding and primary side tube sheet	Nickel Based Alloy	Borated Treated Water	Cracking	Chemistry Program (B.1.2)

TABLE 3.1-2 (CONTINUED)
FCS REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.1.2.05	Reactor coolant pump thermal barrier	Cast Austenitic Stainless Steel (CASS)	Corrosion-Inhibited Treated Water	Cracking	Chemistry Program (B.1.2)
3.1.2.06	Secondary side of the tubesheet, steam generator feedwater, steam and instrument nozzles, and feedwater nozzle safe ends	Low-Alloy Steel	Deoxygenated Treated Water	Loss of Material • General and crevice corrosion due to the exposure of low-alloy steel to dissolved oxygen • Pitting corrosion due to the exposure of low-alloy steel to halogens and sulfates	Chemistry Program (B.1.2), Steam Generator Program (B.2.9) and Inservice Inspection Program (B.1.6))
3.1.2.07	Steam generator tube plugs	Nickel Based Alloy	Deoxygenated Treated Water	Loss of Material Crevice and pitting corrosion due to the exposure of nickel-based alloys to halogens and sulfates	Chemistry Program (B.1.2) and Steam Generator Program (B.2.9)

TABLE 3.1-2 (CONTINUED)
FCS REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.1.2.08	Reactor vessel internals - flow skirt	Alloy 600	Borated Treated Water	Changes in Dimensions Void swelling as a result of helium bubble nucleation and growth from nuclear transmutation reactions of nickel or boron in the austenitic stainless steel or nickel-based alloy material.	Reactor Vessel Internals Inspection Program (B.2.8)
3.1.2.09	Reactor vessel internals - flow skirt	Alloy 600	Borated Treated Water	Cracking · Primary Water Stress Corrosion Cracking · irradiation-assisted stress corrosion cracking in the presence of oxygen concentrations > 5 ppb, halogen concentrations > 150 ppb, and fluence levels > 5 E20 n/cm2	Alloy 600 Program (B.3.1)

TABLE 3.1-2 (CONTINUED)
FCS REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.1.2.10	Reactor vessel internals - flow skirt	Alloy 600	Borated Treated Water	Fatigue Due to repeated stress/strain cycles caused by fluctuating loads and temperatures	Fatigue Monitoring Program (B.2.4)
3.1.2.11	Reactor vessel internals - flow skirt	Alloy 600	Borated Treated Water	Reduction of Fracture Toughness Due to changes in the properties of the stainless steel and nickel-base alloys used in reactor internals	Reactor Vessel Internals Inspection Program (B.2.8)
3.1.2.12	Steam generator secondary manway steel bolts	Carbon Steel	Ambient Air	Loss of preload Due to stress relaxation in high temperature environments	Bolting Integrity Program (B.1.1)
3.1.2.13	Pressurizer manway cover plate, SG feedwater and steam nozzle safe ends	Carbon Steel	Ambient Air	Loss of Material Due to the exposure to leaking boric acid	Boric Acid Corrosion Prevention Program (B.2.1)

TABLE 3.1-2 (CONTINUED)
FCS REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.1.2.14	Steam generator steam nozzle safe end, steam generator feed ring	Carbon Steel	Deoxygenated Treated Water	Loss of Material • General and pitting corrosion due to the exposure to dissolved oxygen • pitting corrosion due to the exposure to halogens and sulfates	Chemistry Program (B.1.2), Steam Generator Program (B.2.9) and Inservice Inspection Program (B.1.6)
3.1.2.15	Pressurizer base	Low-Alloy Steel	Ambient Air	Loss of Material Due to the exposure to leaking boric acid	Boric Acid Corrosion Prevention Program (B.2.1)
3.1.2.16	Pressurier relief valve and Instrument nozzle nozzle inserts	Nickel Based Alloy	Borated Treated Water	Cracking Stress corrosion cracking due to potential exposure to halogens or sulfates.	Chemistry Program (B.1.2) and Inservice Inspection Program (B.1.6)

TABLE 3.1-3
COMPONENTS IN REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.1.3.01	Thermal Shield and Thermal Shield Positioning Pin & Bolt	Stainless Steel	High Temp/ Neutron Fluence/ Borated Treated Water	Cracking	Chemistry Program (B.1.2)	3.1.1.34	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, IV.B3.4-a and IV.B3.4-e
3.1.3.02	Thermal Shield and Thermal Shield Positioning Pin & Bolt	Stainless Steel	High Temp/ Neutron Fluence/ Borated Treated Water	Cracking	Reactor Vessel Internals Inspection Program (B.2.8)	3.1.1.34	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, IV.B3.4-a and IV.B3.4-e

TABLE 3.1-3 (CONTINUED)
COMPONENTS IN REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.1.3.03	Bolt - Thermal Shield	Stainless Steel	High Temp/ Neutron Fluence/ Borated Treated Water	Loss of preload	Inservice Inspection Program (B.1.6)	3.1.1.37	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, IV.B3.4-h
3.1.3.04	Thermal Shield and Thermal Shield Positioning Pin & Bolt	Stainless Steel	High Temp/ Neutron Fluence/ Borated Treated Water	Reduction of Fracture Toughness	Reactor Vessel Integrity Program (B.1.7)	3.1.1.32	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, IV.B3.4-c and IV.B3.4-g

TABLE 3.1-3 (CONTINUED)
COMPONENTS IN REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.1.3.05	Thermal Shield and Thermal Shield Positioning Pin & Bolt	Stainless Steel	High Temp/ Neutron Fluence/ Borated Treated Water	Changes in Dimensions	Reactor Vessel Internals Inspection Program (B.2.8)	3.1.1.08	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, IV.B3.4-b
3.1.3.06	Reactor coolant valves including PORV, drain valves, head and pressurizer vent valves, instrument isolation valves etc.; Reactor vessel cladding	Stainless Steel	Borated treated water	Cracking	Chemistry (B.1.2) and Inservice Inspection Programs (B.1.6)	3.1.1.25	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management programs as the components evaluated in NUREG-1801, Volume 2, IV.C2.2-f and IV.A2.4-b
3.1.3.07	Not used in application						

TABLE 3.1-3 (CONTINUED)
COMPONENTS IN REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.1.3.08	Feedwater nozzle safe end	Low-Alloy Steel	Containment Air	Loss of Material	Boric Acid Corrosion Prevention Program (B.2.1)	3.1.1.27	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management programs as the components evaluated in NUREG-1801, Volume 2, IV.D1.1-g
3.1.3.09	Reactor coolant pump driver mounts	Carbon Steel	Containment Air	Loss of Material	Boric Acid Corrosion Prevention Program (B.2.1)	3.1.1.27	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management programs as the components evaluated in NUREG-1801,Volume 2, IV.C2.3-f

TABLE 3.1-3 (CONTINUED)
COMPONENTS IN REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.1.3.10	Pressurizer relief valve external portion of body	Carbon Steel	Containment Air	Loss of Material	Boric Acid Corrosion Prevention Program (B.2.1)	3.1.1.27	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management programs as the components evaluated in NUREG-1801, Volume 2, IV.C2.4-f
3.1.3.11	Reactor vessel nozzles and safe ends, pressurizer shell	Low-Alloy Steel	Containment Air	Loss of Material	Boric Acid Corrosion Prevention Program (B.2.1)	3.1.1.27	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management programs as the components evaluated in NUREG-1801, Volume 2, IV.A2.1-a

TABLE 3.1-3 (CONTINUED)
COMPONENTS IN REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.1.3.12	Steam generator feedwater and steam nozzles	Low-Alloy Steel	Deoxygenated Treated Water	Loss of Material	Flow-Accelerated Corrosion Program (B.1.5)	3.1.1.22	The material is subject to the same environment and aging effect, and managed by the same aging management program as evaluated in Table 3.1-1, Item 3.1.1.22. The aging effect is independent of component type.
3.1.3.13	ICI Nozzles, RV Vent Nozzle	Alloy 600	Borated Treated Water	Cracking	Chemistry Program (B.1.2) Alloy 600 Program (B.3.1)	3.1.1.24	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management programs as the components evaluated in NUREG-1801, Volume 2, IV.A2.2-a and IV.A2.7-b

TABLE 3.1-3 (CONTINUED)
COMPONENTS IN REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.1.3.14	Thermal Shield	Stainless Steel	High Temp/ Neutron Fluence/ Borated Treated Water	Fatigue	TLAA	3.1.1.01	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management programs as the components evaluated in NUREG-1801, Volume 2, IV.B3.4-d

3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES SYSTEMS

The Engineered Safety Features Systems are composed of the Safety Injection and Containment Spray System and the Mechanical Containment Penetrations Commodity Group at FCS.

The Safety Injection (SI) System injects borated water into the Reactor Coolant System to provide emergency core cooling. The major components of the SI system are the three high pressure safety injection (HPSI) pumps, two low pressure safety injection (LPSI) pumps, four safety-injection tanks, four safety-injection leakage coolers, eight HPSI control valves, four LPSI control valves and other various valves, instrumentation, and piping.

During normal plant operation the SI system is maintained in a standby mode with all of its components lined up for emergency injection. A safety injection actuation signal (SIAS) automatically starts the HPSI and LPSI pumps and automatically opens the high pressure and low pressure injection valves. During the injection mode of operation, the HPSI and LPSI pumps take suction from the Safety Injection and Refueling Water Tank (SIRWT) and inject borated water into the Reactor Coolant System (RCS) via the safety injection nozzles located on the RCS cold legs. The four safety injection tanks constitute a passive injection system.

The Containment Spray (CS) System consists of three spray pumps, two heat exchangers (shutdown cooling heat exchangers) and all necessary piping, valves, instruments, and accessories. The pumps discharge the borated water through the two heat exchangers, during recirculation, to a dual set of spray headers and spray nozzles in the containment. These spray headers are supported from the containment roof.

The Containment Penetrations and System Interface Components for Non-CQE Systems Commodity Group consists of isolation valves, piping, and mechanical penetrations into containment for the following mechanical systems: Compressed Air (CA-PA), Demineralized Water (DW), Blowpipe and Feedwater Blowdown (FW-BD). The safety related heat exchangers in the Demineralized Water System are included. The mechanical portions of all electrical penetrations (i.e., canister and header plate) are also included.

Operating Experience:

Site: A review of plant specific operating experience was conducted, including the review of Condition Reports and discussions with appropriate site personnel to identify AERM. These reviews concluded that the AERM identified by the FCS specific operating experience were consistent with those identified in NUREG-1801.

Industry: A review of industry-wide operating experience was conducted to identify aging effects requiring management. This included a review of operating experience issued during 2001. This review concluded that the AERM identified by industry operating experience were consistent with those identified in NUREG-1801.

On-Going: The on-going review of plant specific and industry-wide operating experience is conducted in accordance with the FCS Operating Experience Program.

3.2.1 AGING MANAGEMENT PROGRAMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR LICENSE RENEWAL

Table 3.2-1 shows the aging management programs evaluated in NUREG-1801 that are relied on for license renewal of the Engineered Safeguards Features Systems at FCS. Note that this table only includes those components, materials and environments that are applicable to a PWR. Information on FCS specific components and materials, not listed in NUREG-1801 but included in the component group of this application, is included in the discussion column.

TABLE 3.2-1
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ENGINEERED SAFETY FEATURES EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1.01	Piping, fittings, and valves in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The metal fatigue time limited aging analyses are discussed in Section 4.3.
3.2.1.02	Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to general corrosion	Plant specific	Yes, plant specific	The applicable FCS components, materials and environments identified in NUREG-1801 are discussed in row number 3.2.1.06 of this table.

TABLE 3.2-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ENGINEERED SAFETY FEATURES EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1.03	Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to pitting and crevice corrosion	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Chemistry Program (B.1.2) supplemented by the One Time Inspection Program (B.3.5) to verify the effectiveness of the Chemistry Program's management of the aging effects of these components. These programs are described in Appendix B of this application. 3. Consistent with NUREG-1801, this group only includes stainless steel in oxygenated treated water for components in containment isolation at FCS.
3.2.1.04	Containment isolation valves and associated piping	Loss of material due to microbiologically influenced corrosion	Plant specific	Yes, plant specific	No FCS containment isolation valves and associated piping in systems that are not addressed in this or other sections of this application were determined to be subject to the aging effect of loss of material due to microbiologically influenced corrosion
3.2.1.05	High pressure safety injection (charging) pump miniflow orifice	Loss of material due to erosion	Plant specific	Yes, plant specific	The component identified in NUREG-1801 is not applicable to FCS.

TABLE 3.2-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ENGINEERED SAFETY FEATURES EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1.06	External surface of carbon steel components *This row is only found in Table 2 of NUREG-1801, Volume1. It is not found in Table 3.2-1 of NUREG-1800.*	Loss of material due to general corrosion	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The General Corrosion of External Surfaces Program (B.3.3) manages the aging effects of these components. This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes carbon steel components in ambient air at FCS.
3.2.1.07	Piping and fittings of CASS in emergency core cooling system	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	No	The material identified in NUREG-1801 is not applicable to FCS. CASS piping and fittings are not used in the ESF systems at FCS.
3.2.1.08	Components serviced by open-cycle cooling system	Local loss of material due to corrosion and/or buildup of deposits due to biofouling	Open-cycle cooling water system	No	The FCS ESF components are not serviced by open-cycle cooling system.

TABLE 3.2-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ENGINEERED SAFETY FEATURES EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1.09	Components serviced by closed-cycle cooling system	Loss of material due to general, pitting, and crevice corrosion	Closed-cycle cooling water system	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel, carbon steel and cast iron in corrosion-inhibited treated water at FCS.
3.2.1.10	Pumps, valves, piping, and fittings in containment spray and emergency core cooling systems	Crack initiation and growth due to SCC	Water chemistry	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel and stainless steel clad carbon steel in chemically treated borated water at FCS.
3.2.1.11	Carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon and low alloy steel at FCS.

TABLE 3.2-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ENGINEERED SAFETY FEATURES EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1.12	Closure bolting in high pressure or high temperature systems	Loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC	Bolting integrity	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon and low alloy steel in ambient air at FCS.

3.2.2 COMPONENTS OR AGING EFFECTS THAT ARE NOT ADDRESSED IN NUREG-1801

Table 3.2-2 contains Engineered Safety Features Systems aging management review results that are not addressed in NUREG-1801. This table includes the component types, materials, environments, and aging effects requiring management, and the programs and activities for managing aging. Table 3.2-3 contains components in Engineered Safety Features not evaluated in NUREG-1801 that rely on aging management programs in NUREG-1801 for FCS License Renewal and the justification for the use of these programs.

TABLE 3.2-2
FCS ENGINEERED SAFETY FEATURES COMPONENT TYPES SUBJECT TO AGING MANAGEMENT REVIEW NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.2.2.01	Heat Exchanger - Tubes	Alloy 600	Chemically Treated Borated Water	Loss of Material Crevice corrosion in the presence of sufficient levels of oxygen, halogens, sulfates, or copper	Chemistry Program (B.1.2)
3.2.2.02	Heat Exchanger - Tubes	Alloy 600	Chemically Treated Borated Water	Cracking Stress Corrosion Cracking due to exposure to halogens or sulfates	Chemistry Program (B.1.2)
3.2.2.03	Heat Exchanger - Tubes	Alloy 600	Corrosion-Inhibited Treated Water	Loss of Material • Crevice and pitting corrosion in the presence of sufficient levels of oxygen, halogens, or sulfates • MIC due to exposure to microbiological activity	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)
3.2.2.04	External surface of stainless steel components	Stainless Steel	Ambient Air	None	Not Applicable

TABLE 3.2-2 (CONTINUED)
FCS ENGINEERED SAFETY FEATURES COMPONENT TYPES SUBJECT TO AGING MANAGEMENT REVIEW NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.2.2.05	Filter/Strainers	Galvanized Steel	Containment Air	Loss of Material • Crevice corrosion where crevices exist that allow a corrosive environment to develop • General corrosion where both oxygen and moisture are present	Period Surviellance and Preventive Maintenance Program
3.2.2.06	Heat Exchanger - Shell	Cast Iron	Corrosion-Inhibited Treated Water	Loss of Material Selective leaching due to the exposure of cast iron to dissolved oxygen	Selectrive Leaching Program
3.2.2.07	Valve, Pipes & Fittings	Carbon Steel	Dry Air/Gas	None	Not Applicable

TABLE 3.2-3
COMPONENTS IN ENGINEERED SAFETY FEATURES NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.2.3.01	Safety injection tanks, flow element and orifice bodies, orifice plate, tubing and heat exchangers	Stainless steel	Chemically Treated Borated Water	Crack initiation and growth / Stress corrosion cracking	Chemistry Program (B.1.2)	3.2.1.10	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, V.D1.1-a
3.2.3.02	Leakage accumulators	Carbon steel with stainless steel cladding	Chemically Treated Borated Water	Crack initiation and growth / Stress corrosion cracking	Chemistry Program (B.1.2)	3.2.1.10	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, V.D1.7-b

3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

The Auxiliary Systems consist of the following systems and components:

- Spent Fuel Pool Cooling System
- Fuel Handling and Heavy Load Cranes (including New and Spent Fuel Storage Racks)
- Raw Water System (Open Cycle Cooling Water System in NUREG-1801)
- Component Cooling Water System (Closed Cycle Cooling Water System in NUREG-1801)
- Chemical and Volume Control System
- Instrument Air System
- Nitrogen Gas System
- Control Room HVAC and Toxic Gas Monitoring System
- Auxiliary Building HVAC System
- Containment HVAC System
- Ventilating Air System (includes Diesel Generator rooms)
- Fire Protection System including the Fire Protection Fuel Oil System
- Diesel Generator Fuel Oil System and Auxiliary Boiler Fuel Oil System
- Diesel Generator System including the Diesel Jacket Water System, the Diesel Generator Lube Oil System, and the Diesel Generators Starting Air System
- Primary Sampling System
- Liquid Waste Disposal System
- Gaseous Waste Disposal System
- Radiation Monitoring-Mechanical Components

The Spent Fuel Pool Cooling System consists of a stainless steel lined storage pool, two storage pool circulation pumps, a storage pool heat exchanger, a demineralizer and filter, two fuel transfer canal drain pumps, piping, and manual valves. The pool concrete and liner are evaluated with the Auxiliary Building.

The Fuel Handling and Heavy Load Cranes System consists of the refueling machine, tilting machines in the Auxiliary Building and in Containment, fuel transfer conveyor, fuel transfer carrier box, fuel transfer tube, new and spent fuel handling tools, new and spent fuel storage racks, thirty-six (36) cranes of varying types (i.e., polar crane, overhead crane, hoist with monorail, and jib crane) and three (3) elevators.

The Raw Water (RW) system is an open-cycle cooling water system which uses screened water from the Missouri River. The system includes four parallel vertical mixed-flow pumps installed in the Intake Structure pump house. The pumps discharge into an interconnected header which splits into two parallel supply headers. The two supply headers run underground from the Intake Structure to the Auxiliary Building, where they join in an interconnected inlet header to the four Component Cooling Water (CCW) heat exchangers. Downstream of the CCW heat exchangers, the Raw Water discharge header runs through the Turbine Building and discharges to the river.

The Component Cooling Water System is a closed loop system used to transfer heat from various components carrying radioactive or potentially radioactive fluids to the raw water. This system consists of three motor driven circulating pumps, four heat exchangers, a surge tank, valves, and piping. The water in the system is demineralized and deaerated and an inhibitor is added for protection against corrosion.

The Chemical and Volume Control System includes one regenerative heat exchanger, one letdown heat exchanger, five ion exchangers, one volume control tank, three positive-displacement charging pumps, one boric acid batching tank, two boric acid storage tanks, two centrifugal boric acid transfer pumps, and one chemical addition tank.

The Instrument Air System provides oil-free, filtered, and dried air for pneumatic controls, instrumentation, and the actuation of valves, dampers and similar devices. Instrument Air is distributed to the various pneumatic components it serves through a network of supply headers and distribution risers. The Instrument Air System also feeds the suction of the compressors for the Diesel Starting Air system. Backup accumulators containing instrument air or nitrogen are provided on selected pneumatic devices to ensure their operability if instrument air pressure drops.

The Nitrogen Gas System provides compressed nitrogen gas to the Safety Injection Tanks and provides a gas blanket to various vessels and contained areas of the plant.

The Control Room HVAC and Toxic Gas Monitoring System consists of two air conditioning units; two outside air filter units, each with its own supply fan; an outside air intake plenum; and distribution ductwork.

The Auxiliary Building HVAC System is a once-through, non-recirculating type using supply and exhaust fans. Portions of the Auxiliary Building HVAC System may be utilized to purge hydrogen from the containment.

The Containment HVAC System provides ventilation and cooling of the containment. Containment HVAC consists of four separate sub-systems. These sub-systems provide containment air re-circulation, cooling, nuclear detector well cooling, containment purge, and hydrogen purge.

The Ventilating Air System passive equipment is contained within the Emergency Diesel Generator rooms.

The Fire Protection System water supply system has two vertical turbine type fire pumps. One fire pump is driven by an electric motor and the other fire pump is driven by a diesel engine. Both pumps deliver screened and strained Missouri River water to the underground water distribution system, which in turn supply the automatic water fire suppression systems, interior hose stations and fire hydrants in the yard. An independent underground looped yard main system capable of delivering sprinkler flow plus adequate hose flow to support manual fire fighting for a single fire is provided for the Fire Protection System.

Four safety related plant areas are provided with automatic halon 1301 extinguishing systems. These areas include the Cable Spreading Room, both Switchgear Rooms and the Control Room cabinets. The plant is divided into unique fire areas as required by Appendix A to NRC Branch Technical Position APCSB 9.5-1, and 10CFR 50, Appendix R. Walls enclosing separate fire areas utilize fire resistive construction. Openings in plant fire barriers are protected by rated fire doors, fire dampers, and fire barrier penetration seals. Portable fire extinguishers are identified in the Fire Hazards Analysis as being provided throughout the station, generally in accordance with NFPA 10. Fire extinguishers, fire hoses, and air packs are not subject to an aging management review because they are replaced based on condition in accordance with applicable NFPA standards and plant procedures for fire protection equipment. This position is consistent with the NRC Staff's guidance on consumables, which has been incorporated into NEI 95-10 Revision 2.

RCP lube oil collection neoprene hoses will be replaced on condition in accordance with the Period Surveillance and Preventive Maintenance Program. These hoses provide a gravity drain of RCP lube oil from the collection pans to the lube oil collection tanks. The hoses are not pressurized and do not normally contain fluid.

The Fire Protection Fuel Oil System supplies the sole source of fuel oil to the diesel engine fire pump. The unit is located at the north end of the Intake Structure. A 10-gallon fuel oil day tank for the diesel engine is located adjacent to the engine. Fuel is transferred from the 550-gallon diesel fire pump fuel oil tank to the day tank.

The Diesel Generator Fuel Oil System provides fuel to the emergency diesel generators in the proper amount to maintain engine speed and load. An 18,000 gallon underground storage tank serves both engines. Two transfer pumps for each diesel transfer fuel from the underground storage tank to the wall-mounted auxiliary tank. Fuel gravity drains from the wall mounted tank to the engine base tank. One engine-driven fuel oil pump and one motor driven fuel oil pump delivers fuel to the engine fuel injectors. Warehoused components include a portable hand pump, a rubber hose and hose couplings. These components will be replaced on performance or condition in accordance with the Periodic Surveillance and Preventive Maintenance Program. These components contribute to the first intended function listed above, involving the transfer of diesel fuel from the auxiliary boiler fuel oil storage tank to the diesel engine fuel oil storage tank. The components are normally not pressurized and normally do not contain fluid. The Auxiliary Boiler Fuel Oil System consists of a fuel oil transfer pump, piping, filters, instrumentation and warehoused equipment for delivery of fuel oil from the auxiliary boiler fuel oil storage tank to the diesel engine fuel oil storage tank.

The Diesel Generator System includes emergency diesel generators designed to furnish reliable in-plant ac power when power is not available from the 345 or 161-kV systems. Each emergency diesel generator is provided with an exhaust silencer and auxiliaries. Each emergency diesel generator interfaces with an integral cooling system, two air starting systems, a lubricating system, two fuel systems between the engine mounted fuel oil tanks and the engine fuel lines. Both emergency diesel generators are supplied fuel from a common, underground fuel oil storage tank by redundant transfer pumps. Immersion heaters are provided to maintain engine jacket water and lubricating oil temperatures at desirable temperatures for quick, reliable starting. The emergency diesel generators are located in separate rooms of the Auxiliary Building.

The Diesel Jacket Water System provides cooling to the engine. Each engine has its own self contained radiator type cooling system. Two different coolant mixtures are used in the diesels. For DG-1 a glycol based coolant mixture is used during the winter months with the coolant mixture being changed out to a nitrite based coolant mixture during the summer to ensure the rating of the generator. DG-2 uses a glycol based coolant mixture year round. The Diesel Generator Lube Oil System lubricates the diesel engine components and filters the engine lube oil. The Diesel Generators Starting Air System provides stored pressurized air for starting the emergency diesel generators. Each tank has the capacity for five starts of the diesel (combining for a total of ten emergency starts).

The Primary Sampling system includes the primary sampling panel, the CVCS panel, the steam generator blowdown analyzer rack, the instrument panel, steam generator blowdown sample chiller, and the manual sampling sink and hood.

The Liquid Waste Disposal system is used to collect, store, prepare for disposal, and dispose of liquid radioactive wastes. Radioactive liquid wastes are generated as a result of plant operation, repair, and maintenance activities.

The Gaseous Waste Disposal System includes the containment isolation valves that close on a Containment Isolation Actuation Signal (CIAS) and the piping between the containment penetrations and the containment isolation valves. Also included are the waste gas compressor seal water heat exchangers that receive cooling water from the Component Cooling Water System.

The Radiation Monitoring-Mechanical Components System consists of the mechanical portions of the radiation monitors and their supporting components.

Operating Experience:

Site: A review of plant specific operating experience was conducted, including the review of Condition Reports and discussions with appropriate site personnel to identify AERM. These reviews concluded that the AERM identified by the FCS specific operating experience were consistent with those identified in NUREG-1801.

Industry: A review of industry-wide operating experience was conducted to identify aging effects requiring management. This included a review of operating experience issued during 2001. This review concluded that the AERM identified by industry operating experience were consistent with those identified in NUREG-1801.

On-Going: The on-going review of plant specific and industry-wide operating experience is conducted in accordance with the FCS Operating Experience Program.

3.3.1 AGING MANAGEMENT PROGRAMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR LICENSE RENEWAL

Table 3.3-1 shows the aging management programs evaluated in NUREG-1801 that are relied on for license renewal of the Auxiliary Systems at FCS. Note that this table only includes those components, materials and environments that are applicable to a PWR. Information on FCS-specific components and materials, not listed in NUREG-1801 but included in the component group of this application, is included in the discussion column.

TABLE 3.3-1
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.01	Components in spent fuel pool cooling and cleanup	Loss of material due to general, pitting, and crevice corrosion	Water chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated	The material identified in NUREG-1801 is not applicable to FCS. These components are addressed in Section 3.3.2 of this application.
3.3.1.02	Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The General Corrosion of External Surfaces Program (B.3.3) manages this aging effect. This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group only includes elastomer seals in the ventilation systems exposed to ambient air at FCS.
3.3.1.03	Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801 for the chemical and volume control and primary sampling systems. 2. The metal fatigue time limited aging analyses are discussed in Section 4.3.1 of this application.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.04	Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR)	Crack initiation and growth due to SCC or cracking	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Chemistry (B.1.2) and One-Time Inspection Programs (B.3.5) manage this aging effect. One-Time Inspection will be conducted prior to the period of extended operation to confirm the effectiveness of the Chemistry Program. This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes stainless steel in chemically treated borated water at FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.05	Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Periodic Surveillance and Preventive Maintenance (B.2.7), General Corrosion of External Surfaces (B.3.3), and Fire Protection Programs (B.2.5) manage this aging effect. These programs are described in Appendix B of this application. The FCS Fire Protection Program provides guidance for detecting loss of material due to general, pitting, crevice, and microbiologically influenced corrosion (MIC). 3. Consistent with NUREG-1801, this group includes carbon steel, galvanized steel, and copper in air, and carbon steel in diesel engine exhaust gases at FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.06	Components in reactor coolant pump oil collect system of fire protection	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	Yes, detection of aging effects is to be further evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The One-Time Inspection Program (B.3.5) manages this aging effect. These inspections will be conducted prior to the period of extended operation. This program is described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes copper in lubricating oil at FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.07	Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Diesel Fuel Monitoring and Storage Program (B.2.3) manages this aging effect. This program is described in Appendix B of this application. Diesel Fuel Monitoring and Storage Program includes the Fuel Oil Chemistry Program at FCS. The Diesel Fuel Monitoring and Storage Program includes measures to verify the effectiveness of the fuel oil chemistry control. These inspections will be conducted prior to the period of extended operation to confirm the effectiveness of the oil chemistry control. 3, Consistent with NUREG-1801, this group includes carbon steel in fuel oil at FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.08	Heat exchangers in chemical and volume control system	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and a plant-specific verification program	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Chemistry Program (B.1.2) verified by the One-Time Inspection Program (B.3.5), Cooling Water Corrosion Program (B.2.2) and Periodic Surveillance and Preventive Maintenance Program (B.2.7) manage this aging effect. Inspections will be conducted prior to the period of extended operation to confirm the effectiveness the Chemistry Program. These programs are described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes stainless steel in chemically treated borated and corrosion inhibited treated water at FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.09	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant specific	Yes, plant specific	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Periodic Surveillance and Preventive Maintenance Program (B.2.7) manages this aging effect. This program is described in Appendix B of this application. The surveillance test evaluates the neutron absorbing samples for dimensional change, weight change, neutron attenuation change and specific gravity change. 3. Consistent with NUREG-1801, this group includes Boral encapsulated in stainless steel in chemically treated borated water at FCS.
3.3.1.10	New fuel rack assembly	Loss of material due to general, pitting, and crevice corrosion	Structures monitoring	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in ambient air at FCS.
3.3.1.11	Spent fuel storage racks and valves in spent fuel pool cooling and cleanup	Crack initiation and growth due to stress corrosion cracking	Water chemistry	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel in borated treated water at FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.12	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring	No	The material identified in NUREG-1801 is not applicable to FCS.
3.3.1.13	Closure bolting and external surfaces of carbon steel and low-alloy steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon and low alloy steel in air exposed to leaking and dripping borated treated water at FCS.
3.3.1.14	Components in or serviced by closed-cycle cooling water system	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel and stainless steel in chemically treated corrosion inhibited water at FCS.
3.3.1.15	Cranes including bridge and trolleys and rail system in load handling system	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling systems	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in ambient air at FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.16	Components in or serviced by open-cycle cooling water systems	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposits due to biofouling	Open-cycle cooling water system	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel, bronze, cast iron and stainless steel in raw water at FCS.
3.3.1.17	Buried piping and fittings	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	1. The aging management results are consistent with the results documented in NUREG-1801. 2. The aging effects are managed by the Buried Surfaces External Corrosion Program (B.3.2) and the Fire Protection Program (B.2.4) described in Appendix B of this application. The aging management activities of the Fire Protection Program are the same as those of the Buried Surfaces External Corrosion Program. 3. Consistent with NUREG-1801, this group includes carbon steel in soil at FCS.
3.3.1.18	Components in compressed air system	Loss of material due to general and pitting corrosion	Compressed air monitoring	No	The environment identified in NUREG-1801 is not applicable to FCS. Components in the instrument air system at FCS are exposed to dry air.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.19	Components (doors and barrier penetration seals) and concrete structures in fire protection	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel and sealant in ambient air at FCS.
3.3.1.20	Components in water-based fire protection	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel, cast iron, stainless steel, and bronze in raw water at FCS.
3.3.1.21	Components in diesel fire system	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in fuel oil at FCS.
3.3.1.22	Tanks in diesel fuel oil system	Loss of material due to general, pitting, and crevice corrosion	Above ground carbon steel tanks	No	The components identified in NUREG-1801 are not applicable to FCS.

TABLE 3.3-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR AUXILIARY SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1.23	Closure bolting	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel and low alloy steel in ambient air at FCS.
3.3.1.24	Components (aluminum bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink	Loss of material due to selective leaching	Selective leaching of materials	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes cast iron and bronze in raw water and soil at FCS.
3.3.1.25	Fire barriers, walls, ceilings and floors in fire protection	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel	Fire protection and structures monitoring	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes concrete in ambient air at FCS.

3.3.2 COMPONENTS OR AGING EFFECTS THAT ARE NOT ADDRESSED IN NUREG-1801

Table 3.3-2 contains Auxiliary Systems aging management review results that are not addressed in NUREG-1801. This table includes the component types, materials, environments, and aging effects requiring management, and the programs and activities for managing aging. Table 3.3-3 contains components in Auxiliary Systems not evaluated in NUREG-1801 that rely on aging management programs in NUREG-1801 for FCS License Renewal and the justification for the use of these programs.

TABLE 3.3-2
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.01	External surfaces of aluminum components	Aluminum	Ambient Air	None	Not Applicable
3.3.2.02	Filter/Strainer housing, valve bodies	Aluminum	Fuel Oil	Loss of Material • MIC due to the potential for microorganism introduction and moisture contamination during bulk fuel oil supply and delivery • Pitting/Crevice/General Corrosion due to potential for water contamination and water pooling in a fuel oil system	Diesel Fuel Monitoring and Storage Program (B.2.3)
3.3.2.03	Not used in application				
3.3.2.04	Filter/Strainer housing, Valve Operators, Valve bodies	Aluminum	Instrument Air	None	Not Applicable
3.3.2.05	Valve bodies	Aluminum	Gas - Nitrogen	None	Not Applicable
3.3.2.06	Switch/Bistable housing	Aluminum	Raw Water	Loss of Material Crevice and pitting corrosion and MIC due to stagnant conditions	Fire Protection Program (B.2.5)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.07	New and spent fuel handling tools	Aluminum	Occasionally exposed to Treated Water -Borated	Cracking Stress corrosion cracking (SCC) due to the exposure of aluminum to halogens and stress	Chemistry Program (B.1.2)
3.3.2.08	New and spent fuel handling tools	Aluminum	Occasionally exposed to Treated Water -Borated	Loss of Material • Pitting corrosion due to the exposure of aluminum to halogens and sulfates • Galvanic corrosion due to aluminum in contact with stainless steel and exposed to halogens • Exfoliation due to the exposure of aluminum to halogens	Chemistry Program (B.1.2)
3.3.2.09	Subcomponent - new fuel storage rack - boral sheets	Boral	Ambient Air	None	Not Applicable
3.3.2.10	External surfaces of brass or bronze components	Brass or Bronze	Ambient Air	None	Not Applicable

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.11	Valve bodies, filters/strainer housing, pump casings	Brass or Bronze	Fuel Oil	Loss of Material • MIC due to the potential for microorganism introduction and moisture contamination during bulk fuel oil supply and delivery • Pitting/Crevice/General Corrosion due to potential for water contamination and water pooling in a fuel oil system	Diesel Fuel Monitoring and Storage Program (B.2.3)
3.3.2.12	Valve bodies	Brass	Gas - Halon	None	Not Applicable
3.3.2.13	Valve bodies	Brass or Bronze	Gas - Instrument Air	None	Not Applicable
3.3.2.14	Valve bodies	Brass or Bronze	Gas - Nitrogen	None	Not Applicable
3.3.2.15	Valve bodies	Brass	Gas - Refrigerant (Liquid)	None	Not Applicable
3.3.2.16	Heat exchanger	Brass or Bronze	Lubricating Oil	Loss of Material General corrosion due to the possibility for water contamination and water pooling	Cooling Water Corrosion Program (B.2.2)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.17	Heat exchanger	Brass	Corrosion-Inhibited Treated Water	Cracking Due to SCC because of the ammonium compounds present in the water due to the nitrite corrosion inhibitor	Cooling Water Corrosion Program (B.2.2) and Chemistry Program (B.1.2)
3.3.2.18	Heat exchanger	Brass, Copper Alloy	Corrosion-Inhibited Treated Water	Loss of Material • Crevice and pitting corrosion due to potential stagnant or low flow conditions • Galvanic corrosion due to the high conductivity of the process fluid and the presence of dissimilar metals in contact • MIC due to the exposure of copper alloy to microbiological activity	Cooling Water Corrosion Program (B.2.2) and Chemistry Program (B.1.2)
3.3.2.19	Switch/Bistable housing	Brass	Raw Water	Loss of Material • Crevice and pitting corrosion and MIC due to stagnant conditions • Galvanic corrosion due to the conductivity of the process fluid and the presence of dissimilar metals in contact	Fire Protection Program (B.2.5)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.20	Valve bodies	Cadmium Plated Steel	Gas - Instrument Air	None	Not Applicable
3.3.2.21	Pipes & fittings	Carbon Steel	Above ground, buried in gravel and protected from the elements	Loss of Material External surface corrosion due to the potential for the existence of sufficient oxygen, moisture levels, and/or soil contaminants	Diesel Fuel Monitoring and Storage Program (B.2.3)
3.3.2.22	Pipes & fittings	Carbon Steel	Concrete	None	Not Applicable
3.3.2.23	Filter/Strainer housing, heat exchangers, lubricator motors, pipes & fittings, tanks, valve bodies, accumulators, valve operators	Carbon Steel	Gas - Instrument Air	None	Not Applicable
3.3.2.24	Pipes and fittings	Carbon Steel	Gas - Hydrogen	None	Not Applicable
3.3.2.25	Valve bodies, accumulators, pipes & fittings	Carbon Steel	Gas - Nitrogen	None	Not Applicable
3.3.2.26	Pipes & fittings, valves	Carbon Steel or Cast Iron	Concrete	None	Not Applicable

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.27	Heat exchanger - shell	Carbon Steel	Oxygenated Treated Water <200 deg F	Loss of Material • General and crevice corrosion due to dissolved oxygen • Pitting corrosion due to halogens • Galvanic corrosion due to the conductivity of the process fluid and the presence of dissimilar metals in contact	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)
3.3.2.28	Valve bodies	Cast Iron	Gas - Refrigerant (Liquid)	None	Not Applicable
3.3.2.29	Pump casings, valve bodies, pipes & fittings, heat exchanger - channel/channel head	Cast Iron	Corrosion-Inhibited Treated Water	Loss of Material • General and crevice corrosion due to the exposure of cast iron to dissolved oxygen • Pitting corrosion due to exposure to halogens	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)
3.3.2.30	Pump casings, valve bodies, pipes & fittings	Cast Iron	Corrosion-Inhibited Treated Water	Loss of Material Selective leaching due to the exposure of cast iron to dissolved oxygen	Selective Leaching Program (B.3.6)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.31	Valve bodies, pipes & fittings	Cast Iron	Buried in Ground	Loss of Material • General corrosion due to exposure to dis-solved oxygen • Selective leaching due to the exposure of cast iron to dissolved oxygen	The Fire Protection Program (B.2.5) governs implementing procedures that provide reasonable assurance the Fire Protection System pressure-retaining components will be adequately managed by specific performance and/or condition monitoring activities in accordance with Current Licensing Basis requirements.
3.3.2.32	Tanks, pipes & fittings, filter/strainers, valves	Coated Carbon Steel, Cast Iron, Stainless Steel, Galvanized Steel	Fuel Oil	Loss of Material • MIC due to the potential for microorganism intro-duction and moisture contamination during bulk fuel oil supply and delivery • Pitting/Crevice/General Corrosion due to poten-tial for water contamina-tion and water pooling in a fuel oil system	Diesel Fuel Monitoring and Storage Program (B.2.3)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.33	Pressure vessels	Coated Carbon Steel	Gas - Halon (Liquid)	None	Not Applicable
3.3.2.34	Pipes & fittings	Concrete	Buried in Ground	None	Not Applicable
3.3.2.35	Pipes & fittings	Concrete	Raw Water	None	Not Applicable
3.3.2.36	Safety Injection Refueling Water Tank (SIRWT)	Concrete with coated carbon steel liner	Treated Water - Borated	Loss of Material Due to exposure of the material to moisture, contaminants, dissolved oxygen, and boric acid (i.e., general corrosion, crevice corrosion, pitting corrosion, boric acid corrosion and galvanic corrosion)	Structures Monitoring Program (B.2.10)
3.3.2.37	Pipes & fittings, tubing	Copper, Copper Alloy, Copper-Zinc Alloy	Gas - Instrument Air	None	Not Applicable
3.3.2.38	Valve bodies, pipes & fittings, heat exchanger tubes	Copper, Copper Alloy	Gas - Refrigerant	None	Not Applicable

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.39	Heat exchangers, valves	Brass, Copper, Copper Alloy	Corrosion-Inhibited Treated Water	Loss of Material • Crevice and pitting corrosion due to potential stagnant or low flow conditions • Galvanic corrosion due to the high conductivity of the process fluid and the presence of dissimilar metals in contact • MIC due to the exposure of copper alloy to microbiological activity	Cooling Water Corrosion Program (B.2.2) and Chemistry Program (B.1.2)
3.3.2.40	External surfaces of brass, bronze, copper, copper alloy or copper-zinc alloy components	Brass, Bronze, Copper, Copper Alloy, Copper-Zinc Alloy	Ambient Air	None	Not Applicable
3.3.2.41	Heat exchangers, valves	Copper Alloy	Corrosion-Inhibited Treated Water	Cracking Due to SCC because of the ammonium compounds present in the water due to the nitrite corrosion inhibitor	Cooling Water Corrosion Program (B.2.2) and Chemistry Program (B.1.2)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.42	Tubing	Copper-Zinc Alloy	Buried in Ground	Loss of Material General and pitting corrosion due to the potential for the existence of sufficient oxygen, moisture levels, and/or soil contaminants	Buried Surfaces External Corrosion Program (B.3.2)
3.3.2.43	Tubing	Copper-Zinc Alloy	Buried in Ground	Loss of Material Due to dezincification	Selective Leaching Program (B.3.6)
3.3.2.44	Tubing	Copper-Zinc Alloy	Above ground, buried in gravel and protected from the elements	Loss of Material General and pitting corrosion due to the potential for the existence of sufficient oxygen, moisture levels, and/or soil contaminants	Diesel Fuel Monitoring and Storage Program (B.2.3)
3.3.2.45	Tubing	Copper-Zinc Alloy	Fuel Oil	Loss of Material • MIC due to the potential for microorganism introduction and moisture contamination during bulk fuel oil supply and delivery • Pitting/Crevice/General Corrosion due to potential for water contamination and water pooling in a fuel oil system	Diesel Fuel Monitoring and Storage Program (B.2.3)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.46	Pipes & fittings	Galvanized Steel	Gas - Diesel Exhaust	Cracking Due to embrittlement at elevated temperatures. Loss of Material • Crevice corrosion due to the presence of an aggressive chemical species and moisture • Pitting corrosion due to halides, chlorides or hypochlorites	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.47	Pipes & fittings	Galvanized Steel	Above ground, buried in gravel and protected from the elements	Loss of Material General and pitting corrosion due to the potential for the existence of sufficient oxygen, moisture levels, and/or soil contaminants	Diesel Fuel Monitoring and Storage Program (B.2.3)
3.3.2.48	External surfaces of galvanized steel components	Galvanized Steel	Ambient Air	Loss of Material • Crevice corrosion due to crevices existing that allow a corrosive environment to develop • General corrosion due to presence of both oxygen and moisture	General Corrosion of External Surfaces Program (B.3.3)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.49	Sight glass	Glass	Fuel Oil, Lubricating Oil, Corrosion-Inhibited Treated Water, Air	None	Not Applicable
3.3.2.50	Flow element/orifice body, pipes & fittings, pump casings, valve bodies	Heat-Traced Stainless Steel	Plant Indoor Air	Cracking Due to possible leachables in heat-tracing adhesive (cement) combined with component temperatures exceeding 160 deg F due to the heat tracing	One Time Inspection Program (B.3.5)
3.3.2.51	Fire barriers	Mineral Fiber	Ambient Air	Separation Due to vibration, movement, and shrinkage	Fire Protection Program (B.2.5)
3.3.2.52	Fire barriers	Mineral Fiber Board	Ambient Air	Cracking Due to vibration and movement	Fire Protection Program (B.2.5)
3.3.2.53	Fire barriers	Mineral Fiber Board	Ambient Air	Loss of Material Due to abrasion	Fire Protection Program (B.2.5)
3.3.2.54	Fire barriers	Mineral Fiber Board	Ambient Air	Separation Due to vibration, movement, and shrinkage	Fire Protection Program (B.2.5)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.55	Heat exchanger - tubes, heat exchanger - shell	Nickel-Base Alloy	Deoxygenated Treated Water (>200 deg F)	Cracking Stress Corrosion Cracking due to exposure to halogens or sulfates	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)
3.3.2.56	Heat exchanger - tubes, heat exchanger - shell	Nickel-Base Alloy	Deoxygenated Treated Water (>200 deg F)	Loss of Material • Crevice corrosion due to potential exposure to dissolved oxygen • MIC due to the potential for microbiological activ-ity • Pitting corrosion due to potential exposure to halogens and sulfates	Chemistry Program (B.1.2), Cooling Water Corrosion Program (B.2.2) and One Time Inspection Program (B.3.5)
3.3.2.57	Heat exchanger - tubes, heat exchanger - shell	Copper Alloy, Nickel-Base Alloy	Corrosion-Inhibited Treated Water	Loss of Material Crevice and pitting corrosion due to the exposure of nickel-based alloys to halogens and sulfates	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)
3.3.2.58	Heat exchanger - shell	Nickel-Base Alloy	Plant Indoor Air	None	Not Applicable
3.3.2.59	Fire barriers	Pyrocrete	Ambient Air	Cracking Due to vibration, movement, and shrinkage	Fire Protection Program (B.2.5)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.60	Fire barriers	Pyrocrete	Ambient Air	Loss of Material • Due to vibration that may cause delamination • Due to movement that may cause separation	Fire Protection Program (B.2.5)
3.3.2.61	Fire barriers	Pyrocrete	Ambient Air	Separation • Due to contact with pipe surfaces • Due to hydration	Fire Protection Program (B.2.5)
3.3.2.62	Indicator/Recorder body	Polysulfone	Plant Indoor Air	None	Not Applicable
3.3.2.63	Indicator/Recorder body	Polysulfone	Raw Water	None	Not Applicable
3.3.2.64	External surfaces of stainless steel components	Stainless Steel	Ambient Air	None	Not Applicable
3.3.2.65	Pipes & fittings	Stainless Steel	Concrete	None	Not Applicable
3.3.2.66	Pipes & fittings, valve bodies	Stainless Steel	Deoxygenated Treated Water (>200 deg F)	Cracking Due to exposure of stainless steel to halogens and sulfates	Chemistry Program (B.1.2) and One Time Inspection Program (B.3.5)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.67	Pipes & fittings, valve bodies	Stainless Steel	Deoxygenated Treated Water (>200 deg F)	Loss of Material • Crevice corrosion due exposure of stainless steel to dissolved oxygen • Pitting corrosion due to the exposure of stainless steel to halogens and sulfates	Chemistry Program (B.1.2) and One Time Inspection Program (B.3.5)
3.3.2.68	Filter/Strainer housing, valve bodies, tubing	Stainless Steel	Fuel Oil	Loss of Material • MIC due to the potential for microorganism introduction and moisture contamination during bulk fuel oil supply and delivery • Pitting/Crevice/General Corrosion due to potential for water contamination and water pooling in a fuel oil system	Diesel Fuel Monitoring and Storage Program (B.2.3)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.69	Pipes & fittings	Stainless Steel	Gas - Diesel Exhaust	Cracking Due to moisture-containing contaminants concentrate, resulting in an environment conducive to SCC/IGA. Loss of Material • Crevice corrosion due to the presence of an aggressive chemical species and moisture • Pitting corrosion due to halides, chlorides or hypochlorites	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.70	Valve bodies	Stainless Steel	Gas - Hydrogen	None	Not Applicable
3.3.2.71	Pipes & fittings, valve bodies, tubing	Stainless Steel	Gas - Instrument Air	None	Not Applicable
3.3.2.72	Pipes & fittings, valve bodies, tubing	Stainless Steel	Gas - Nitrogen	None	Not Applicable
3.3.2.73	Pipes & fittings, valve bodies, piping spray shield	Stainless Steel	Lubricating Oil	Loss of Material General corrosion due to the possibility for water contamination and water pooling	Fire Protection Program (B.2.5)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.74	Flow element/orifice body; indicator/recorder housing, orifice plate, pipes & fittings, valve bodies, heat exchanger - tubes	Stainless Steel	Corrosion-Inhibited Treated Water	Cracking Due to exposure to halogens and sulfates	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)
3.3.2.75	External surfaces of stainless steel componenets	Stainless Steel	Ambient Air	None	Not Applicable
3.3.2.76	Heat exchanger - tubes	Stainless Steel	Oxygenated Treated Water <200 deg F	Loss of Material • Crevice corrosion due to an oxygenated treated water environment • Pitting corrosion due to exposure to halogens and sulfates	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)
3.3.2.77	Filter strainer housing	Stainless Steel	Raw Water	Loss of Material • Crevice corrosion due to the presence of dis-solved oxygen and impurities • MIC due to exposure to microbiological activity • Pitting corrosion due to exposure to halide ions	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.78	Not used in application				
3.3.2.79	Glass in metal fire penetration barriers	Glass	Ambient Air	None	Not Applicable

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.80	Calcium silicate board	Calcium Silicate	Ambient Air	None	Not Applicable
3.3.2.81	Fuel transfer carrier box, fuel transfer conveyor, UGS lift rig, reactor head lift rig, fuel handling tools, fuel transfer tilting machine, spent fuel storage racks	Stainless Steel	Ambient Air and Borated Water	Loss of Material • Crevice corrosion due to the exposure to dissolved oxygen. • Pitting corrosion due to the exposure to halogens and sulfates.	Chemistry Program (B.1.2)
3.3.2.82	Valve bonnets protected by rubber diaphragm	Ductile Iron	Possibly exposed to borated water	Loss of material due to boric acid corrosion	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.83	Pipes & fittings	Galvanized Steel	Ambient Air	Loss of material • General corrosion due to exposure to oxygen and moisture • Crevice corrosion due to exposure to moisture	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.84	Heat exchanger tubes, valve bodies	Copper Alloy	Corrosion-Inhibited Treated Water	Loss of material Due to selective leaching	Selective Leaching Program (B.3.6)
3.3.2.85	Heat exchanger tubes, valves	Copper Alloy, Brass, Bronze	Lubricating Oil	Loss of Material Pitting, general and crevice corrosion due to potential for water contamination	Periodic Surveillance and Preventive Maintenance Program (B.2.7)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.86	Pipes & fittings, tanks	Coated Carbon Steel	Buried in Ground	Loss of Material External surface corrosion due to the potential for the existence of sufficient oxygen, moisture levels, and/or soil contaminants.	Buried Surfaces External Corrosion Program (B.3.2)
3.3.2.87	Pump Casing	Cast Iron	Fuel Oil	Loss of Material • MIC due to the potential for microorganism introduction and moisture contamination during bulk fuel oil supply and delivery • Pitting, general and crevice corrosion due to potential for water contamination	Diesel Fuel Monitoring and Storage Program (B.2.7)
3.3.2.88	Pump Casing	Cast Iron	Lubricating Oil	Loss of Material Pitting, general and crevice corrosion due to potential for water contamination	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.89	Heat exchangers - shell and tube sheet, tanks, valves	Carbon Steel, Cadmium Plated Steel	Lubricating Oil	Loss of Material General corrosion due to the possibility for water contamination and water pooling.	Periodic Surveillance and Preventive Maintenance Program (B.2.7)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.90	Blower and fan housing	Cast Iron	Containment Air	Loss of Material due to general corrosion where both oxygen and moisture are present	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.91	Piping and fittings	Copper	Ambient Air	Loss of Material due to wear	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.3.2.92	Bolting	Zinc Plated Steel	Buried in Ground	Loss of Material External surface corrosion due to the potential for the existence of sufficient oxygen, moisture levels, and/or soil contaminants	Fire Protection Program (B.2.5)
3.3.2.93	Filter/Strainers, valves	Cast Iron	Ambient Air	Loss of Material due to general corrosion where both oxygen and moisture are present	Fire Protection Program (B.2.5)
3.3.2.94	Piping and fittings	Galvanized Steel	Raw Water	Loss of Material due to general, crevice, pitting and galvanic corrosion and MIC.	Fire Protection Program (B.2.5)
3.3.2.95	Traveling Screen Frame	Carbon Steel	Raw Water	Loss of Material due to general, crevice, pitting and galvanic corrosion and MIC.	Periodic Surveillance and Preventive Maintenance Program (B.2.7)

TABLE 3.3-2 (CONTINUED)
FCS AUXILIARY SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.3.2.96	Piping and fittings	Stainless Steel	Borated Treated Water	Cracking Stress corrosion cracking	Periodic Surveillance and Preventive Maintenance Program (B.2.7)

TABLE 3.3-3
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.01	Pipes, fittings, valve bodies, filter casings, pump casings, ion exchangers and heat exchangers	Stainless Steel	Borated Treated Water	Cracking Stress corrosion cracking	Chemistry Program (B.1.2)	3.3.1.10	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, V.D1.1-a.
3.3.3.02	Fuel transfer carrier box, fuel transfer conveyor, UGS lift rig, reactor head lift rig, fuel handling tools, fuel transfer tilting machine	Stainless Steel	Ambient Air and Borated Treated Water	Cracking Stress corrosion cracking	Chemistry Program (B.1.2)	3.3.1.12	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.A2.1-c.

TABLE 3.3-3 (CONTINUED)
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.03	Pipes, fittings	Stainless Steel	Deoxygenated Treated Water (<200F)	Loss of Material	Chemistry Program (B.1.2)	3.4-1.02	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VIII.G.4-b.
3.3.3.04	Pipes, fittings, valve bodies	Stainless Steel	Borated Treated Water	Cracking Stress corrosion cracking	Chemistry Program (B.1.2)	3.3.1.08	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.E1.7-c.

TABLE 3.3-3 (CONTINUED)
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.05	Filter/Strainer bodies, flow element/orifice, pipes & fittings, braided flexible hose	Carbon Steel	Lubricating Oil	Loss of Material	Periodic Surveillance and Preventive Maintenance Program (B.2.7)	3.4-1.04	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VIII.G.5-d.
3.3.3.06	Filter/Strainer bodies, pipes & fittings, valves, pumps, tanks	Carbon Steel	Fuel Oil	Loss of Material	Diesel Fuel Monitoring and Storage Program (B.2.3)	3.3.1.07	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.H1.4-a.

TABLE 3.3-3 (CONTINUED)
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.07	Valve bodies, piping & fittings, fan housings, bolts, duct, pumps	Cast Iron, cadmium plated steel, galvanized steel	Ambient Air	Loss of Material	General Corrosion of Ext. Surfaces Program (B.3.3)	3.3.1.05	The material is subject to the same environment and aging effect, and managed by the same aging management program as evaluated in Table 3.3-1, Item 3.3.1.05. The aging effect is independent of component type.
3.3.3.08	Electric heater sleeves, tanks, heat exchanger, orifice,	Carbon Steel	Corrosion-Inhibited Treated Water	Loss of Material	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)	3.3.1.14	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.H2.1-a and VII.C2.5-a.

TABLE 3.3-3 (CONTINUED)
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.09	Valve bodies, piping & fittings, duct, damper, bolts, heat exchangers	Cast Iron, cadmium plated steel, galvanized steel, copper alloy	Ambient Air	Loss of Material	Boric Acid Corrosion (BAC) Prevention Program (B.2.1)	3.3.1.13	The material is subject to the same environment and aging effect, and managed by the same aging management program as evaluated in Table 3.3-1, Item 3.3.1.13. The aging effect is independent of component type.
3.3.3.10	Fire blocking damper, duct, valve bodies, fan housings	Galvanized steel, cast iron	Ambient Air	Loss of Material	Periodic Surveillance and Preventive Maintenance Program (B.2.7)	3.3.1.05	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.F2.1-a.

TABLE 3.3-3 (CONTINUED)
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.11	Filter/Strainer, valve, heat exchanger	Cast iron	Raw Water	Loss of Material	Cooling Water Corrosion Program (B.2.2) and Selective Leaching Program (B.3.6) or Periodic Surveillance and Preventive Maintenance Program (B.2.7) for externally exposed components	3.3.1.16 3.3.1.24	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.C1.5-a.

TABLE 3.3-3 (CONTINUED)
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.12	Heat exchanger, Pumps, Indicator / Recorder	Stainless Steel	Raw Water	Loss of Material Biofouling	Cooling Water Corrosion Program (B.2.2)	3.3.1.16	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.C1.4-a.
3.3.3.13	Heat exchanger	Stainless Steel	Corrosion-Inhibited Treated Water	Cracking	Cooling Water Corrosion Program (B.2.2)	3.3.1.08	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.E1.8-b.

TABLE 3.3-3 (CONTINUED)
COMPONENTS IN AUXILIARY SYSTEMS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.3.3.14	Traveling Screen Frame	Carbon Steel	Raw Water	Loss of Material	Cooling Water Corrosion Program (B.2.2)	3.3.1.16	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.C1.1-a.
3.3.3.15	Pipes & fittings, Indicator / Recorder, Heat Exchanger	Stainless Steel	Corrosion-Inhibited Treated Water	Loss of Material	Chemistry Program (B.1.2) and Cooling Water Corrosion Program (B.2.2)	3.3.1.14	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.C2.2-a.

3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEMS

The Steam and Power Conversion Systems consist of the Main Steam System, the Main and Auxiliary Feedwater Systems, Steam Generator Blowdown System and associated components at FCS.

The Main Steam System consists of piping from each steam generator that penetrates the containment wall to the main steam isolation valves that are located in each pipe just outside containment. Also included in the Main Steam System boundary is the piping to the turbine-driven auxiliary feedwater pump and the associated drains and vents.

The Feedwater System consists of a supply line to each steam generator. A feedwater isolation valve in each steam generator supply line is located just outside the containment penetration.

The Auxiliary Feedwater (AFW) System supplies feedwater to the steam generators whenever the reactor coolant system temperature is above 300 deg F and the main feedwater system is not in operation. The AFW System contains the emergency feedwater storage tank (EFWST), two pumps, plus related piping, valves, and instrumentation. One pump is electric motor driven, and the other is steam turbine driven. The AFW System can supply the steam generators through two different flow paths. One flow path is through an interconnection with the main feedwater piping upstream of the feedwater regulating valves, after which the water enters the each steam generator through the normal feed ring. This flow path is typically used during normal plant heatup and cooldown evolutions. The other flow path connects to the AFW nozzles on the steam generators. Either AFW pump can pump water from the EFWST to the steam generators.

Operating Experience:

Site: A review of plant specific operating experience was conducted, including the review of Condition Reports and discussions with appropriate site personnel to identify AERM. These reviews concluded that the AERM identified by the FCS specific operating experience were consistent with those identified in NUREG-1801.

Industry: A review of industry-wide operating experience was conducted to identify aging effects requiring management. This included a review of operating experience issued during 2001. This review concluded that the AERM identified by industry operating experience were consistent with those identified in NUREG-1801.

On-Going: The on-going review of plant specific and industry-wide operating experience is conducted in accordance with the FCS Operating Experience Program.

3.4.1 AGING MANAGEMENT PROGRAMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR LICENSE RENEWAL

Table 3.4-1 shows the aging management programs evaluated in NUREG-1801 that are relied on for license renewal of the Steam and Power Conversion Systems at FCS. Note that this table only includes those components, materials and environments that are applicable to a PWR. Information on FCS specific components and materials, not listed in NUREG-1801 but included in the group described in a particular line of the table, is included in the discussion column.

TABLE 3.4-1
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component Group	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1.01	Piping and fittings in main feedwater line, steam line and AFW piping (PWR only)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	1. The TLAA is applicable to Class II and III piping at FCS. See Section 4.3.4 for the TLAA discussion of Class II and III Piping. 2. Consistent with NUREG-1801, this group includes piping, fittings, and valve bodies at FCS.
3.4.1.02	Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be further evaluated	1. The Chemistry Program (B.1.2), supplemented by the One-Time Inspection Program (B.3.5) manages the aging effects of these components. The programs are described in Appendix B of this application. NUREG-1801 indicates that the verification of the effectiveness of the water chemistry program should be conducted with an inspection of stagnant flow locations within the systems. These inspections will be conducted in accordance with the One-Time Inspection Program. 2. Consistent with NUREG-1801, this group includes carbon steel in treated water at FCS.

TABLE 3.4-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component Group	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1.03	Auxiliary feedwater (AFW) piping	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific	Yes, plant specific	The environment identified in NUREG-1801 is not applicable to FCS. The AFW piping at FCS is not exposed to untreated water from a backup water supply
3.4.1.04	Oil coolers in AFW system (lubricating oil side possibly contaminated with water)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant specific	Yes, plant specific	1. The Periodic Surveillance and Preventive Maintenance Program (B.2.7) manages this aging effect by ensuring water is not present in lubricating oil and that the oil is changed on a refueling frequency. This program is described in Appendix B of this application. 2. Consistent with NUREG-1801, this group includes carbon steel and stainless steel in lubricating oil possibly contaminated with water at FCS
3.4.1.05	External surface of carbon steel components	Loss of material due to general corrosion	Plant specific	Yes, plant specific	1. The General Corrosion of External Surfaces Program (B.3.3) manages this aging effect. This program is described in Appendix B of this application. 2. Consistent with NUREG-1801, this group includes carbon and low alloy steel in ambient air at FCS.

TABLE 3.4-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component Group	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1.06	Carbon steel piping and valve bodies	Wall thinning due to flow-accelerated corrosion	Flow Accelerated Corrosion	No	1. The aging management results are consistent with the results reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in treated water and saturated steam at FCS.
3.4.1.07	Carbon steel piping and valve bodies in main steam system	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in saturated steam at FCS.
3.4.1.08	Closure bolting in high-pressure or high-temperature systems	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC.	Bolting Integrity	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon and low alloy steel bolting in ambient air in high pressure or high temperature systems at FCS.

TABLE 3.4-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component Group	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1.09	Heat exchangers and coolers/condensers serviced by open-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposits due to biofouling	Open-cycle Cooling Water System	No	The combinations of materials and environment identified in NUREG-1801 are not applicable to FCS. The applicable heat exchangers are not serviced by open-cycle cooling water
3.4.1.10	Heat exchangers and coolers/condensers serviced by closed-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-cycle Cooling Water System	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel components in corrosion inhibited treated water at FCS.
3.4.1.11	External surface of above ground condensate storage tank	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Above Ground Carbon Steel Tanks	No	The component identified in NUREG-1801 is not applicable to FCS.

TABLE 3.4-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component Group	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1.12	External surfaces of buried condensate storage tank and AFW piping	Loss of material due to general, pitting, and crevice corrosion and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	The component identified in NUREG-1801 is not applicable to FCS.
3.4.1.13	External surface of carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon and low alloy steel components in ambient air and leaking and dripping, chemically treated, borated water at FCS.

3.4.2 COMPONENTS OR AGING EFFECTS THAT ARE NOT ADDRESSED IN NUREG-1801

Table 3.4-2 contains Steam and Power Conversion Systems aging management review results that are not addressed in NUREG-1801. This table includes the component types, materials, environments, aging effects requiring management, and the programs and activities for managing aging. Table 3.4-3 contains components in Steam and Power Conversion Systems not evaluated in NUREG-1801 that rely on aging management programs in NUREG-1801 for FCS License Renewal and the justification for the use of these programs.

TABLE 3.4-2
FCS STEAM AND POWER CONVERSION SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT REVIEW NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.4.2.01	Pumps	Aluminum	Lubricating Oil	Loss of Material General corrosion due to the possibility for water contamination and water pooling	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.4.2.02	Pumps	Aluminum	Plant Indoor Air	None	Not Applicable
3.4.2.03	Heat exchanger (channel, channel head, tubes) and valves	Copper Alloy	Deoxygenated Treated Water	Loss of Material • Crevice and pitting corrosion due to potential stagnant or low flow conditions • Wear due to flow induced vibration	One Time Inspection Program (B.3.5)
3.4.2.04	Heat exchanger (channel, channel head, tubes) and valves	Copper Alloy	Deoxygenated Treated Water	Loss of Material Selective leaching	Selective Leaching Program (B.3.5)
3.4.2.05	Filters/Strainers, heat exchanger (shell and tubes), indicator/ recorder body, pipes, fittings and valves	Copper Alloy	Lubricating Oil	Loss of Material General corrosion due to the possibility for water contamination and water pooling	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.4.2.06	External surface of copper alloy components	Copper Alloy	Ambient Air	None	Not Applicable

TABLE 3.4-2 (CONTINUED)
FCS STEAM AND POWER CONVERSION SYSTEMS COMPONENT TYPES SUBJECT TO AGING MANAGEMENT REVIEW NOT EVALUATED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.4.2.07	Indicator/Recorder (sightglass)	Glass	Deoxygenated Treated Water Lubricating Oil Ambient Air	None	Not Applicable
3.4.2.08	External surface of stainless steel components	Stainless Steel	Ambient Air	None	Not Applicable
3.4.2.09	Pipes, fittings, valves, filter/strainer, flow element/orifice, transmitter element, pump casing	Stainless Steel	Oxygenated or Deoxygenated Treated Water	Cracking Due to exposure of stainless steel to halogens and sulfates	Water Chemistry (B.1.2) and One-Time Inspection (B.3.5)
3.4.2.10	Pipes, fittings, and valves	Stainless Steel	Deoxygenated Treated Water or Saturated Steam	Cracking Due to exposure of stainless steel to halogens and sulfates	Water Chemistry (B.1.2) and One-Time Inspection (B.3.5)
3.4.2.11	Pipes, fittings, and valves	Stainless Steel	Deoxygenated Treated Water or Saturated Steam	Loss of Material • Crevice corrosion due exposure of stainless steel to dissolved oxygen • Pitting corrosion due to the exposure of stainless steel to halogens and sulfates	Water Chemistry (B.1.2) and One-Time Inspection (B.3.5)

TABLE 3.4-3
COMPONENTS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.4.3.01	Filter/Strainer, pumps	Carbon Steel	Lubricating Oil	Loss of Material	Periodic Surveillance and Preventive Maintenance Program (B.2.8)	3.4.1.04	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VIII.G.5-d.
3.4.3.02	Filter/Strainer, flow element/ orifice housing, pipes & fittings	Stainless Steel	Deoxygenated Treated Water	Loss of Material	Chemistry Program (B.1.2), supplemented by the One-Time Inspection Program (B.3.5)	3.4.1.02	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VIII.G.4-b.

TABLE 3.4-3 (CONTINUED)
COMPONENTS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.4.3.03	Turbine casing, filter/strainer, pipes & fittings, valve bodies	Carbon Steel	Saturated Steam	Loss of Material	Chemistry Program (B.1.2)	3.4.1.07	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VIII.B1.2-a and VIII.B1.1-a.
3.4.3.04	Filter/strainer, pipes & fittings, valve bodies	Carbon Steel	Saturated Steam	Loss of Material	Flow Accelerated Corrosion (FAC) Program (B.1.5)	3.4.1.06	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VIII.B1.1-c.

TABLE 3.4-3 (CONTINUED)
COMPONENTS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS FOR STEAM AND POWER CONVERSION SYSTEMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.4.3.05	Valves	Low-Alloy Steel	Deoxygenated Treated Water	Loss of Material	Chemistry Program (B.1.2) supplemented by the One-Time Inspection Program (B.3.5)	3.4.1.02	The material is subject to the same environment and aging effect, and managed by the same aging management program as evaluated in Table 3.4-1, Item 3.4.1.02. The aging effect is independent of component type.

3.5 AGING MANAGEMENT OF CONTAINMENT, STRUCTURES AND COMPONENT SUPPORTS

The Containment, Structures and Component Supports are comprised of the Containment, Auxiliary Building, Turbine and Service Building, Intake Structure, Building Piles and associated component supports at FCS.

The Containment structure is a partially prestressed, reinforced concrete Class I structure composed of cylindrical walls, domed roof and a bottom mat. The mat is common to both the Containment structure and the Auxiliary Building and is supported on steel piles driven to bedrock. The mat incorporates a depressed center portion for the reactor vessel. The Containment has a 1/4-inch internal carbon steel liner. The unbonded tendons are in conduits filled with waterproof grease. The tendon anchors are accessible for inspection, testing, and re-tensioning via the tendon access gallery located directly beneath the cylinder walls and at the dome roof.

The Auxiliary Building is a multi-floored, reinforced concrete, Class I structure. From the bottom of the foundation mat to the roof, the structure is of box-type construction with internal bracing provided by vertical concrete walls and horizontal floor slabs. The spent fuel pool is contained within the Auxiliary Building and consists of a stainless steel lined concrete structure. The control room is located within the Auxiliary Building. The Auxiliary Building masonry walls in the area of safety-related equipment have been reinforced to provide protection for Class I equipment and components located nearby.

The Turbine and Service Building is a multi-floored Class II structure. From the basement floor to the operating floor, the structure is a box-type, reinforced concrete structure with internal bracing provided by concrete walls, floor slabs and structural steel. The mat foundation is supported on steel piles driven to bedrock. From the operating floor to the roof, the structure is braced steel frame clad with aggregate resin panels. The multi-layered built-up roof is supported by metal decking spanning between open web steel joists. The turbine generator is located on the operating floor. It is supported by a mass concrete structure referred to as the turbine pedestal.

The Intake Structure is a multi-floored Class I structure. From the bottom of the foundation mat to seven feet above the operating floor, the structure is a box-type reinforced concrete structure with internal bracing provided by concrete walls and floor slabs. The mat foundation is supported on steel pipe piles driven to bedrock. Above the reinforced concrete structure to the roof the structure is a braced steel frame clad with aggregate resin panels. The multi-layered built-up roof is supported by metal decking spanning between open web steel joists. The diesel-driven fire pump fuel tank enclosure is included in the Intake Structure.

The Building Piles commodity group consists of four types of piles: Class A steel pipe piles, Class B steel pipe piles, concrete caissons, and steel H-piles. Class A piles are 20-inch OD open-end pipe piles with 1.031-inch thick walls driven to bedrock. The piles are filled with sand to the point four feet below the top of the pile. The remaining top four feet is filled with concrete. Class A piles are capped with a 2-inch thick steel plate end closure. Class B piles are 12.75-inch OD closed-end pipe piles with 0.25-inch thick walls and filled with concrete. Class B piles are capped with a 1.25-inch steel plate end closure. Concrete caissons are 3-foot diameter reinforced concrete cylinders that extend 10 feet into bedrock. Steel H-piles are used in the foundations of the diesel engine fuel oil storage tank.

Duct banks are comprised of conduits encased in concrete and are located below grade. Duct banks are used to route electrical power cables between buildings. Electrical manholes are reinforced concrete box-type structures which allow for inspection and routing of the cables. Duct banks and electrical manholes contain both CQE and Non-CQE cables. Only the duct banks and electrical manholes of Class I design that contain safety-related cables are within the scope of license renewal.

Operating Experience:

Site: A review of plant specific operating experience was conducted, including the review of Condition Reports and discussions with appropriate site personnel to identify AERM. These reviews concluded that the AERM identified by the FCS specific operating experience were consistent with those identified in NUREG-1801.

Industry: A review of industry-wide operating experience was conducted to identify aging effects requiring management. This included a review of operating experience issued during 2001. This review concluded that the AERM identified by industry operating experience were consistent with those identified in NUREG-1801.

On-Going: The on-going review of plant specific and industry-wide operating experience is conducted in accordance with the FCS Operating Experience Program.

3.5.1 AGING MANAGEMENT PROGRAMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR LICENSE RENEWAL

Table 3.5-1 shows the aging management programs evaluated in NUREG-1801 that are relied on for license renewal of Structures, and Component Supports at FCS. Note that this table only includes those components, materials and environments that are applicable to a PWR. Information on FCS specific components and materials, not listed in NUREG-1801 but included in the component group of this application, is included in the discussion column.

TABLE 3.5-1
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	Common Components to all Types of PWR and BWR Containments				
3.5.1.01	Penetration sleeves, penetration bellows, and dissimilar metal welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	1. The metal fatigue time limited aging analyses are discussed in Section 4.6 of this application. 2. Consistent with NUREG-1801, this group includes penetration sleeves, penetration bellows, and dissimilar metal welds at FCS.
3.5.1.02	Penetration sleeves, bellows, and dissimilar metal welds.	Cracking due to cyclic loading, or crack initiation and growth due to SCC	Containment ISI and Containment leak rate test	Yes, detection of aging effects is to be evaluated	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801 with the exception of item 4 below. 2. The Containment Inservice Inspection Program (B.1.3) and the Containment Leak Rate Program (B.1.4) manage these aging effects. These programs are described in Appendix B of this application. 3. Consistent with NUREG-1801, this group includes stainless steel in ambient air at FCS. 4. Stress corrosion cracking for stainless steel bellows with dissimilar metal welds is applicable only if the susceptible material is exposed to a corrosive environment. The bellows at FCS are not exposed to a corrosive environment; therefore, Stress Corrosion Cracking is not an aging effect requiring management.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.03	Penetration sleeves, penetration bellows, and dissimilar metal welds	Loss of material due to corrosion	Containment ISI and Containment leak rate test	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in ambient air at FCS.
3.5.1.04	Personnel airlock and equipment hatch	Loss of material due to corrosion	Containment ISI and Containment leak rate test	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-180, this group includes carbon steel in ambient air at FCS.
3.5.1.05	Personnel airlock and equipment hatch	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanism	Containment leak rate test and Plant Technical Specifications	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel in ambient air at FCS.
3.5.1.06	Seals, gaskets, and moisture barriers	Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers	Containment ISI and Containment leak rate test	No	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The equipment hatch gasket, made of neoprene, is the only component included in this component group at FCS.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	PWR Concrete (Reinforced and Prestressed) and Steel Containment				
3.5.1.07	Concrete elements: foundation, walls, dome.	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Yes, if aging mechanism is significant for inaccessible areas	1. The FCS aging management review results are consistent with those reviewed and approved in NUREG-1801. 2. The Containment Inservice Inspection Program (B.1.3) manages the aging effects for these components. This program is described in Appendix B of this application. 3. Leaching of calcium hydroxide from reinforced concrete becomes significant only if the concrete is exposed to flowing water. The reinforced concrete at FCS is not exposed to flowing water. Cracking is controlled through proper arrangement and distribution of reinforcing bars. The concrete at FCS was designed in accordance with ACI 318-63 (per USAR Section 5.3.1 and USAR Section 5.11.3.1) and has these characteristics. Therefore, a plant specific program for below-grade inaccessible areas is not required. 4. Below-grade exterior reinforced concrete at FCS is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Periodic monitoring of below-grade water chemistry will be conducted during the period of extended operation to demonstrate that the below-grade environment is not aggressive. Therefore, a plant specific aging management program for below-grade inaccessible areas is not required.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.08	Concrete elements: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring	No, if within the scope of the applicant's Structures Monitoring Program	1. The aging management results are consistent with those reviewed and approved in NUREG 1801. Applicable components are within the scope of the Structures Monitoring Program (B.2.10) described in Appendix B of this application. 2. The structures at FCS are supported on end-bearing steel pipe piles driven to bedrock. Settlement of the concrete subfoundation is not a plausible aging mechanism. A de-watering system is not relied upon for control of settlement at FCS.
3.5.1.09	Concrete elements: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring	No, if within the scope of the applicant's Structures Monitoring Program	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. Applicable components are within the scope of the Structures Monitoring Program (B.2.10) described in Appendix B of this application. 2. The reinforced concrete at FCS is not exposed to flowing water and a de-watering system is not relied upon for control of erosion of cement from porous concrete subfoundations.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.10	Concrete elements: foundation, dome, and wall	Reduction of strength and modulus due to elevated temperature	Plant specific	Yes, for any portions of concrete containment that exceed specified temperature limits	Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 150 deg F except for local areas that are allowed to have increased temperatures not to exceed 200 deg F. Per USAR Section 2.5.2.3, the record high temperature in the vicinity of FCS was 114 deg F in July 1936. This is below the temperature limit of 150 deg F. USAR Table 9.10-1 provides maximum building/room temperatures for the Auxiliary Building, Turbine Building, Containment, Control Room, Engine Driven Auxiliary Feedwater Pump Room, Radioactive Waste Processing Building, Chemistry and Radiation Protection Building, and Office/Cafeteria Addition.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					The maximum indoor plant temperature in Table 9.10-1 is 120 deg F inside the main area of containment. This is below the temperature limit of 150 deg F. Per USAR Section 5.5.4, sleeve radiation fins and thermal sleeves (in conjunction with pipe insulation) are used to limit maximum temperature at the containment penetration sleeves to 150 deg F under operating conditions. The nuclear detector well cooling system cools the out-of-core neutron detectors, which are located in tubes or wells in the reactor compartment annulus between the lower portion of the reactor vessel and the biological shield, and maintains the shield concrete temperature below 150 deg F. Technical Specification Limiting Condition for Operation 2.13 requires that the annulus exit temperature from the nuclear detector cooling system shall not exceed a temperature found to correlate to 150 deg F concrete temperature. Therefore, no portions of concrete containment exceed specified temperature limits and no aging management is required.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.11	Prestressed containment: tendons and anchorage components	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	1. See Section 4.5 for the TLAA discussion of containment tendons. 2. Consistent with NUREG-1801, this group includes containment tendons and anchorage components at FCS.
3.5.1.12	Steel elements: liner plate, containment shell	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and Containment leak rate test	Yes, if corrosion is significant for inaccessible areas	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Corrosion for inaccessible areas (embedded containment liner) is not significant because: a. Concrete meeting the requirements of ACI 318 or 349 and the guidance of 201.2R was used for the containment concrete in contact with the embedded containment liner. b. The concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner. c. The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with IWE requirements. d. Borated water spills and water ponding on the containment concrete floor are not common and when detected are cleaned up in a timely manner.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.13	Steel elements: protected by coating	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	No	The combinations of components, materials and environments identified in NUREG-1801 are not applicable to FCS. Protective coatings are not relied on to manage the effects of aging at FCS. The Aging Management Review evaluated in NUREG-1801 is not relied on for FCS license renewal.
3.5.1.14	Prestressed containment: tendons and anchorage components	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes containment tendons and anchorage components at FCS.
3.5.1.15	Concrete elements: foundation, dome, and wall	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes concrete exposed to ambient air and below grade concrete at FCS.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	Class I Structures				
3.5.1.16	All Groups except Group 6: accessible interior/ exterior concrete & steel components	All types of aging effects	Structures Monitoring	No, if within the scope of the applicant's Structures Monitoring Program	1. The aging management results are consistent with those reviewed and approved in NUREG 1801. Applicable components are within the scope of the Structures Monitoring Program (B.2.10) described in Appendix B of this Application 2. As described in NUREG-1557, freeze/thaw does not cause loss of material from reinforced concrete in foundations, and in above and below grade exterior concrete, for plants located in a geographic region of negligible weathering conditions (weathering index <100 day-inch/yr). Loss of material from such concrete is not significant at plants located in areas in which weathering conditions are severe (weathering index >500 day-inch/yr) or moderate (100-500 day-inch/yr), provided that the concrete mix design meets the air content (entrained air 3-6%) and water-to-cement ratio (0.35-0.45) specified in ACI 318-63 or ACI 349-85. The weathering index for FCS is >500 day-inch/yr. The concrete mix design specified a water-to-cement ratio of 0.38 and air entrainment of 4.75% + 0.75% for Class A concrete for FCS. It specified a water-to-cement ratio of 0.44 and air entrainment of 5.00% + 1.00% for Class B concrete. Therefore, the conditions of NUREG-1801, Volume 2, Chapter III are satisfied.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					3. Leaching of calcium hydroxide from reinforced concrete becomes significant only if the concrete is exposed to flowing water. Leaching is not significant if the concrete is constructed to ensure that it is dense, well-cured, has low permeability, and that cracking is well controlled. Cracking is controlled through proper arrangement and distribution of reinforcing bars. The concrete at FCS was designed in accordance with ACI 318-63 (per USAR Section 5.3.1 and USAR Section 5.11.3.1) and has these characteristics. Therefore, the conditions of NUREG-1801, Volume 2, Chapter III are satisfied. 4. Investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50 demonstrated that the aggregates used in the construction of FCS do not react within reinforced concrete. Concrete for FCS was constructed in accordance with ACI 201.2R-77. C. Therefore, the conditions of NUREG-1801, Volume 2, Chapter III are satisfied.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					5. Per NUREG-1557, corrosion of embedded steel is not significant for concrete structures above or below grade that are exposed to a non-aggressive environment. A non-aggressive environment, as defined by NUREG-1557, is one with a pH greater than 11.5 or chlorides less than 500 ppm. NUREG-1557 also concludes that corrosion of embedded steel is not significant for concrete structures exposed to an aggressive environment that have a low water-to-cement ratio, adequate air entrainment, and have been designed in accordance with ACI 318-63 or ACI 349-85. A low water-to-cement ratio is defined as 0.35 to 0.45 and adequate air entrainment is defined as 3 to 6 percent. The concrete at FCS is not exposed to aggressive river water or groundwater. There is no heavy industry in the area whose emissions would cause degradation to concrete or steel. The concrete that surrounds the embedded steel has a pH greater than or equal to 12.5. The concrete mix design specified a water-to-cement ratio of 0.38 and air entrainment of 4.75% + 0.75% for Class A concrete. It specified a water-to-cement ratio of 0.44 and air entrainment of 5.00% + 1.00% for Class B concrete.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Class C concrete was only used for radiation shields; therefore, it would not be exposed to an environment that would promote corrosion of embedded steel. The concrete at FCS was designed in accordance with ACI 318-63 (per USAR Section 5.3.1, Revision 0 and USAR Section 5.11.3.1, Revision 2). Therefore, the conditions of NUREG-1801, Volume 2, Chapter III are satisfied and aging management is not required. Below-grade exterior reinforced concrete at FCS is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Periodic monitoring of below-grade water chemistry will be conducted during the period of extended operation to demonstrate that the below-grade environment is not aggressive. Therefore, the conditions of NUREG-1801, Volume 2, Chapter III are satisfied.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					6. Aggressive chemical attack on reinforced concrete is not significant if the concrete is exposed to a nonaggressive environment. A non-aggressive environment, as defined by GALL, is one with a pH greater than 5.5, chlorides less than 500 ppm, or sulfates less than 1500 ppm. The concrete at FCS is not exposed to aggressive river water or groundwater. There is no heavy industry in the area whose emissions would cause degradation to concrete or steel. Therefore, the conditions of NUREG-1801, Volume 2, Chapter III are satisfied. 7. The structures at FCS are supported on end-bearing steel pipe piles driven to bedrock. Settlement of the concrete subfoundations is not plausible aging mechanism. A de-watering system is not relied upon for control of settlement at FCS. 8. The reinforced concrete at FCS is not exposed to flowing water and a de-watering system is not relied upon for control of erosion of cement from porous concrete subfoundations.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					9. Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 150 deg F except for local areas that are allowed to have increased temperatures not to exceed 200 deg F. Per USAR Section 2.5.2.3, the record high temperature in the vicinity of FCS was 114 deg F in July 1936. This is below the temperature limit of 150 deg F. USAR Table 9.10-1 provides maximum building/room temperatures for the Auxiliary Building, Turbine Building, Containment, Control Room, Engine Driven Auxiliary Feedwater Pump Room, Radioactive Waste Processing Building, Chemistry and Radiation Protection Building, and Office/Cafeteria Addition. The maximum indoor plant temperature in Table 9.10-1 is 120 deg F inside the main area of Containment. This is below the temperature limit of 150 deg F. Per USAR Section 5.5.4, sleeve radiation fins and thermal sleeves (in conjunction with pipe insulation) are used to limit maximum temperature at the containment penetration sleeves to 150 deg F under operating conditions.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					The nuclear detector well cooling system cools the out-of-core neutron detectors, which are located in tubes or wells in the reactor compartment annulus between the lower portion of the reactor vessel and the biological shield, and maintains the shield concrete temperature below 150 deg F. Technical Specification Limiting Condition for Operation 2.13 requires that the annulus exit temperature from the nuclear detector cooling system shall not exceed a temperature found to correlate to 150 deg F concrete temperature. Therefore, no portions of concrete containment exceed specified temperature limits and no aging management is required.
3.5.1.17	Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant-specific	Yes, if an aggressive below-grade environment exists	Below-grade exterior reinforced concrete at FCS is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Periodic monitoring of below grade water chemistry will be conducted during the period of extended operation to demonstrate that the below-grade environment is not aggressive. Therefore, the conditions of NUREG-1801, Volume 2, Chapter III are satisfied.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.18	Group 6: all accessible/inaccessible concrete, steel, and earthen components	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	No	The components identified in NUREG-1801 are not applicable to FCS. The plant specific programs for Intake Structure components exposed to flowing river water are discussed in Items 3.5.2.02, 3.5.2.08 and 3.5.2.32 of Table 3.5-2.
3.5.1.19	Group 5: liners	Crack initiation and growth from SCC and loss of material due to crevice corrosion	Water Chemistry Program and Monitoring of spent fuel pool water level	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes stainless steel in borated water at FCS. 3. In addition to monitoring of spent fuel pool level, the Periodic Surveillance and Preventive Maintenance Program (B.2.7) performs a leak rate analysis of the refueling canal liner.
3.5.1.20	Groups 1-3, 5, 6: all masonry block walls	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry Wall	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. The masonry wall program is included in the FCS Structures Monitoring Program (B.2.10). 2. Consistent with NUREG-1801, this group includes concrete block in ambient air at FCS.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.21	Groups 1-3, 5, 7-9: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring	No, if within the scope of the applicant's Structures Monitoring Program	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. Applicable components are within the scope of the Structures Monitoring Program (B.2.10) described in Appendix B of this application 2. The structures at FCS are supported on end-bearing steel pipe piles driven to bedrock. Settlement of the concrete subfoundation are not plausible aging mechanisms. A de-watering system is not relied upon for control of settlement at FCS. 3. Consistent with NUREG-1801, this group includes reinforced concrete at FCS.
3.5.1.22	Groups 1-3, 5-9: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring	No, if within the scope of the applicant's Structures Monitoring Program	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. Applicable components are within the scope of the Structures Monitoring Program (B.2.10) described in Appendix B of this application. 2. The reinforced concrete at FCS is not exposed to flowing water and a de-watering system is not relied upon for control of erosion of cement from porous concrete subfoundations. 3. Consistent with NUREG-1801, this group includes reinforced concrete at FCS.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.22	Groups 1-5: concrete	Reduction of strength and modulus due to elevated temperature	Plant-specific	Yes, for any portions of concrete that exceed specified temperature limits	Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 150 deg F except for local areas that are allowed to have increased temperatures not to exceed 200 deg F. Per USAR Section 2.5.2.3, the record high temperature in the vicinity of FCS was 114 deg F in July 1936. This is below the temperature limit of 150 deg F. USAR Table 9.10-1 provides maximum building/room temperatures for the Auxiliary Building, Turbine Building, Containment, Control Room, Engine Driven Auxiliary Feedwater Pump Room, Radioactive Waste Processing Building, Chemistry and Radiation Protection Building, and Office/Cafeteria Addition. The maximum indoor plant temperature in Table 9.10-1 is 120 deg F inside the main area of Containment. This is below the temperature limit of 150 deg F. Per USAR Section 5.5.4, sleeve radiation fins and thermal sleeves (in conjunction with pipe insulation) are used to limit maximum temperature at the containment penetration sleeves to 150 deg F under operating conditions.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					The nuclear detector well cooling system cools the out-of-core neutron detectors, which are located in tubes or wells in the reactor compartment annulus between the lower portion of the reactor vessel and the biological shield, and maintains the shield concrete temperature below 150 deg F. Technical Specification Limiting Condition for Operation 2.13 requires that the annulus exit temperature from the nuclear detector cooling system shall not exceed a temperature found to correlate to 150 deg F concrete temperature. Therefore, no portions of concrete containment exceed specified temperature limits and no aging management is required.
3.5.1.23	Groups 7, 8: liners	Crack Initiation and growth due to SCC; Loss of material due to crevice corrosion	Plant-specific	Yes	The combinations of components, materials and environments identified in NUREG-1801 are not applicable to FCS.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	Component Supports				
3.5.1.25	All Groups: support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc.	Aging of component supports	Structures Monitoring	No, if within the scope of the applicant's Structures Monitoring Program	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. Applicable components are within the scope of the Structures Monitoring Program (B.2.10) described in Appendix B of this application. 2. Consistent with NUREG-1801, this group includes carbon steel, grout and epoxy grout and reinforced concrete exposed to ambient air at FCS.
3.5.1.26	Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	A CLB fatigue analysis does not exist at FCS Station.
3.5.1.27	All Groups: support members: anchor bolts, welds	Loss of material due to boric acid corrosion	Boric acid corrosion	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel exposed to ambient air at FCS.

TABLE 3.5-1 (Continued)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1.28	Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	No	1. The aging management results are consistent with those reviewed and approved in NUREG-1801. 2. Consistent with NUREG-1801, this group includes carbon steel exposed to ambient air at FCS.
3.5.1.29	Group B1.1: high strength low-alloy bolts	Crack initiation and growth due to SCC	Bolting integrity	No	1. The aging management results are consistent (with deviation) with the results documented in NUREG-1801. 2. The Bolting Integrity Program (B.1.1) discussed in Appendix B of this application includes an alternative means of managing cracking due to SCC. 3. Consistent with NUREG-1801, this group includes high strength low-alloy bolts exposed to ambient air at FCS.

3.5.2 COMPONENTS OR AGING EFFECTS THAT ARE NOT ADDRESSED IN NUREG-1801

Table 3.5-2 contains Containment, Structures and Component Supports aging management review results that are not addressed in NUREG-1801. This table includes the component types, materials, environments, aging effects requiring management, and the programs and activities for managing aging. Table 3.5-3 contains components in Containment, Structures and Component Supports not evaluated in NUREG-1801 that rely on aging management programs in NUREG-1801 for FCS License Renewal and the justification for the use of these programs.

TABLE 3.5-2
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.01	Removable slab lifting devices	Bronze	Plant Indoor Air	None	Not Applicable
3.5.2.02	Intake Structure sluice gate operator gland, pump gland and gland bolting	Bronze, brass	Raw Water	Loss of Material • Crevice and pitting corrosion and MIC due to stagnant conditions • Galvanic corrosion due to the conductivity of the process fluid and the presence of dissimilar metals in contact	Structures Monitoring Program (B.2.10)
3.5.2.03	Class A pipe piles are partially filled with soil during placement and then are filled with sand to the point four feet below the top of the pile. The remaining four feet are then filled with concrete.	Carbon Steel	Below Grade	None	Not Applicable
3.5.2.04	Class B pipe piles Diesel engine fuel oil storage tank H-piles	Carbon Steel	Below Grade	None	Not Applicable
3.5.2.05	Class B pipe piles	Carbon Steel	Concrete	None	Not Applicable

TABLE 3.5-2 (CONTINUED)
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.06	Class A pipe piles are partially filled with soil during placement and then are filled with sand to the point four feet below the top of the pile. The remaining four feet are then filled with concrete.	Carbon Steel	Concrete/Sand/Soil	None	Not Applicable
3.5.2.07	Manhole flange, Flood gates	Carbon Steel	Outside Air	Loss of Material General corrosion due to the exposure of external surfaces to varying levels of humidity	Periodic Surveillance and Preventive Maintenance Program (B.2.7)

TABLE 3.5-2 (CONTINUED)
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.08	Intake Structure carbon steel pipe, pipe sleeve, flange and pipe casing floor penetration	Carbon Steel	Raw Water	Loss of Material • Crevice and general corrosion due to oxygenated raw water environment • Pitting corrosion due to oxygenated raw water environment and stagnant or low flow conditions • Galvanic corrosion due to the conductivity of the process fluid and dissimilar metals in contact • MIC due to exposure to microbiological activity	Periodic Surveillance and Preventive Maintenance Program (B.2.7)

TABLE 3.5-2 (CONTINUED)
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.09	Intake Structure cast iron stuffing box floor penetration	Cast Iron	Raw Water	Loss of Material • Crevice and general corrosion due to oxygenated raw water environment • Pitting corrosion due to oxygenated raw water environment and stagnant or low flow conditions • Galvanic corrosion due to the conductivity of the process fluid and dissimilar metals in contact • MIC due to exposure to microbiological activity	Structures Monitoring Program (B.2.10)
3.5.2.10	Concrete caissons	Concrete	Below Grade	None	Not Applicable

TABLE 3.5-2 (CONTINUED)
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.11	Concrete encased in Class B pipe piles is protected from aggressive environments. The concrete has a compressive strength of 4000 psi, a maximum water-to-cement ratio of 6 gallons/sack or 0.53, and the minimum cement content is 6.50 sacks/cubic yard. The aggregate used has been specified to be non-reactive when mixed with portland cement and water.	Concrete	Carbon Steel	None	Not Applicable
3.5.2.12	Pneumatic flood panel seals	EPDM Rubber	Plant Indoor Air	None	Not Applicable
3.5.2.13	Intake Structure EDPM rubber Link-Seal	EPDM Rubber	Raw Water	Change in Material Properties due to chemical exposure	Structures Monitoring Program (B.2.10)
3.5.2.14	Intake Structure raw water pump rubber foundation seal	EPDM Rubber	Raw Water	Change in Material Properties due to chemical exposure	General Corrosion of External Surfaces Program (B.3.3)
3.5.2.15	Glass in metal fire penetration barriers	Glass	Plant Indoor Air	None	Not Applicable

TABLE 3.5-2 (CONTINUED)
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.16	Intake Structure sand and gravel surrounding the diesel fire pump fuel storage tank	Gravel	Ambient Air Protected from Weather	None	Not Applicable
3.5.2.17	Manhole covers and flange	Gray Cast Iron	Ambient Air	Loss of Material General corrosion and selective leaching due to the exposure of external surfaces to varying levels of humidity	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.5.2.18	Flood panel seals	Neoprene	Plant Indoor Air	Change in Material Properties Due to the prolonged exposure of neoprene to temperatures above 95 deg F	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.5.2.19	Flood panel seals	Neoprene	Plant Indoor Air	Cracking Due to the prolonged exposure of neoprene to temperatures above 95 deg F	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.5.2.20	Manhole foam blocks	Polyurethane foam	Ambient Air Protected from Weather	Cracking Due to vibration, movement, and shrinkage	Periodic Surveillance and Preventive Maintenance Program (B.2.7)

TABLE 3.5-2 (CONTINUED)
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.21	Manhole foam blocks	Polyurethane foam	Ambient Air Protected from Weather	Separation Due to vibration, movement, and shrinkage	Periodic Surveillance and Preventive Maintenance Program (B.2.7)
3.5.2.22	Auxiliary building pressure relief panels	PVC	Outside Air	Change in Material Properties Due to ultraviolet (UV) radiation exposure	Structures Monitoring Program (B.2.10)
3.5.2.23	Auxiliary building pressure relief panels	PVC	Outside Air	Cracking Due to ultraviolet (UV) radiation exposure	Structures Monitoring Program (B.2.10)
3.5.2.24	Intake Structure stainless steel raw water pump gland bolting	Stainless Steel	Raw Water	Loss of Material • Crevice corrosion due to the presence of dissolved oxygen and impurities • MIC due to exposure to microbiological activity • Pitting corrosion due to (1) stagnant or low-flow conditions, and (2) halide ions, chlorides, bromides or hypochlorites	General Corrosion of External Surfaces Program (B.3.3)
3.5.2.25	Structural steel	Stainless Steel	Ambient Air	None	Not Applicable
3.5.2.26	Trisodium phosphate baskets	Stainless Steel	Ambient Air	None	Not Applicable

TABLE 3.5-2 (CONTINUED)
AGING MANAGEMENT PROGRAMS FOR CONTAINMENT, STRUCTURES AND COMPONENTS THAT ARE NOT ADDRESSED IN NUREG-1801

Row Number	Component Types	Material	Environment	AERMs	Program/Activity
3.5.2.27	Boot clamps for auxiliary building boot sealed fire penetration barrier	Stainless Steel	Ambient Air	None	Not Applicable
3.5.2.28	Structural steel, fuel transfer penetration, fasteners	Stainless Steel	Borated treated water	Loss of Material • Crevice corrosion due to an oxygenated treated water environ-ment • Pitting corrosion due to exposure to halogens and sulfates.	Structures Monitoring Program (B.2.10) and Inservice Inspection Program (B.1.3)
3.5.2.29	Not used in application				
3.5.2.30	Radiant energy shield sheet metal	Carbon Steel	Ambient Air	Loss of Material General corrosion due to the exposure of external surfaces to varying levels of humidity.	Fire Protection Program (B.2.5)
3.5.2.31	Component Support Stainless Structural Steel	Stainless Steel	Borated treated water	Cracking Stress corrosion cracking	Chemistry Program (B.1.2)
3.5.2.32	Component Support Stainless Steel Threaded Fasteners	Stainless Steel	Ambient Air	Cracking Stress corrosion cracking	Bolting Integrity Program (B.1.1)
3.5.2.33	Intake Structure concreate exposed to raw water	Concrete	Raw Water	Loss of Material Abrasion	Structures Monitoring Program (B.2.10)

TABLE 3.5-3
COMPONENTS IN STRUCTURES AND COMPONENT SUPPORTS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.5.3.01	Intake Structure bronze sluice gate operator gland and gland bolting and cast iron stuffing box floor penetrations	Bronze, Cast Iron	Raw Water	Loss of Material Due to Dezincification	Selective Leaching Program (B.3.6)	3.3.1.16 3.3.1.24	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, VII.C1.2-a.
3.5.3.02	Steel spring support anchorage	Carbon Steel	Indoor Ambient Air	Loss of Material General Corrosion	Structures Monitoring Program (B.2.10)	3.5.1.25	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, III.B4.1-a.

TABLE 3.5-3 (CONTINUED)
COMPONENTS IN STRUCTURES AND COMPONENT SUPPORTS NOT EVALUATED IN NUREG-1801 THAT RELY ON AGING MANAGEMENT PROGRAMS IN NUREG-1801 FOR FCS LICENSE RENEWAL

Row Number	FCS Components	FCS Material	FCS Environment	FCS AERMs	FCS Program Activity	Applicable NUREG-1801 Aging Management Review Results Row Number	Justification for applying NUREG-1801 Aging Management Review Results
3.5.3.03	Reactor cavity liner, reactor cavity seal ring, fuel transfer penetration	Stainless Steel	Plant Indoor Air/ Borated Water	Loss of Material, Cracking	Water Chemistry Program (B.1.2) and monitoring of spent fuel pool water level	3.5.1.19	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, III.A5.2-b.
3.5.3.04	Containment Ungrouted Masonry Block Walls in Ambient Air	Masonry	Plant Indoor Air	Cracking	Structures Monitoring Program	3.5.1.20	The FCS components are made of the same material, exposed to the same environment, subject to the same aging effects and managed by the same aging management program as the components evaluated in NUREG-1801, Volume 2, III.A3.3-a.

3.6 AGING MANAGEMENT OF ELECTRICAL AND INSTRUMENTATION AND CONTROLS

The components for FCS evaluated in this section of the application consist of the electrical cables, connectors, splices, fuse blocks, terminal blocks, electrical penetrations, and electrical bus bars subject to aging management review.

Cables and their associated connectors perform the function of providing electrical energy (either continuously or intermittently) to power various equipment and components throughout the plant. Cables and connectors associated with the 10 CFR 50.49 program (Environmental Qualification) are addressed either as short lived, periodically replaced, or long-lived Time Limited Aging Analysis (TLAA) candidates; as such, those candidates are not included in the set of cables and connectors requiring additional aging management review.

Electrical penetrations electrically connect specified sections of an electrical circuit through the containment boundary to deliver voltage, current or signal while maintaining the integrity of containment. The pigtail at each end of the penetration is connected to the field cable by industry accepted methods such as connectors, terminal blocks or splice connections. Non-EQ electrical penetrations will be assessed in a similar manner to the non-EQ cable and connectors requiring additional aging management review.

Bus bars electrically connect specified sections of an electrical circuit to deliver voltage, current or signal. The standoffs support the electrical bus bars. This assessment includes the bus bars located in the 480-volt motor control centers. No aging effects requiring management were identified for this group.

Operating Experience:

Site: A review of plant specific operating experience was conducted, including the review of Condition Reports and discussions with appropriate site personnel to identify AERM. These reviews concluded that the AERM identified by the FCS specific operating experience were consistent with those identified in NUREG-1801.

Industry: A review of industry-wide operating experience was conducted to identify aging effects requiring management. This included a review of operating experience issued during 2001. This review concluded that the AERM identified by industry operating experience were consistent with those identified in NUREG-1801.

On-Going: The on-going review of plant specific and industry-wide operating experience is conducted in accordance with the FCS Operating Experience Program.

3.6.1 AGING MANAGEMENT PROGRAMS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR LICENSE RENEWAL

Table 3.6-1 shows the aging management groups (combinations of components, materials and environments) and the aging management programs evaluated in NUREG-1801 that are relied on for license renewal of the Electrical and Instrumentation and Controls Systems at FCS. Information on FCS specific components, materials and aging effects, not listed in NUREG-1801 but included in the component group of this application, is included in the discussion column.

TABLE 3.6-1
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ELECTRICAL AND INSTRUMENTATION AND CONTROLS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1.01	Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	Environmental qualification of electric components	Yes, TLAA	The environmental qualification time limited aging analyses are discussed in Section 4.4 of this application.
3.6.1.02	Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/ thermoxidative degradation of organics; radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	No	Addressed in FCS Plant Specific Non-EQ Cable Aging Management Program (B.3.4), which is described in Appendix B of this application.

TABLE 3.6-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ELECTRICAL AND INSTRUMENTATION AND CONTROLS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1.03	Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements	No	Addressed in FCS Plant Specific Non-EQ Cable Aging Management Program (B.3.4), which is described in Appendix B of this application.
3.6.1.04	Inaccessible medium-voltage (2kV to 15kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	Formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees	Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	No	Modifications were made to the Duct Banks to preclude moisture intrusion; therefore, there is no aging effect requiring management.

TABLE 3.6-1 (CONTINUED)
SUMMARY OF AGING MANAGEMENT PROGRAMS FOR ELECTRICAL AND INSTRUMENTATION AND CONTROLS EVALUATED IN NUREG-1801 THAT ARE RELIED ON FOR FCS LICENSE RENEWAL

Row Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1.05	Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leak-age	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric acid corrosion	No	1. The aging management results are consistent with the results documented in NUREG-1801. 2. Consistent with NUREG-1801, this group includes connectors exposed to borated water leakage at FCS.

3.6.2 COMPONENTS OR AGING EFFECTS THAT ARE NOT ADDRESSED IN NUREG-1801

All components subject to aging management review and aging effects for FCS Electrical and Instrumentation and Controls systems are addressed in Section 3.6.1.

APPENDIX A – UPDATED SAFETY ANALYSIS REPORT (USAR) SUPPLEMENT

A.1 INTRODUCTION

The application for a renewed operating license is required by 10 CFR 54.21(d) to include "an FSAR Supplement." This appendix provides that supplement for the FCS USAR. Section 2 of this appendix contains a summarized description of the programs and activities for managing the effects of aging. Section 3 of this appendix contains a summary of the evaluation of time-limited aging analyses (TLAAs) for the period of extended operation.

A.2 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

This section provides summaries of the programs and activities credited for managing the effects of aging, in alphabetical order. The FCS Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Section A.2 of NUREG 1800, *Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants*, published July 2001. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal.

A.2.1 ALLOY 600 PROGRAM

The Alloy 600 Program includes a primary water stress corrosion cracking (PWSCC) susceptibility assessment to identify susceptible components and inservice inspection (ISI) of Reactor Coolant System penetrations to monitor PWSCC and its effect on the intended function of the component. For susceptible penetrations and locations, the program includes an industry-wide, integrated, long-term inspection program based on the industry response to NRC Generic Letter (GL) 97-01, *Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations.*

A.2.2 BOLTING INTEGRITY PROGRAM

The Bolting Integrity Program includes periodic inspection of closure and structural bolting for indications of potential problems, including loss of material, crack initiation, and loss of preload. The program implements guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and installation of pressure-retaining bolting, and enhanced inspection techniques. The program is based on (1) the bolting integrity program delineated in NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants; (2)* industry's recommendations delineated in ERPRI NP-5769, *Degradation and Failure of Bolting in Nuclear Power Plants*, with the exceptions noted in NUREG-1339 for safety-related bolting; (3) EPRI TR-104213, *Bolted Joint Maintenance and Application Guide*, for pressure retaining bolting and structural bolting; and (4) routine examinations and inspections performed in accordance with the requirements of ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*.

A.2.3 BORIC ACID CORROSION PREVENTION PROGRAM

The Boric Acid Corrosion (BAC) Prevention Program implements administrative controls to (1) perform visual inspections of external surfaces that are potentially exposed to borated water leakage, (2) ensure timely discovery of leak path and removal of the boric acid residues, (3) perform assessments of degradation, and (4) perform follow-up inspections for adequacy of corrective actions. The program is implemented in response to NRC GL 88-05, *Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants*.

A.2.4 BURIED SURFACES EXTERNAL CORROSION PROGRAM

The Buried Surfaces External Corrosion Program provides for inspection of buried piping, tanks, and valves whenever they are uncovered due to excavation for maintenance or modifications. Piping and component coatings and wrappings will be inspected for degraded conditions that could be indicative of possible surface corrosion of the protected metal beneath. The scope and periodicity of inspections will be established and/or adjusted based on the inspection results.

A.2.5 CHEMISTRY PROGRAM

The FCS Chemistry Program controls water chemistry to minimize contaminant concentration and provide chemical additions, such as corrosion inhibitors and biocides, to mitigate aging effects due to corrosion. The program includes specifications for chemical species, limits, representative sampling and analysis frequencies, and corrective actions for control of water chemistry. The program is based on EPRI Guidelines TR-105714, *PWR Primary Water Chemistry Guidelines*, for primary water chemistry, TR-102134, *PWR Secondary Water Chemistry Guideline*, for secondary water chemistry, and TR-107396, *Closed Cooling Water Chemistry Guideline*, for closed-cycle cooling water corrosion inhibitor concentration.

A.2.6 CONTAINMENT INSERVICE INSPECTION PROGRAM

The Containment Inservice Inspection Program implements the examination requirements of ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, Subsection IWE, *Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Power Plants*, and Subsection IWL, *Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants*, for the containment structure and support components. The ASME Section XI, Subsection IWL program consists of periodic visual inspection of concrete surfaces and periodic visual inspection and sample tendon testing for signs of degradation, assessment of damage, and corrective actions. Measured tendon lift-off forces are compared to predicted tendon forces calculated in accordance with NRC Regulatory Guide (RG) 1.35, *Inservice Inspection of Ungrouted Tendons in Prestressed Concrete Containments*. The ASME Section XI, Subsection IWE program consists of periodic visual, surface, and volumetric inspection of pressure retaining components for signs of degradation, assessment of damage and corrective actions. This program is in accordance with the requirements of 10 CFR 50.55a and ASME Section XI, Subsections IWE and IWL, 1992 edition including 1992 addenda.

A.2.7 CONTAINMENT LEAK RATE PROGRAM

The Containment Leak Rate Program implements the requirements of 10 CFR Part 50, Appendix J, as well as those examination requirements needed to comply with ASME Section XI, Subsection IWE, RG 1.163, *Performance-Based Containment Leak-Test Program,* and NEI 94-01, *Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50 Appendix J,* Rev. 0 for the containment structure and pressure retaining components. The program consists of monitoring of leakage rates through containment liner/welds, penetrations, fittings, and other access openings for detecting degradation of the containment pressure boundary. Corrective actions are taken if leakage rates exceed acceptance criteria.

A.2.8 COOLING WATER CORROSION PROGRAM

The Cooling Water Corrosion Program monitors and detects aging effects through inspection and nondestructive evaluations. The program also involves some mitigation activities of periodic flushing and draining. The program's aging management activities are based on EPRI TR-107396, *Closed Cooling Water Chemistry Guideline,* for closed-cycle cooling water systems and NRC GL 89-13, *Service Water System Problems Affecting Safety-Related Equipment,* for open-cycle cooling water systems.

A.2.9 DIESEL FUEL MONITORING AND STORAGE PROGRAM

The FCS Diesel Fuel Monitoring and Storage Program monitors and controls diesel fuel quality regarding water and other contaminants in accordance with the guidelines of ASTM Standards D2709, *Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge,* and D4057, *Standard Practice for Manual Sampling of Petroleum and Petroleum Products.* Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by removal of water and sediment from tanks and by verifying the quality of new fuel oil before its introduction into the storage tanks.

A.2.10 FATIGUE MONITORING PROGRAM

The Fatigue Monitoring Program provides for the monitoring of reactor coolant and associated systems thermal fatigue, pressurizer surge line thermal stratification, and thermal fatigue of selected Class II and III components over the life of the plant to ensure that their operation does not result in exceeding the number of design basis transients included in the design basis of their respective design codes. It will be centered on the industry's automated cycle counting software, FatiguePro. Plant locations that cannot be counted automatically will continue to be counted manually. An FCS site specific evaluation is being performed to address environmental fatigue. Appropriate program enhancements will be made prior to the period of extended operation based on the evaluation results.

A.2.11 FIRE PROTECTION PROGRAM

The FCS Fire Protection Program provides administrative requirements for ensuring the operability of fire protection equipment required to ensure plant safe shutdown. The program includes visual inspections, system flushing, and performance tests of fire barriers (penetration seals, fire doors, walls, ceilings, and floors), fire suppression system components (piping, valves, nozzles, yard hydrants and hose stations, sprinkler heads, and halon systems and cylinders), and the diesel fire pump. The FCS Fire Protection Program includes the requirements identified in Appendix A to NRC Branch Technical Position APCSB 9.5-1 and 10 CFR 50 Appendix R, Section III.G, J, and O and is further described in Section 9.11 of the USAR.

A.2.12 FLOW ACCELERATED CORROSION PROGRAM

The FCS Flow Accelerated Corrosion (FAC) Program implements administrative controls to conduct appropriate analysis and baseline inspections, determine extent of thinning, replace/repair components, and perform follow-up inspections to confirm or quantify and take longer-term corrective actions. The program relies on implementation of EPRI guidelines of NSAC-202L-R2, *Recommendations for an Effective Flow-Accelerated Corrosion Program.*

A.2.13 GENERAL CORROSION OF EXTERNAL SURFACES PROGRAM

The General Corrosion of External Surfaces Program implements systematic inspections and observations to detect corrosion of external surfaces and conditions that can result in corrosion such as damaged coatings and fluid leaks. Inspections and observations include (1) rounds by operators, (2) system engineer walkdowns, and (3) refueling interval inspections inside containment in accordance with RG 1.54, *Quality Assurance Requirements for Protective Coatings Applied to Water - Controlled Nuclear Power Plants.*

A.2.14 INSERVICE INSPECTION PROGRAM

The Fort Calhoun Station Inservice Inspection Program implements the examination requirements of the ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, Subsections IWB, IWC, IWD, IWF. The program consists of periodic volumetric, surface and/or visual examination of components and their supports for assessment, signs of degradation, and corrective actions. This program is in accordance with ASME Section XI, 1995 edition through the 1996 addenda.

A.2.15 NON-EQ CABLE AGING MANAGEMENT PROGRAM

The FCS Non-EQ Cable Aging Management Program establishes a service life value for the Non-EQ cable in a similar fashion as the FCS EQ Program establishes a Qualified Life for the safety related equipment, components, and cable. Corrective actions for Non-EQ Cable, determined not to meet the operational (Service Life) requirements established for the full period of extended operation, will consider using: (1) state of the art analytical techniques to determine if the service life can be further extended; (2) industry accepted and regulatory approved cable inspection techniques that provide aging related data; and/or (3) state of the art, in-situ, non-destructive testing of cable performance, and/or laboratory testing of cable to extend life. Cable replacement will be considered should the aforementioned methodologies not succeed in extending the required service life.

A.2.16 ONE-TIME INSPECTION PROGRAM

The FCS One-Time Inspection Program is a new program that will implement a one-time inspection of internal surfaces of selected components to verify the effectiveness of mitigating programs such as the chemistry and diesel fuel oil programs. Inspections will be performed using suitable techniques at the most susceptible locations to verify that aging effects are not occurring or that the aging effect is progressing at such a slow rate it will not impact the intended function during the period of extended operation.

A.2.17 OVERHEAD LOAD HANDLING SYSTEMS INSPECTION PROGRAM

The Overhead Load Handling Systems Inspection Program implements FCS commitments made in response to NRC GL 81-07, *Control of Heavy Loads at Nuclear Power Plants,* and the maintenance monitoring requirements of 10 CFR 50.65. The program includes assessment of crane lift capabilities, periodic inspections of structural components, and functional tests to assure their integrity.

A.2.18 PERIODIC SURVEILLANCE AND PREVENTIVE MAINTENANCE PROGRAM

The Periodic Surveillance and Preventive Maintenance Program provides for periodic inspections and examinations of specific system and structural components using established NDE techniques. The inspection and examination techniques used and the periodicity of their performance provide reasonable assurance that age related degradation will not compromise the structure or component intended function(s) before the next scheduled inspection.

A.2.19 REACTOR VESSEL INTEGRITY PROGRAM

The Reactor Vessel Integrity Program monitors the extent of changes in material properties and loss of fracture toughness of irradiated reactor pressure vessel materials by periodic removal and testing of surveillance capsules located within the reactor vessel in accordance with RG 1.99, *Radiation Embrittlement of Reactor Vessel Materials,* Rev. 2. The surveillance capsule removal and evaluation is an NRC-approved program that meets the requirements of 10 CFR 50, Appendix H. The program includes revising the FCS surveillance capsule removal schedule in order to optimize the program through the end of the period of extended operation. In addition, the program verifies 10 CFR 50, Appendix G and 10 CFR 50.61 requirements.

A.2.20 REACTOR VESSEL INTERNALS INSPECTION PROGRAM

The Reactor Vessel (RV) Internals Inspection Program includes the following elements for cast austenitic stainless steel (CASS) and other reactor vessel internal components: (a) determination of the susceptibility of CASS components to thermal aging and neutron irradiation embrittlement, (b) identification of the most susceptible or limiting items, (c) development of appropriate inspection techniques to permit detection and characterizing of the feature (cracks) of interest and demonstrate the effectiveness of the proposed technique, and (d) implementation of required inspections prior to the period of extended operation.

A.2.21 SELECTIVE LEACHING PROGRAM

The FCS Selective Leaching Program implements inspection requirements for susceptible components for indication of selective leaching through dezincification or graphitization.

A.2.22 STEAM GENERATOR PROGRAM

The FCS Steam Generator Program consists of inspection scope, frequency, and acceptance criteria for various steam generator components, including the plugging and repair of flawed tubes in accordance with the plant Technical Specifications and the guidance of NEI 97-06, *Steam Generator Program Guidelines.*

A.2.23 STRUCTURES MONITORING PROGRAM

The Structures Monitoring Program provides for periodic visual inspection of designated FCS structures and component supports to ensure that aging degradation will be detected, evaluated, and repaired prior to any loss of intended functions. The inspection requirements are based on the following industry documents: NRC Bulletin 80-11, *Masonry Wall Design;* NRC IN 87-67, *Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11;* NUMARC 93-01, *Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants (Line-In/Line-Out Version)*, Rev. 2; and NRC RG 1.160, *Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, Rev. 2.

A.2.24 THERMAL AGING EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL PROGRAM

The Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program includes evaluation of the reactor coolant piping as bounded by the Leak-Before-Break (LBB) analysis, assessment of other CASS components for susceptibility to thermal embrittlement, and performance of volumetric inspection of piping or component-specific flaw tolerance evaluation for susceptible components.

A.3 EVALUATION OF TIME-LIMITED AGING ANALYSES

A.3.1 REACTOR VESSEL NEUTRON EMBRITTLEMENT

There are four analyses affected by neutron embrittlement that have been identified as TLAAs:

- Pressure/Temperature (P/T) Curves
- Low Temperature Overpressure Protection (LTOP) Power Operated Relief Valve (PORV) Setpoints
- Pressurized Thermal Shock (PTS)
- Reactor Vessel Upper Shelf Energy

A.3.1.1 PRESSURE/TEMPERATURE (P/T) CURVES

Appendix G to 10 CFR 50 requires that PT limits be established during all phases of reactor operation and that thermal stresses be limited by determining maximum heatup and cooldown rates. The current pressure/temperature analyses are valid out to 40 effective full power years, which extends beyond the current operating license period but not to the end of the period of extended operation. The Technical Specifications will continue to be updated as required by either Appendices G or H of 10 CFR 50, or as operational needs dictate. This will assure that operational limits remain valid for current and projected cumulative neutron fluence levels. Therefore, the analyses will be projected to the end of the period of extended operation.

A.3.1.2 LOW TEMPERATURE OVERPRESSURE PROTECTION (LTOP) PORV SETPOINTS

Low temperature overpressure protection limits are considered as part of the calculation of pressure/temperature curves. Loss of ductility at low temperatures due to neutron embrittlement must be evaluated during the period of extended operation. Therefore, the LTOP analyses will be projected to the end of the period of extended operation.

A.3.1.3 PRESSURIZED THERMAL SHOCK (PTS)

10 CFR 50.61 addresses another issue related to embrittlement and thermal stress called Pressurized Thermal Shock (PTS). Irradiation makes the vessel's beltline more susceptible to cracking during a pressurized thermal shock event. The parameter describing this fracture potential is called the transition temperature (or RT_{PTS}) and it corresponds to the nil ductility reference temperature for the most limiting beltline material. It is a function of the projected fluence values and is calculated using guidance in Regulatory Guide 1.99, revision 2. Applicants are obligated to project the values of the increasing transition temperature into the period of extended operation.

OPPD has completed the projected calculation and the NRC has concluded that RT_{PTS} for the FCS reactor vessel will remain below the 10 CFR 50.61 PTS screening criteria until 2033, the end of the proposed license renewal period. Therefore, the analyses have been projected to the end of the period of extended operation.

A.3.1.4 REACTOR VESSEL UPPER SHELF ENERGY

Upper shelf energy is a measure of fracture toughness at temperatures above RT_{PTS} when the vessel is exposed to neutron radiation. The screening criteria for the increase in transition temperature are found in 10 CFR 50.61. The screening criterion for the decrease in upper shelf energy is found in 10 CFR 50, Appendix G.

Preliminary calculations have shown that the vessel beltline Charpy upper-shelf energy for the limiting weld will be approximately 54.6 ft-lbs, based on position 1.2 of RG 1.99. This value remains above the regulatory approved minimum of 50 ft-lbs through the period of extended operation. The existing Appendix G analysis will be finalized and formally revised to reflect that it bounds the minimum approved fluence value at the end of plant life. Therefore, the analyses will be projected to the end of the period of extended operation.

A.3.2 METAL FATIGUE

There are three distinct issues considered separately under the TLAA for Metal Fatigue:

- Reactor Coolant and associated systems thermal fatigue,
- Pressurizer Surge Line Thermal Stratification, and
- Fatigue of Class II and III components.

Each of these issues is managed by the Fatigue Monitoring Program which is addressed in Section A.2.10 of this Appendix.

A.3.3 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL EQUIPMENT

10 CFR 50.49 requires that certain safety related and non-safety related electrical equipment remains functional during and after identified Design Basis Events (DBEs). For the period of extended operation, Environmental Qualification (EQ) is a TLAA affecting all equipment in the scope of the EQ program, with a qualified life longer than the original license period but shorter than the combined original license period plus the period of extended operation, whether active or passive.

The FCS Electrical Equipment Qualification (EEQ) Program has been demonstrated to be capable of programmatically managing the qualified lives of EQ components within the scope of license renewal. The NRC has determined that the EEQ Program is an acceptable program to address environmental qualification in accordance with 10 CFR 54. The FCS EEQ Program will provide for extension of the qualification to the end of the period of extended operation. Therefore, the effects of aging on the intended functions will be adequately managed for the period of extended operation.

A.3.4 CONCRETE CONTAINMENT TENDON PRE-STRESS

The containment wall and dome were pre-stressed by means of unbonded post-tensioned tendons. The pre-stress on the containment tendons decreases over plant life as a result of elastic deformation, creep and shrinkage of concrete, anchorage seating losses, tendon wire friction, stress relaxation and corrosion. Pre-stressing tendon integrity is monitored and confirmed by a regular program of tendon surveillance. Curves showing anticipated variation of tendon force with time, together with the lower limit curves to be applied to surveillance readings are shown in the FCS USAR. The calculated pre-stress at end of plant life exceeds by a reasonable margin the intensity required to meet the design criteria.

The USAR curves will be extended to 60 years of plant life to cover the period of extended operation. This will also show that the pre-stressing force is acceptable for continued service at the end of the period of extended operation considering the assumed time dependent nature of pre-stress losses. The tendon surveillance program will be continued into the period of extended operation using the updated curves. Therefore, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

A.3.5 CONTAINMENT LINER PLATE AND PENETRATION SLEEVE FATIGUE

The containment liner and penetration sleeves were designed to be leak-tight under all postulated loading combinations by limiting strains to those values that have been shown to result in leak-tight pressure vessels. The results of the containment fatigue analysis indicated that when the maximum compressive strain in the liner was reached under operating conditions and subsequent cyclic temperature variations were applied to the liner, there was no significant change in stress and strain in concrete or steel for the second cyclic load indicating that shakedown had occurred during the first cycle of loading. Also, the investigation for 500 cycles of loading for the liner steel, anchor steel and anchor welds resulted in a computed cumulative usage factor of 0.05 as compared with an allowable usage factor of 1.0. Consideration of 60 years of operation as opposed to 40 would have no relevant impact on these results. However, the observed buckling of the liner is slightly larger than was assumed in the original analyses. This condition has been evaluated and found adequate for the current term. FCS will complete an analysis considering the actual bulges for a 60-year life. The analysis will be completed before the beginning of the period of extended operation. Therefore, the analysis will be projected to the end of the period of extended operation.

A.3.6 PLANT-SPECIFIC TIME-LIMITED AGING ANALYSES

A.3.6.1 REACTOR COOLANT PUMP FLYWHEEL FATIGUE

A.3.6.1.1 GENERAL ELECTRIC RCP FLYWHEELS

The resistance to rupture of the reactor coolant pump flywheels has been examined at 120 percent overspeed. The conclusion was that over 185,000 complete cycles from zero to 120 percent overspeed would be required to cause a crack to grow to critical size.

This number of cycles will not be exceeded if the licensing period is extended to 60 years. To do so would require in excess of 8 pump starts per day, which far exceeds actual and projected pump use. Since the cycle limit will not be exceeded, the analysis for the General Electric produced RCP flywheels remains valid for the period of extended operation.

A.3.6.1.2 ASEA BROWN BOVERI (ABB) MOTOR FLYWHEEL

During the 1996 refueling outage, reactor coolant pump RC-3B motor was replaced with a motor manufactured by ABB Industries. A crack growth analysis was performed which demonstrated that critical flaw growth would not occur with fewer than 10,000 complete cycles from zero to 120 percent overspeed.

This number of cycles will not be exceeded if the licensing period is extended to 60 years. To do so would require approximately 1 pump start every 2 days, which far exceeds actual and projected pump use. Since the cycle limit will not be exceeded, the analysis for the ABB produced RCP flywheel remains valid for the period of extended operation.

A.3.6.2 LEAK BEFORE BREAK (LBB) ANALYSIS FOR RESOLUTION OF USI A-2

There are two TLAA aspects to LBB, crack growth and thermal aging. While transient cycle fatigue crack growth is a TLAA for FCS and also a design consideration, thermal aging was not evaluated for FCS by either the original design code or the LBB analysis. Consequently, OPPD will perform a plant-specific LBB analysis prior to the period of extended operation. This analysis will consider a 60-year life and thermal aging effects of the CASS RCS and will be completed before the beginning of the period of extended operation. Therefore, the analysis will be projected to the end of the period of extended operation.

A.3.6.3 HIGH ENERGY LINE BREAK (HELB)

The High Energy Line Break (HELB) analysis is a potential TLAA because postulated fatigue cumulative usage factors (CUFs) based on 40 years of operation may be used as screening criteria to determine piping locations that require further analysis regarding the effects of pipe ruptures outside the Containment Structure. For FCS, the Main Steam (MS) and Main Feedwater (MFW) systems contain piping for which CUFs have been evaluated for screening.

Fatigue analyses were previously performed for the B31.7 Class I portions of MS and MFW outside the Containment Structure to identify locations with cumulative usage factors greater than 0.1 as one of the criteria for selecting postulated break locations. The Class I portions encompass the piping from the Containment Structure penetrations to the first isolation valves outside the Containment Structure.

For the Class I MFW piping, projection of the CUFs for the period of extended operation does not require either any additional pipe break analysis to be performed or hardware to be installed on the Class I portions of MFW outside the Containment Structure. Also, for the Class I MS piping, projection of the CUFs for the period of extended operation will not require any additional pipe break analysis to be performed or hardware to be installed on the Class I portions of MS outside the Containment Structure.

The circumferential breaks, already postulated, are bounding for all nodes with respect to direction and magnitude of force. Consideration of the period of extended operation will not impact the selection of the bounding locations. The barrel slats, which cover the piping segments, restrain longitudinal movements and jets along the length of the Class I pipe, not just at the postulated break points. In summary, projection of the CUFs used as HELB screening criteria for the period of extended operation will not require any additional pipe break analysis to be performed or hardware to be installed on the Class I piping. The CUFs are in fact not part of the actual analysis, but only represent screening criteria used to select bounding locations. Therefore, the analysis remains valid for the period of extended operation.

APPENDIX B – AGING MANAGEMENT ACTIVITIES

INTRODUCTION

The aging management activity descriptions are provided in this appendix for each activity credited for managing aging effects based upon the aging management review results provided in Sections 3.1 through 3.6.

The FCS Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2 of NUREG-1800. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and non-safety-related structures, systems, and components that are subject to aging management review.

In many cases, existing activities were found adequate for managing aging effects during the period of extended operation. In some cases, aging management reviews revealed that existing activities should be enhanced to adequately manage aging. In a few cases, new activities were developed to provide reasonable assurance that aging effects are adequately managed.

Each aging management activity presented in this appendix is characterized as one of the following:

Existing Activity: A current activity that will continue to be implemented during the period of extended operation.

Enhanced Activity: A current activity that will be modified to manage aging during the period of extended operation.

New Activity: An activity that does not currently exist, which will manage aging during the period of extended operation.

The following aging management activities are described in the sections listed in this appendix. Site specific programs are indicated. All other programs correlate to some degree with programs in NUREG-1801.

Existing Aging Management Activities

B.1.1	Bolting Integrity Program
B.1.2	Chemistry Program
B.1.3	Containment Inservice Inspection Program
B.1.4	Containment Leak Rate Program
B.1.5	Flow Accelerated Corrosion Program
B.1.6	Inservice Inspection Program
B.1.7	Reactor Vessel Integrity Program

Enhanced Aging Management Activities

B.2.1	Boric Acid Corrosion Prevention Program
B.2.2	Cooling Water Corrosion Program
B.2.3	Diesel Fuel Monitoring and Storage Program
B.2.4	Fatigue Monitoring Program
B.2.5	Fire Protection Program
B.2.6	Overhead Load Handling Systems Inspection Program
B.2.7	Periodic Surveillance and Preventive Maintenance Program **(site specific program)**
B.2.8	Reactor Vessel Internals Inspection Program
B.2.9	Steam Generator Program
B.2.10	Structures Monitoring Program

New Aging Management Activities

B.3.1	Alloy 600 Program
B.3.2	Buried Surfaces External Corrosion Program
B.3.3	General Corrosion of External Surfaces Program **(site specific program)**
B.3.4	Non-EQ Cable Aging Management Program **(site specific program)**
B.3.5	One-Time Inspection Program
B.3.6	Selective Leaching Program
B.3.7	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel

Correlation between NUREG-1801 (Generic Aging Lessons Learned (GALL)) programs and FCS programs are shown below. For the FCS Programs, appropriate references to sections of this application are provided.

NUREG-1801 ID Number	NUREG-1801 Program	FCS Program
XI.M1	ASME Section XI Inservice Inspection, Subsection IWB, IWC, IWD	Inservice Inspection Program (B.1.6)
XI.M2	Water Chemistry	Chemistry Program (B.1.2)
XI.M3	Reactor Head Closure Studs	Bolting Integrity Program (B.1.1)
XI.M4	BWR Vessel ID Attachment Welds	Not applicable, FCS is a PWR.
XI.M5	BWR Feedwater Nozzle	Not applicable, FCS is a PWR.
XI.M6	BWR Control Rod Drive Return Line Nozzle	Not applicable, FCS is a PWR.
XI.M7	BWR Stress Corrosion Cracking	Not applicable, FCS is a PWR.
XI.M8	BWR Penetrations	Not applicable, FCS is a PWR.
XI.M9	BWR Vessel Internals	Not applicable, FCS is a PWR.
XI.M10	Boric Acid Corrosion	Boric Acid Corrosion Prevention Program (B.2.1)
XI.M11	Nickel-Alloy Nozzles and Penetrations	Alloy 600 Program (B.3.1)
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) (B.3.7)
XI.M13	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	Reactor Vessel Internals Inspection Program (B.2.8)
XI.M14	Loose Part Monitoring	Not credited for aging management. Reactor vessel internals inspections were determined to be adequate to manage identified aging effects.

NUREG-1801 ID Number	NUREG-1801 Program	FCS Program
XI.M15	Neutron Noise Monitoring	Reactor vessel internals vibration monitoring is a current FCS licensing commitment. The implementing task is incorporated in the Reactor Vessel Internals Inspection Program (B.2.8).
XI.M16	PWR Vessel Internals	Reactor Vessel Internals Inspection Program (B.2.8)
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion Program (B.1.5)
XI.M18	Bolting Integrity	Bolting Integrity Program (B.1.1)
XI.M19	Steam Generator Tube Integrity	Steam Generator Program (B.2.9)
XI.M20	Open-Cycle Cooling Water System	Cooling Water Corrosion Program (B.2.2)
XI.M21	Closed-Cycle Cooling Water System	Cooling Water Corrosion Program (B.2.2)
XI.M22	Boraflex Monitoring	Not applicable, FCS does not have Boraflex.
XI.M23	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Overhead Loading Handling Systems Inspection Program (B.2.6)
XI.M24	Compressed Air Monitoring	Not credited for aging management. No aging effects requiring management were identified for the Compressed Air System.
XI.M25	BWR Reactor Water Cleanup System	Not applicable, FCS is a PWR.
XI.M26	Fire Protection	Fire Protection Program (B.2.5)
XI.M27	Fire Water System	Fire Protection Program (B.2.5)

NUREG-1801 ID Number	NUREG-1801 Program	FCS Program
XI.M28	Buried Piping and Tanks Surveillance	Not credited for aging management. FCS cathodic protection was not credited for managing aging effects. The FCS aging management program was based on the requirements of NUREG-1801 XI.M34.
XI.M29	Aboveground Carbon Steel Tanks	Not credited for aging management. Steel tanks were not treated as separate components from their respective systems. Applicable aging management activities have been incorporated into programs credited for similar component, material, and environments in the system.
XI.M30	Fuel Oil Chemistry	Diesel Fuel Monitoring and Storage Program (B.2.3)
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Integrity Program (B.1.7)
XI.M32	One-Time Inspection	One-Time Inspection Program (B.3.5)
XI.M33	Selective Leaching of Materials	Selective Leaching Program (B.3.6)
XI.M34	Buried Piping and Tanks Inspection	Buried Surfaces External Corrosion Program (B.3.2)
XI.E1	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Plant Specific Program - Non-EQ Cable Aging Management Program (B.3.4)
XI.E2	Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Plant Specific Program - Non-EQ Cable Aging Management Program (B.3.4)

NUREG-1801 ID Number	NUREG-1801 Program	FCS Program
XI.E3	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Plant Specific Program - Non-EQ Cable Aging Management Program (B.3.4)
XI.S1	ASME Section XI, Subsection IWE	Containment Inservice Inspection Program (B.1.3)
XI.S2	ASME Section XI, Subsection IWL	Containment Inservice Inspection Program (B.1.3)
XI.S3	ASME Section XI, Subsection IWF	Inservice Inspection Program (B.1.6)
XI.S4	10 CFR 50, Appendix J	Containment Leak Rate Program (B.1.4)
XI.S5	Masonry Wall Program	Structures Monitoring Program (B.2.10)
XI.S6	Structures Monitoring Program	Structures Monitoring Program (B.2.10)
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Structures Monitoring Program (B.2.10)
XI.S8	Protective Coating Monitoring and Maintenance Program	Not credited for aging management.
Chapter 10		
X.M1	Metal Fatigue of Reactor Coolant Pressure Boundary	Fatigue Monitoring Program (B.2.4)
X.E1	Environmental Qualification (EQ) of Electric Components	See Section 4.4 of this application.
X.S1	Concrete Containment Tendon Prestress	Containment Inservice Inspection Program (B.1.3)

B.1 EXISTING AGING MANAGEMENT ACTIVITIES

B.1.1 BOLTING INTEGRITY PROGRAM

The Bolting Integrity Program is consistent with XI.M3, "*Reactor Head Closure Studs*" and XI.M18, "*Bolting Integrity,*" as identified in NUREG-1801 with the following exception:

- § XI.M18 - 3. Parameters Monitored/Inspected and 4. Detection of Aging Effects

  FCS has not identified stress corrosion cracking (SCC) as a creditable aging effect requiring management for high strength carbon steel bolting in plant indoor air. FCS will utilize ASME Section XI, Subsection IWF visual VT-3 inspection requirements rather than volumetric inspections for inspection of supports.

The scope of the FCS Bolting Integrity Program includes those plant specific components identified in Tables 3.1.2 and 3.5.2 of this application for which the Bolting Integrity Program is identified as an aging management program.

Operating Experience:

Inspections of bolted components have been conducted under the FCS Inservice Inspection Program (based on ASME Section XI code requirements), the FCS Boric Acid Corrosion (BAC) Prevention Program, and the Structures Monitoring Program. Visual inspections conducted under the Boric Acid Corrosion Prevention Program include inspection of bolted components in borated systems. Any indication of BAC residue or damage is reported and evaluated to determine if a component can remain in service per established procedures. Documentation of operating experience is included in the BAC Inspection Program. On occasion, visual observations have identified BAC damage. These deficiencies were documented in accordance with the FCS corrective action program and resulted in repair or replacement if required. Review of the plant specific operating experience indicates that the inspections have been effective in managing the aging effects of bolted components.

Conclusion:

The Bolting Integrity Program provides reasonable assurance that the aging effects will be managed such that the bolted components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.2 CHEMISTRY PROGRAM

The FCS Chemistry Program is consistent with XI.M2, *Water Chemistry*, and the chemistry-related portions of XI.M21, *Closed-Cycle Cooling Water System*, as identified in NUREG-1801. The scope of the FCS Chemistry Program includes those plant specific components identified in Tables 3.1.2 through 3.5.2 and Tables 3.1.3 through 3.5.3 of this application for which the Chemistry Program is identified as an aging management program.

Operating Experience:

Over the FCS operating history, chemistry related situations have occasionally occurred. These include a steam generator tube leak, condenser tube leaks, and some resin intrusion into the primary water storage tank. These situations were properly corrected and long-term corrective actions were implemented to prevent recurrence. Chemistry management of aging effects has evolved over the years based on FCS and industry experience. OPPD has adopted industry practices throughout the years, and continues to do so in order to enhance chemistry control. The low percentage of plugged steam generator tubes based on the number of years the generators have been in service is indicative of the effective chemistry control. The overall experience illustrates that the Chemistry Program is effective in managing aging.

Conclusion:

The Chemistry Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.3 CONTAINMENT INSERVICE INSPECTION PROGRAM

The FCS Containment Inservice Inspection Program is consistent with X.S1, "*Concrete Containment Tendon Prestress,*" XI.S1, "*ASME Section XI, Subsection IWE,*" and XI.S2, "*ASME Section XI, Subsection IWL,*" as identified in NUREG-1801. The 10 Year Containment (IWE & IWL) Inservice Inspection Program Plan for FCS, incorporating Subsection IWE and Subsection IWL examination requirements, has been developed and implemented.

Operating Experience:

Inspections of the Containment Liner have been conducted in accordance with the Containment Leak Rate Testing Program and the Maintenance Rule Implementation Program. Inspections of the tendons and tendon anchorages have been conducted in accordance with Technical Specifications, the USAR, and plant procedures. The ASME Section XI, Subsection IWL Inservice Inspection Program incorporates all of the inspection criteria and guidelines of the previous tendon inspection program and is implemented using existing plant procedures. No significant age related degradation has been identified in theinspections performed.

Conclusion:

The Containment Inservice Inspection Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.4 CONTAINMENT LEAK RATE PROGRAM

The FCS Containment Leak Rate Program is consistent with XI.S4, "*10 CFR Part 50, Appendix J*," and applicable sections of XI.S1, "*ASME XI, Subsection IWE*" related to Appendix J testing as identified in NUREG-1801.

Operating Experience:

Containment leak-tight verification and visual examination of the steel components that are part of the leak-tight barrier have been conducted at FCS since initial unit startup. Prior to the development of the ASME Section XI, Subsection IWE Inservice Inspection Program, examinations were performed in accordance with 10 CFR 50, Appendix J. No significant age related degradation has been identified in the inspections performed.

Conclusion:

The Containment Leak Rate Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.5 FLOW ACCELERATED CORROSION PROGRAM

The FCS Flow Accelerated Corrosion (FAC) Program is consistent with XI.M17, "*Flow-Accelerated Corrosion*," as identified in NUREG-1801. The scope of the FCS FAC Program includes those plant specific components identified in Tables 3.1.3 and 3.4.3 of this application for which the FAC Program is identified as an aging management program.

Operating Experience:

FAC inspections have been performed periodically on both in-scope and out-of-scope piping. These inspections have gone on for many years and the FAC program has been adjusted based on inspection and other results. On occasion, pipe wall has been found below established screening criteria and visual observations have identified through-wall erosion. These deficiencies were documented in accordance with the FCS corrective action program and resulted in repair or replacement of the affected areas. A rupture occurred on a non-CQE extraction steam line in 1997 which resulted in significant upgrades to the FAC program. Internal audits and NRC inspection of the program since 1997 have found the program to be maintained in accordance with NSAC-202L-R2, "*Recommendations for an Effective Flow-Accelerated Corrosion Program.*"

Conclusion:

The Flow Accelerated Corrosion Program provides reasonable assurance that flow accelerated corrosion will be managed such that components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.6 INSERVICE INSPECTION PROGRAM

The Inservice Inspection Program is consistent with XI.M1, "*ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD*," and XI.S3, "*ASME Section XI, Subsections IWF*," as identified in NUREG-1801. The scope of the FCS Inservice Inspection Program includes those plant specific components identified in Tables 3.1.2 and 3.1.3 of this application for which the Inservice Inspection Program is identified as an aging management program.

Operating Experience:

Review of the plant specific operating experience indicates that the FCS Inservice Inspection Program has been effective in managing the aging effects of components. No significant age related deterioration has been identified in the inspections performed.

Conclusion:

The FCS Inservice Inspection Program provides reasonable assurance that the aging effects will be managed such that the ASME Class 1, 2, and 3 components and their integral supports subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.7 REACTOR VESSEL INTEGRITY PROGRAM

The FCS Reactor Vessel Integrity Program is consistent with XI.31, "*Reactor Vessel Surveillance*," as identified in NUREG-1801 with the exception of the following enhancements that will be made to the Reactor Vessel Integrity Program prior to the period of extended operation.

NUREG-1801 Program	Criteria	Enhancement
XI.31, Reactor Vessel Surveillance	Evaluation and Technical Basis Reactor vessel surveillance programs are plant specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant submits its proposed withdrawal schedule for approval prior to implementation. Thus, further staff evaluation is required for license renewal.	The revised, optimized withdrawal and test schedule was submitted to the NRC staff for review and approval per OPPD Letter LIC-01-0107 dated November 8, 2001.

Operating Experience:

At FCS, three surveillance capsules have been removed and the materials tested. The FCS operating experience is being supplemented by surveillance capsule test results from other operating reactors whose surveillance capsules include materials that exactly match the materials of the various FCS reactor vessel beltline welds, including the limiting or critical weld. The results of testing of the early surveillance capsules, use of the chemistry factors for the limiting weld, and the early results of the updated fluence analysis indicated that the FCS reactor vessel could exceed the PTS screening criteria of 10 CFR 50.61 before the end of the current 40-year license period in 2013. As a result, FCS implemented core design limitations aimed at restricting the fluence of the reactor vessel beltline region. Analysis has been completed which demonstrates that FCS will be able to operate to the end of the extended period of operation without exceeding the PTS screening criteria. These analysis results have been reviewed and NRC approved by Amendment 199 to the FCS Operating License.

Conclusion:

The Reactor Vessel Integrity Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2 ENHANCED AGING MANAGEMENT ACTIVITIES

B.2.1 BORIC ACID CORROSION PREVENTION PROGRAM

The FCS Boric Acid Corrosion (BAC) Prevention Program is consistent with XI.M10, "*Boric Acid Corrosion,*" as identified in NUREG-1801 with the exception of enhancements specified in the following table. These enhancements will be made to the Boric Acid Corrosion Program prior to the period of extended operation. The scope of the FCS Boric Acid Corrosion Program includes those plant specific components identified in Tables 3.1.2, 3.1.3, and 3.3.3 of this application for which the Boric Acid Corrosion Program is identified as an aging management program.

NUREG-1801 Program	Criteria	Enhancement
XI.M10 Boric Acid Corrosion	Scope	Specific guidance will be added to the program basis document and applicable procedures to inspect components, structures, and electrical components where boric acid may have leaked. Add Spent Fuel Pool Cooling and Waste Disposal Systems to the program.
	Parameters Monitored/ Inspected	Two areas not routinely inspected will be added to inspection scope.
	Monitoring and Trending	Specific guidance will be implemented for maintenance personnel to report boric acid leakage to the BAC Program Engineer.

Operating Experience:

FCS experienced severe boric acid corrosion on reactor coolant pump studs as documented in NRC Generic Letter (GL) 88-05, "*Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants.*" Significant program improvements were implemented in response to that GL. A review of the post GL 88-05 operating history indicates that the BAC Prevention Program at FCS routinely identifies and corrects borated water leakage and BAC in the Reactor Coolant System and other borated water systems, including any adjacent structures or components that could be adversely affected.

Conclusion:

The FCS Boric Acid Corrosion Prevention Program provides reasonable assurance that the aging effects will be managed such that the susceptible components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.2 COOLING WATER CORROSION PROGRAM

The FCS Cooling Water Corrosion Program is consistent with XI.M20, "*Open-Cycle Cooling Water System,*" and XI.21, "*Closed-Cycle Cooling Water System,*" as identified in NUREG-1801, with the exception of the enhancements specified in the following table and with the following clarifications:

- XI.M20 - Program Description, 3. Parameters Monitored/Inspected, 4.Detection of Aging Effects, 5. Monitoring and Trending, and 6. Acceptance Criteria

  External coatings are addressed by the FCS General Corrosion of External Surfaces Program.

- XI.M21 - Program Description, 2. Preventative Actions, 5. Monitoring and Trending, 6. Acceptance Criteria, and 7. Corrective Action

  The Chemistry-related portions of the program are addressed in the FCS Chemistry Program.

- The scope of the FCS Cooling Water Corrosion Program includes those plant specific components identified in Tables 3.2.2, 3.3.2, and 3.3.3 of this application for which the Cooling Water Corrosion Program is identified as an aging management program.

The FCS Cooling Water Corrosion Program will also include the following exceptions to NUREG-1801:

- XI.M21 - 3. Parameters Monitored/Inspected, 4. Detection of Aging Effects, and 5. Monitoring and Trending

  The license renewal commitment for these programs relates only to the maintenance of the pressure boundary and not the maintenance of fluid flow. Fluid flow is considered an active function. Performance testing and other active system function testing is not performed on an 18 month or 5 year frequency in accordance with EPRI TR-107396, Closed Cooling Water Chemistry Guideline, because this EPRI document does not address this criteria or specify that testing frequency. Non-destructive testing and heat transfer performance to identify pressure boundary integrity are performed per EPRI TR-107396.

The following enhancements will be made to the Cooling Water Corrosion Program prior to the period of extended operation.

NUREG-1801 Program	Criteria	Enhancement
XI.M20, Open-Cycle Cooling Water System	1. Scope of Program 4. Detection of Aging Effects 5. Monitoring and Trending	Inspections to various raw water components will be added based on FCS' Cooling Water Corrosion Program susceptibility evaluation. These inspection activities will be commensurate with the GALL Program.
XI.M21, Closed-Cycle Cooling Water System	3. Parameters Monitored/ Inspected 4. Detection of Aging Effects	Inspections to various cooling water components will be added based on FCS' Cooling Water Corrosion Program susceptibility evaluation. These inspection activities will be commensurate with the GALL Program.

Operating Experience:

Review of FCS operating experience has identified some component part replacements (and repairs) due to corrosion and cracking in the Component Cooling Water and Raw Water Systems. Appropriate long term corrective actions were implemented based on these experiences. These included material changes, additional preventive maintenance, and increased sample evaluation.

Conclusion:

The FCS Cooling Water Corrosion Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.3 DIESEL FUEL MONITORING AND STORAGE PROGRAM

The FCS Diesel Fuel Monitoring and Storage Program is consistent with XI.M30, "*Fuel Oil Chemistry*," as identified in NUREG-1801 with the exception of the enhancements specified in the following table, and with the following clarifications:

- XI.M30-3. Parameters Monitored/Inspected

  Although OPPD does perform particulate analysis of fuel oil, OPPD does not credit this analysis for any aging management. Particulate analysis is performed on diesel fuel for fuel burn quality concerns (i.e., clogging of filters), and does not have any impact on pressure boundary integrity.

- XI.M30-4. Detection of Aging Effects

  Ultrasonic testing is not performed on the fire protection diesel fuel oil tank due to the inaccessibility of the tank. Leak detection is employed to monitor the condition of the tank and is adequate to maintain the system design requirements.

- The scope of the FCS Diesel Fuel Monitoring and Storage Program includes those plant specific components identified in Tables 3.3.2 and 3.3.3 of this application for which the Diesel Fuel Monitoring and Storage Program is identified as an aging management program.

The following enhancements will be made to the Diesel Fuel Monitoring and Storage Program prior to the period of extended operation.

NUREG-1801 Program	Criteria	Enhancement
XI.M30, Fuel Oil Chemistry	2. Preventive Actions	Removal of sediment and water at the bottom of the Fire Protection diesel fuel tank will be added.
	4. Detection of Aging Effects	Inspection of diesel fuel day tanks for corrosion will be added.
	5. Monitoring and Trending	Fuel analysis of the Fire Protection Day Tank will be added.

Operating Experience:

FCS operating experience indicates there have been no instances of fuel oil system component failures due to aging effects.

Conclusion:

The FCS Diesel Fuel Monitoring and Storage Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.4 FATIGUE MONITORING PROGRAM

The FCS Fatigue Monitoring Program is consistent with X.M1, "*Metal Fatigue of Reactor Coolant Pressure Boundary*," as identified in NUREG-1801 with the exception of the enhancements specified in the following table. These enhancements will be made to the Fatigue Monitoring Program prior to the period of extended operation. The scope of the FCS Fatigue Monitoring Program includes those plant specific components identified in Table 3.1.2 of this application for which the Fatigue Monitoring Program is identified as an aging management program.

NUREG-1801 Program	Criteria	Enhancement
X.M1, Metal Fatigue of Reactor Coolant Pressure Boundary	1. Scope	Add the following to the scope of components subject to the FCS Fatigue Monitoring Program: • Pressurizer Surge Line bounding locations • Class 2 and 3 components not included in the NUREG-1801 program which are subject to fatigue as an aging effect requiring management.
	2. Preventive Actions 6. Acceptance Criteria	Perform site-specific analysis to address environmental fatigue concerns identified in NUREG/CR-6260. Corrective actions or program enhancements will be implemented if necessary based on the results of evaluation.

Operating Experience:

There have been no thermal fatigue related failures at FCS; however, there have been two occurrences (with associated corrective action documents) at FCS relative to thermal fatigue that have resulted in enhancements to the FCS Fatigue Monitoring Program.

The first of these documents summarizes concerns about the operation of the Chemical and Volume Control System (CVCS) and whether specific components within or related to the system were having their thermal cycles monitored and tracked consistently. This resulted in the performance of an Engineering Assessment to document a review of Design Basis Documents, the USAR, Technical Specifications, and other documents to determine cycle counting requirements. This review resulted in revision to some of these documents. An operating history review was performed to determine the number of cycles that the components of concern actually experienced. Part of this review was to ensure that the thermal cycles counted were, in fact, a result of design basis conditions that merited inclusion in the cycle counting.

The other document was written after a rash of industry small bore piping failures (generally detected as small cracks or leaks as opposed to major pressure boundary ruptures) in primary coolant systems. Two of the resulting action items created a small bore piping fatigue program and a systematic program for thermal fatigue. These actions have been ongoing and are being integrated with license renewal specific thermal fatigue action items to form the basis for this new program.

The sample frequency of the Primary Sampling System is such that its limit of 7000 cycles will be exceeded before the end of the period of extended operation. Prior to entering the period of extended operation, a stress analysis will be performed based on the sampling evolution parameters to determine whether or not the applicable sampling evolution piping will have to be replaced before the end of the period of extended operation.

Pressurizer surge line thermal stratification is an issue identified by NRC Bulletin 88-11. Generic and bounding analysis for all CE plants was performed by CE and submitted to the NRC. The fatigue portion of this analysis calculated a 0.937 usage factor for the surge line after the 40-year design life that would obviously be exceeded during the period of extended operation. This value is based on the use of the most limiting configuration of the surge line that exists in the CE-designed plants and as a result is very conservative for FCS. To address this issue for the purposes of license renewal, the pressurizer surge line bounding locations will be included in the FCS Fatigue Monitoring Program. As part of this program, realistic usage factors will be compiled for the critical areas based on actual plant operating data to include the effects of thermal stratification. These are expected to be lower than those predicted by the generic evaluation. This reevaluation will take place prior to the period of extended operation. Based on the results of this plant specific analysis, realistic fatigue usage for the surge line will be tracked, and actions will be taken to reevaluate, repair, or replace the surge line as necessary.

Conclusion:

The Fatigue Monitoring Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

B.2.5 FIRE PROTECTION PROGRAM

The Fire Protection Program is consistent with XI.M26, "*Fire Protection*," and XI.M27, "*Fire Water System*," as identified in NUREG-1801 with the exception of the enhancements specified in the following table and with the following clarification:

- XI.M27-2. Preventative Action

  NUREG-1801 specifies in Section XI.M27, "*Fire Water System*," that "portions of the fire protection sprinkler system, which are not routinely subjected to flow, are to be subjected to full flow tests at the maximum design flow and pressure." The FCS USAR, Table 9.11-3, directs flow testing to be performed using a clean water source. The demineralized water booster pumps or Blair City water are used for flow testing at pressures slightly lower than the normal system operating pressure. This is not consistent with NUREG-1801; however, both the pressure and resulting flow are sufficient to effectively entrain and adequately flow test/flush the sprinkler system piping. This ensures that aging effects are managed such that the intended function is maintained.

The following enhancements will be made to the Fire Protection Program prior to the period of extended operation. The scope of the FCS Fire Protection Program includes those plant specific components identified in Table 3.3.2 of this application for which the Fire Protection Program is identified as an aging management program.

NUREG-1801 Program	Criteria	Enhancement
XI.M26, *Fire Protection*	3. Parameters Monitored or Inspected	Additional guidance will be added to the diesel fire pump maintenance procedure to inspect diesel fire pump fuel line and zinc plug for corrosion or mechanical damage. Specific guidance will be added to halon and fire damper inspection procedures to inspect halon system components and fire dampers for corrosion, mechanical, and physical damage. Specific acceptance criteria will be added to fire barrier inspection procedures for concrete walls, floors, and ceilings. Specific guidance will be added to the fire door inspection procedure to inspect for wear and missing parts.
XI.M27, *Fire Water System*	Program Description	Specific guidance will be developed to replace or inspect in-scope sprinkler heads in accordance with NFPA 25
	2. Preventive Actions	Additional guidance will be added to one of the system valve cycling tests to improve system flushing.
	3. Parameters Monitored or Inspected	Specific guidance will be developed for flow testing in-scope sprinkler system.

Operating Experience:

Routine visual inspections of fire barriers have proven effective in identifying material degradation and damage. A recent decline in the number of identified fire barrier penetration discrepancies is attributed to a recent fire barrier and penetration upgrade effort. Historical operating experience shows fire barrier walls, ceilings, doors and floors are adequately managed through inspections.

Through-wall leakage of seamed fire protection system piping has been identified at FCS. Routine walkdowns and piping inspections (internal inspections performed when the system is breached for repair) have been implemented to accurately detect and identify early stages of pressure boundary deterioration and leakage. Historical operating experience and discussions with fire protection personnel show this program effectively manages and corrects pressure boundary failures. Operating history for yard fire hydrants, fire dampers, sprinklers and nozzles shows adequate management of the aging effects identified by chapters XI.M26 and XI.M27 of NUREG-1801. Halon system piping and tanks have shown few historical discrepancies and are adequately managed by the FCS program. No historical experience was identified concerning the diesel fire pump fuel oil supply line.

Conclusion:

The Fire Protection Program provides reasonable assurance that the aging effects will be managed such that the structures and components subject to aging management review will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

B.2.6 OVERHEAD LOAD HANDLING SYSTEMS INSPECTION PROGRAM

The FCS Overhead Load Handling Systems Inspection Program is consistent with XI.M23, "*Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems*," as identified in NUREG-1801 with the exception of the enhancements specified in the following table. The following enhancements will be made to the Overhead Load Handling Systems Inspection Program prior to the period of extended operation.

NUREG-1801 Program	Criteria	Enhancement
XI.M23, *Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems*	5. Detection of Aging Effects	Specific guidance will be added to applicable inspection procedures to inspect for degradation of expansion anchors and surrounding concrete.
	6. Acceptance Criteria	Specific guidance will be added to applicable inspection procedures to identify acceptance criteria for general corrosion and degradation of expansion anchors and surrounding concrete.
	7. Corrective Actions	Specific guidance will be added to applicable inspection procedures to initiate FCS corrective action documentation if excessive general corrosion or cracking of concrete around expansion anchors is identified.

Operating Experience:

The subject load handling equipment is periodically inspected for degradation. No aging effects which impact the intended functions of the structures or components were identified in the inspections performed.

Conclusion:

The FCS Overhead Load Handling Systems Inspection Program provides reasonable assurance that aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.7 PERIODIC SURVEILLANCE AND PREVENTIVE MAINTENANCE (PM) PROGRAM

The stated purpose of the PM program is to prevent or minimize equipment breakdown and to maintain equipment in a condition that will enable it to perform its normal and emergency functions. The program and the site administrative control processes provide for a systematic approach in establishing the method, frequency, acceptance criteria, and documentation of results.

The FCS Periodic Surveillance and Preventive Maintenance Program consists of periodic inspections and tests that are relied on to manage aging for system and structural components and that are not evaluated as part of the other aging management programs addressed in this appendix. The preventive maintenance and surveillance testing activities are implemented through periodic work orders that provide for assurance of functionality of the components by confirmation of integrity of applicable parameters.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Program:

The FCS Periodic Surveillance and Preventive Maintenance Program provides for periodic inspection and testing of components in the following systems and structures.

- Auxiliary Building
- Auxiliary Building HVAC
- Auxiliary Feedwater
- Chemical and Volume Control
- Component Cooling
- Containment
- Containment HVAC
- Control Room HVAC and Toxic Gas Monitoring
- Diesel Generator Lube Oil
- Duct Banks
- Emergency Diesel Generators
- Fire Protection
- Fuel Handling Equipment/Heavy Load Cranes
- Intake Structure
- Liquid Waste Disposal
- Containment Penetration, and System Interface Components for Non-CQE Systems
- Reactor Coolant
- Safety Injection and Containment Spray
- Ventilating Air

(2) Preventive Actions:

The Periodic Surveillance and Preventive Maintenance Program includes periodic refurbishment or replacement of components, which could be considered to be preventive or mitigative actions. The inspections and testing to identify component aging degradation effects do not constitute preventive actions in the context of this element.

(3) Parameters Monitored or Inspected:

Inspection and testing activities monitor parameters including surface condition, loss of material, presence of corrosion products, signs of cracking and presence of water in oil samples.

(4) Detection of Aging Effects:

Preventive maintenance and surveillance testing activities provide for periodic component inspections and testing to detect the following aging effects and mechanisms:

- Change in Material Properties
- Cracking
- Fouling
- Loss of Material
- Loss of Material - Crevice Corrosion
- Loss of Material - Fretting
- Loss of Material - General Corrosion
- Loss of Material - Pitting Corrosion
- Loss of Material - Pitting/ Crevice/Gen. Corrosion
- Loss of Material - Wear
- Separation

The extent and schedule of the inspections and testing assures detection of component degradation prior to the loss of their intended functions. Established techniques such as visual inspections and dye penetrant testing are used.

(5) Monitoring and Trending:

Preventive maintenance and surveillance testing activities provide for monitoring and trending of aging degradation. Inspection intervals are established such that they provide for timely detection of component degradation. Inspection intervals are dependent on the component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

The program includes provisions for monitoring and trending with the stated intent of identifying potential failures or degradation and making adjustments to ensure components remain capable of performing their functions. PM review and update guidelines are provided that include adjustment of PM task and frequency based on the as-found results of previous performance of the PM. In particular, responsible system engineers are required to periodically review the results of preventive maintenance and recommend changes based on these reviews. The program includes guidance to assist the system engineers in achieving efficient and effective trending.

(6) Acceptance Criteria:

Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in the specific inspection and testing procedures. They confirm component integrity by verifying the absence of the aging effect or by comparing applicable parameters to limits based on the applicable intended function(s) as established by the plant design basis.

(7) Corrective Actions:

Identified deviations are evaluated within the FCS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation. The FCS corrective action process is in accordance with 10 CFR 50 Appendix B.

(8) Confirmation Process:

The FCS corrective action process is in accordance with 10 CFR 50 Appendix B and includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls:

All credited aging management activities are subject to the FCS administrative controls process, which is in accordance with 10 CFR 50 Appendix B and requires formal reviews and approvals.

(10) Operating Experience:

Periodic surveillance and preventive maintenance activities have been in place at FCS since the plant began operation. These activities have a demonstrated history of detecting damaged and degraded components and causing their repair or replacement in accordance with the site corrective action process. With few exceptions, age-related degradation adverse to component intended functions was discovered and corrective actions were taken prior to loss of intended function.

Conclusion:

The Periodic Surveillance and Preventive Maintenance Program assures that various aging effects are managed for a wide range of components at FCS. Based on the program structure and administrative processes and FCS operating experience, there is reasonable assurance that the credited inspection and testing activities of the Periodic Surveillance and Preventive Maintenance Program will continue to adequately manage the identified aging effects of the applicable components so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

B.2.8 REACTOR VESSEL INTERNALS INSPECTION PROGRAM

The FCS Reactor Vessel Internals Inspection Program is consistent with XI.M13, "*Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)*," and XI.M16, "*PWR Vessel Internals*," as identified in NUREG-1801 with the exception of the enhancements specified in the following table and with the following exceptions:

- XI.M16-4. Detection of Aging Effects

  No augmented inspection of bolting is scheduled. The tensile stresses on the FCS reactor vessel internals bolting are lower than the industry levels where cracking was observed as an aging effect. Refer to discussion in Operating Experience below.

- XI.M16-Program Description, 1. Scope of Program and 2. Preventative Actions

  The Chemistry-related portions of the program are addressed in the FCS Chemistry Program.

The following enhancements will be made to the Reactor Vessel Internals Inspection Program prior to the period of extended operation. The scope of the FCS Reactor Vessel Internals Inspection Program includes those plant specific components identified in Tables 3.1.2 and 3.1.3 of this application for which the Reactor Vessel Internals Inspection Program is identified as an aging management program.

NUREG-1801 Program	Criteria	Enhancement
XI.M13, *Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)*	4. Detection of Aging Effects	A fluence and stress analysis will be performed to identify critical locations. A fracture mechanics analysis for critical locations will be performed to determine flaw acceptance criteria and resolution required to detect flaws. Appropriate inspection techniques will be implemented based on analyses.
XI.M16, *PWR Vessel Internals*	7. Parameters Monitored 8. Detection of Aging Effects	A fluence and stress analysis will be performed to identify critical locations. A fracture mechanics analysis for critical locations will be performed to determine flaw acceptance criteria and resolution required to detect flaws. Appropriate inspection techniques will be implemented based on analyses.

Operating Experience:

No cracking has been discovered in US pressurized water reactor (PWR) reactor vessel (RV) internals fabricated with austenitic stainless steel except for various bolting applications for Babcock & Wilcox and Westinghouse-designed NSSSs and thermal shield components at St. Lucie Unit 1 and Millstone Unit 2, which are CE designed Nuclear Steam Supply System (NSSS). The cracking at St. Lucie and Millstone was caused by flow-induced high cycle fatigue; the thermal shields at these plants were removed. Cracking of core barrel, baffle, and former bolts at Electricite de France (EdF), Westinghouse and Babcock & Wilcox-designed RV internals has been discovered. The cause of cracking of core barrel bolts at Babcock & Wilcox designed plants was stress corrosion cracking (SCC) and the cracking of baffle bolts at Westinghouse and EdF plants is believed to be irradiation assisted stress corrosion cracking (IASCC).

Reactor vessel internals inspections are performed under the FCS Inservice Inspection Program. No cracking caused by high cycle fatigue was discovered in the FCS thermal shield and therefore the FCS thermal shield was not removed, as is the case for St. Lucie Unit 1 and Millstone Unit 2. In 1984 a commitment was made to the NRC to perform an inspection of the thermal shield during the 1987 refueling outage. However, in 1986 an inspection deferral program was implemented that allowed a thermal shield monitoring program to replace the inspection commitment. This monitoring program generated data from 1988 through 1990 that indicated the early stages of loosening of the thermal sleeve positioning pins. During the 1992 refueling outage, visual inspection of the support lugs and the positioning pins was performed. No noticeable cracks, weld cracks, missing parts, misalignment, gaps, looseness, or wear were found. Eleven pins (7 lower pins and 4 upper pins) were removed and replaced to reinstate the specified amount of initial relative displacement between the thermal shield and the core support barrel. The amount of initial relative displacement was based on maintaining specified preload over twenty years in the pins while accounting for radiation-induced relaxation and wear. This action reduced vibrations to below specified levels. No unacceptable vibration has been detected since 1992 and FCS continues to monitor thermal shield vibrations using the Internals Vibration Monitoring program. Any unacceptable vibration will be corrected when appropriate.

To date, no cracking has been discovered in bolting for Combustion Engineering (CE)-designed RV internals bolting. The Combustion Engineering Owners Group (CEOG) provided an assessment of the cracking of the baffle former bolts reported in foreign PWRs, including the potential impact of the cracking on domestic CE plants. The results are in CEOG Report CE NPSD-1098 for CEOG Task 1011, "*Evaluation of the Applicability of Baffle Bolt Cracking to Ft. Calhoun and Palisades Internals Bolts*," Final Report, Revision 00, April 1998. The most likely mechanism for the cracking of cold-worked 316 stainless steel baffle former bolts in foreign plants is IASCC. There are only two CE-designed plants (FCS and Palisades) that use bolts to attach the core shroud panels (i.e., the baffle plates) to the former plates. The report indicates that these bolts in FCS are less susceptible to IASCC because: (1) the material used in these bolts is annealed 316 stainless steel, which is not cold worked; (2) the bolt stress from preload, as a percentage of yield strength, is much less than the EdF plants; (3) the differential pressure across the core shroud panels does not result in tensile loads on the panel (i.e., the baffle bolts) during normal operation; and (4) the core shroud panel design allows for some flexing of the former plate relative to the core barrel, thus reducing the load on the panel bolts. Since CE NPSD-1098 was issued, cracking has been discovered in Point Beach baffle bolts. However, as with the EdF experience, cracked bolts were highly stressed during preload, tensile stresses were applied during operation because of the Westinghouse design, and the bolts were fabricated with cold worked 316 stainless steel. Therefore, the findings of CE NPSD-1098 still apply.

Stress corrosion cracking was identified in B&W lower thermal shield and lower core barrel bolts that were fabricated with A-286. Most of the failed bolts were highly stressed to at or over the yield strength. Cracked bolts were replaced with bolts of improved design fabricated with Inconel X-750. No cracking of these bolts has recurred. Although there have been no failures of CEA Shroud Bolts in CE-designed RV internals, there is a concern that SCC may occur since these bolts are fabricated with Alloy A-286. CE provided an evaluation of the stress level for these bolts in 1984. According to CEN-282, "*Investigation and Evaluation of A286 Bolt Applications in C-E's NSSS*," September 1984, operating stress levels are just below 32 Ksi. The stress concentration factor for the CEA Shroud Bolts is 2.06, leading to a local stress of approximately 66 Ksi. Yield strength for A-286 is about 115 Ksi, so the stress is approximately 60 percent of yield. Most of the failed B&W bolts had working stresses of approximately 65 Ksi and a local stress of 134 Ksi which is above the yield strength of the material. There were no failed B&W bolts with working stresses of 35 Ksi. The conclusion of the report indicates a low probability for cracking of the CEA Shroud Bolts.

Conclusion:

The Reactor Vessel Internals Inspection Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

B.2.9 STEAM GENERATOR PROGRAM

The FCS Steam Generator Program is consistent with XI.M19, "*Steam Generator Tube Integrity,*" as identified in NUREG-1801 with the exception of the enhancements specified in the following table and with the following clarifications:

- In addition to the requirements of XI.M19, the FCS Steam Generator Program also includes aging management activities to address plant specific AMP requirements identified in Table 3.1.1.
- The scope of the FCS Steam Generator Program includes those plant specific components identified in Tables 3.1.2 of this application for which the Steam Generator Program is identified as an aging management program.

The following enhancements will be made to the Steam Generator Program prior to the period of extended operation.

NUREG-1801 Program	Criteria	Enhancement
XI.M19, Steam Generator Tube Integrity	2. Preventive Actions 6. Acceptance Criteria	An Annunciator Response Procedure will be written for the Loose Parts Monitor in the Steam Generator.

Operating Experience:

Steam generator management of aging effects has evolved and improved over the years based on industry experience. FCS has adopted industry practices throughout the years, and continues to do so. Past NRC inspections on this program cited sample plans and inspection evaluation as a strength. Only one noteworthy situation has occurred. In 1984, a misplug and misdiagnosed tube problem led to a tube rupture. This situation was corrected and long-term corrective actions were implemented to prevent recurrence. Current FCS practices are state-of-the-art. The overall experience illustrates that the Steam Generator Program is effective in managing aging.

Conclusion:

The FCS Steam Generator Program provides reasonable assurance that the aging effects will be managed such that components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.10 STRUCTURES MONITORING PROGRAM

The Structures Monitoring Program is consistent with XI.S5, *Masonry Wall Program*, XI.S6, "*Structures Monitoring Program*," and XI.S7, RG 1.127, "*Inspection of Water-Control Structures Associated with Nuclear Power Plants*," as identified in NUREG-1801 with the exception of the enhancements specified in the following table and with the following clarifications:

- FCS does not have lubrite supports as identified in NUREG-1801, Chapter III, item A4.2-b. FCS does have lubrite on some steam generator supports which are inspected under the FCS Inservice Inspection Program rather than the Structures Monitoring Program.

- XI.S7. Program Description

  FCS is not committed to RG 1.127. Applicable attributes from RG 1.127 have been incorporated into the Structures Monitoring Program as specified in the program description.

The following enhancements will be made to the Structures Monitoring Program prior to the period of extended operation. The scope of the FCS Structures Monitoring Program includes those plant specific components identified in Tables 3.3.2, 3.5.2, and 3.5.3 of this application for which the Structures Monitoring Program is identified as an aging management program.

<u>NUREG-1801 Program</u>	<u>10 elements</u>	<u>Enhancement</u>
XI.S5, Masonry Wall Program	3. Parameters Monitored or Inspected	Specific guidance will be added to inspect masonry walls for cracking and condition of steel bracing.
	6. Acceptance Criteria	Specific acceptance criteria will be added to inspection procedures to be commensurate with industry codes, standards, and guidelines.

XI.S6, Structures Monitoring Program	3. Parameters Monitored or Inspected	Specific guidance will be added for inspection of component supports, new fuel storage rack, and the plant specific components identified in the Section 3 tables. Aging management activities related to these components will be commensurate with industry standards and practices as identified in the NUREG-1801 Structures Monitoring Program criteria.
	4. Detection of Aging Effects	Additional guidance commensurate with industry codes, standards, and guidelines, will be added to inspection procedures.
	6. Acceptance Criteria	Specific acceptance criteria will be added to the inspection procedures to be commensurate with industry codes, standards, and guidelines.
XI.S7, Regulatory Guide 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants	3. Parameters Monitored or Inspected	Additional guidance will be added to the inspection procedure to identify specific parameters to inspect.
	5. Monitoring and Trending	Additional guidance will be added to review maintenance activities since last inspection.
	6. Acceptance Criteria	Specific acceptance criteria will be added to the inspection procedures to be commensurate with industry codes, standards, and guidelines.

In addition the following FCS specific tasks will be added to the Structures Monitoring Program prior to the period of extended operation.

- Performance of periodic sampling and evaluation of ground water.
- Guidance to inspect structural components when exposed by excavation.

Operating Experience:

Inspections have been performed in the Auxiliary Building, Containment, Intake Structure, and Turbine Building in 1996/1997 and 1999/2000. No significant deterioration was identified. Some examples of corrosion of support anchors have been observed and documented under the FCS corrective action program.

Conclusion:

The Structures Monitoring Program provides reasonable assurance that the identified aging effects will be managed such that the structures and components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3 NEW AGING MANAGEMENT ACTIVITIES

B.3.1 ALLOY 600 PROGRAM

The FCS Alloy 600 Program will be consistent with the requirements of XI.M11, *"Nickel-Alloy Nozzles and Penetrations,"* as identified in NUREG-1801 prior to the period of extended operation with the following exceptions:

- XI.M11-4. Detection of Aging Effects

  The FCS Alloy 600 Program will not rely on an enhanced leakage detection system for detection of leaks caused by primary water stress corrosion cracking (PWSCC) as suggested by XI.M11 in NUREG-1801. Bounding evaluations exist that demonstrate that PWSCC cracks can be detected via boric acid leakage prior to the structural integrity of the pressure boundary being compromised and prior to unacceptable material loss of carbon steel vessels due to boric acid corrosion.

- XI.M11-Program Description, 1. Scope of Program, and 2. Preventative Action.

  The Chemistry-related portions of the program are addressed in the FCS Chemistry Program.

The program includes participation in industry programs to determine an appropriate aging management program for SCC of Alloy 600 and PWSCC of Inconel 182 welds.

The scope of the FCS Alloy 600 program includes those plant specific components identified in Table 3.1.2 of this application for which the Alloy 600 Program is identified as an aging management program.

Operating Experience:

OPPD has proactively responded to industry experience with PWSCC of Alloy 600. In response to NRC Information Notice 90-10, *"Primary Water Stress Corrosion Cracking (PWSCC) of Inconel 600,"* OPPD initiated an investigation of the applications of Alloy 600, Alloy 82 and Alloy 182 in the FCS reactor coolant system. OPPD participated in the industry integrated inspection program used to respond to Generic Letter 97-01, *"Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations,"* and is currently following industry developments related to circumferential cracking in control rod drive mechanisms (CRDMS) as described in NRC Bulletin 2001-01. Experience with weld PWSCC at V.C. Summer and a pressurizer instrument nozzle leak at FCS (both in October, 2000) prompted OPPD to review fabrication records of Alloy 82 and Alloy 182 welds and Alloy 600 components for evidence of fabrication rework, since this was identified as a causal factor in both incidents. In response to the V.C. Summer incident, FCS engineering staff briefed plant operators and inspection personnel to sensitize them to the potential for Alloy 82/182 butt weld cracks.

Conclusion:

The Alloy 600 Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.2 BURIED SURFACES EXTERNAL CORROSION PROGRAM

The Buried Surfaces External Corrosion Program will be consistent with XI.M34, "*Buried Piping and Tanks Inspection*," as identified in NUREG-1801 prior to the period of extended operation.

Operating Experience:

Tank wall thickness measurements, conducted as part of the Diesel Fuel Oil Monitoring and Storage Program for the emergency diesel generator and auxiliary boiler fuel oil storage tanks, have determined that there is no indication of external corrosion for either vessel.

As opportunities have arisen, visual inspections have been performed on excavated piping. A recent excavation for the repair of buried valves in the Fire Protection System also exposed sections of Raw Water System piping. The applied coatings and wrappings of the excavated Fire Protection and Raw Water System piping and components were found to be in good condition with no indication of loss of material from the metal beneath.

Conclusion:

The Buried Surfaces External Corrosion Program provides reasonable assurance that the identified aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.3 GENERAL CORROSION OF EXTERNAL SURFACES PROGRAM

The General Corrosion of External Surfaces Program at FCS is credited for aging management of the effects of loss of material and cracking for applicable components, including piping, valves, supports, tanks, and bolting, which are made of cadmium plated steel, carbon steel, cast iron, copper alloy, galvanized steel, low alloy steel, and neoprene.

(1) Scope of Program

The General Corrosion of External Surfaces Program consists of several FCS activities that manage the aging effects of loss of material and cracking for components in the following systems:

- Auxiliary Boiler Fuel Oil
- Auxiliary Building HVAC
- Auxiliary Feedwater (AFW)
- Chemical and Volume Control
- Component Cooling Water (CCW)
- Containment HVAC
- Control Room HVAC
- Diesel Generator Lube Oil
- Diesel Jacket Water
- Starting Air
- Feedwater
- Fire Protection Fuel Oil
- Gaseous Waste Disposal
- Instrument Air
- Main Steam (MS) and Turbine Steam Extraction
- Containment Penetration, and System Interface Components for Non-CQE Systems
- Nitrogen Gas
- Primary Sampling
- Raw Water
- Ventilating Air

(2) Preventive Actions

This program does not prevent aging.

(3) Parameters Monitored or Inspected

Surface conditions of components are monitored through visual observation and inspection to detect signs of external corrosion and to detect conditions that can result in external corrosion, such as fluid leakage.

(4) Detection of Aging Effects

The aging effects of concern are loss of material and cracking. These effects can be detected by visual observation and inspection of external surfaces. Inspection for evidence of leaking fluids also provides indirect monitoring of certain components that are not routinely accessible.

(5) Monitoring and Trending

Various plant personnel including operators and system engineers perform periodic material condition inspections and observations outside containment. These inspections are performed in accordance with approved plant procedures. Evidence of fluid leaks, significant coating damage, or significant corrosion is documented.

Inspections and observations are performed at intervals based on previous inspections and industry experience. Operator rounds occur several times daily and system engineer walkdowns occur at least quarterly. Inspections inside containment are conducted each refueling outage by a team that includes knowledgeable subject matter experts from Engineering and Quality Control. The in-containment inspections for corrosion are part of the containment coatings inspections described in the OPPD response to NRC Generic Letter 98-04, "*Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment.*"

(6) Acceptance Criteria

Plant procedures provide criteria for determining the acceptability of as-found conditions and for initiating the appropriate corrective action. The acceptance criteria and guidance are related to avoiding unacceptable degradation of the component intended functions, and include existence of leakage, presence of corrosion products, coating defects, and elastomer cracking. Appropriate provisions of NRC and industry guidance are incorporated.

(7) Corrective Action

The FCS corrective action process provides measures to verify completion and effectiveness of corrective action.

(8) Confirmation Process

The FCS corrective action process is in accordance with 10 CFR 50 Appendix B and includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls

The procedures governing inspections and observations for external corrosion are subject to the site administrative controls process which implements the requirements of 10 CFR 50, Appendix B.

(10) Operating Experience

The activities relied on to detect loss of material, cracking, and fouling of accessible cadmium plated steel, carbon steel, cast iron, copper alloy, galvanized steel, low alloy steel, and neoprene component external surfaces and the precursors thereof are a subset of a larger number of inspection activities that result in redundant inspections. The activities credited for license renewal were selected based on their effectiveness as indicated by a review of site corrective action documents.

The activities are elements of established FCS programs that have been ongoing for years. They have been enhanced over the years based on site and industry experience. Review of plant records indicates they are effective in detecting loss of material due to corrosion and its precursors for accessible external surfaces. These findings are consistent with the findings of recent internal and external assessments of these activities, such as audits and NRC inspections.

Conclusion:

The General Corrosion of External Surfaces Program provides reasonable assurance that aging effects will be managed such that components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.4 NON-EQ CABLE AGING MANAGEMENT PROGRAM

The FCS Non-EQ Cable Aging Management Program establishes a service life value for the Non-EQ cable in a similar fashion as the FCS EQ Program establishes a Qualified Life for the safety related equipment, components, and cable. Non-EQ cable was purchased to the same requirements and specifications as that included in the EQ Program for the cable installed and qualified under the FCS 10 CFR 50.49 Environmental Qualification Program. Additional temperature and environmental data utilized to extend the qualified life of the EQ Program equipment and cables will be utilized to analyze and establish a service life for the Non-EQ cables. These analyses are relied upon to predict the life expectancy of the Non-EQ cable under the normal and abnormal plant operating conditions. Cables not capable of having a 60-year service life will be further analyzed using state of the art analytical techniques to determine if the service life can be further extended. Industry accepted and regulatory approved cable inspection techniques that provide aging related data, as well as state of the art in-situ, non-destructive testing of cable performance, and/or laboratory testing of cable to extend life, may also be considered should the aforementioned methodologies not succeed in extending the required service life.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Program

The FCS Non-EQ Cable Aging Management Program is credited for managing the aging of all Non-EQ cables and connectors in the FCS plant electrical system subject to aging management review.

(2) Preventive Actions

The program does not prevent aging from occurring.

(3) Parameters Monitored or Inspected

The FCS Non-EQ Cable Program does not credit the inspections delineated within NUREG-1801 Section XI.E1, since specific analyses are provided for the Non-EQ cable which demonstrate that the cable will perform as intended. Additionally, this analysis takes credit for the manner in which the cable was procured, i. e., same as that in the EQ Program, and the methodology used to establish the 60 year service life.

(4) Detection of Aging Effects

The EQ program, as well as the program established for the Non-EQ cable, does not detect aging effects, but rather establishes a rate of aging based on analysis of materials (i.e., the insulation system). The material analysis includes consideration of material mechanical and electrical properties and their performance in ambient environments under operational conditions as well as self-heating effects. Additional environmental conditions such as humidity and radiation are also considered in the establishment of the service life. These analyses are relied upon to predict the life expectancy of the Non-EQ cable under the normal and abnormal plant operating conditions.

(5) Monitoring and Trending

The FCS Non-EQ Cable Aging Management Program establishes a service life value for the Non-EQ cable in a similar fashion as the FCS EQ Program establishes a Qualified Life for the safety related equipment, components, and cable. Non-EQ cable was purchased to the same requirements and specifications as that included in the EQ Program for the cable installed and qualified under the FCS 10 CFR 50.49 Environmental Qualification Program. Additional temperature and environmental data utilized to extend the qualified life of the EQ Program equipment and cables will be utilized to analyze and establish a service life for the Non-EQ cables.

(6) Acceptance Criteria

Acceptance criteria are based on the cable insulation service life (i.e., the predicted life expectancy). The service life evaluation of the cable insulation material includes consideration of material mechanical and electrical properties and their performance in ambient environments under operational conditions as well as self-heating effects. Additional environmental conditions such as humidity and radiation are also considered in the establishment of the service life. These analyses are relied upon to predict the life expectancy of the Non-EQ cable under the normal and abnormal plant operating conditions.

(7) Corrective Actions:

Cables for which a 60-year service life has not been or can not be demonstrated by state of the art analysis, inspection, or test, will be replaced prior to expiration of the established service life. This action is in accordance with the FCS 10 CFR 50 Appendix B corrective action process.

(8) Confirmation Process:

N/A. Cable replacement in accordance with the current licensing basis negates the need to confirm that the corrective action was effective in assuring the cable intended function(s). As noted above, the FCS corrective action process is in accordance with 10 CFR 50 Appendix B.

(9) Administrative Controls:

Non-EQ Cable Aging Management Program activities will be subject to the FCS administrative controls process, which is in accordance with 10 CFR 50 Appendix B and requires formal reviews and approvals.

(10) Operating Experience

This program is based on the EQ program, which has been shown through operating experience to be effective in managing cable aging. There is extensive industry and FCS experience in establishing and monitoring the service life of cables and other EQ equipment. The program will be improved, as appropriate, as additional industry experience becomes available.

Conclusion:

The FCS Non-EQ Cable Aging Management Program provides reasonable assurance that aging effects will be managed such that non-EQ cables subject to aging management review will continue to perform their intended functions consistent with the current licensing basis through the period on extended operation.

B.3.5 ONE-TIME INSPECTION PROGRAM

The FCS One-Time Inspection Program will be consistent with XI.M.32, "*One-Time Inspections*," as identified in NUREG-1801 prior to the period of extended operation. The scope of the FCS One-Time Inspection Program includes those plant specific components identified in Tables 3.3.2 and 3.4.2 of this application for which the One-Time Inspection Program is identified as an aging management program.

Operating Experience:

This is a new FCS program implemented to meet license renewal requirements specified in NUREG-1801. Results obtained from the required program inspections will be reviewed and documented in accordance with plant procedures. Corrective actions will be taken if necessary in accordance with the plant corrective action program.

Conclusion:

The One-Time Inspection Program will provide reasonable assurance that applicable aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation

B.3.6 SELECTIVE LEACHING PROGRAM

The FCS Selective Leaching Program will be consistent with XI.M.33, "*Selective Leaching of Materials*," as identified in NUREG-1801 prior to the period of extended operation, with the following clarification:

- XI.M33-Program Description, 3. Parameters Monitored/Inspected, and 4. Detection of Aging Effects

  OPPD does not perform hardness measurement, because brasses, bronzes, and other copper-alloys do not have hardness acceptance criteria. For cast irons, graphitization is easily visually identified and the ASTM and ASME standards do not prescribe hardness acceptance criteria.

The scope of the FCS Selective Leaching Program includes those plant specific components identified in Tables 3.2.2, 3.3.2, 3.3.3, 3.4.2, 3.5.2, and 3.5.3 of this application for which the Selective Leaching Program is identified as an aging management program.

Operating Experience:

FCS operating experience has revealed no problems related to selective leaching.

Conclusion:

The Selective Leaching Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.7 THERMAL AGING EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL

The FCS Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program will be consistent with XI.M12, "*Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)*," as identified in NUREG-1801 prior to the period of extended operation.

Operating Experience:

No age related degradiation associated with thermal embrittlement of CASS was identified in the FCS operating experience.

Conclusion:

The FCS Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Program provides reasonable assurance that the aging effects will be managed such that components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.