APPLICATION FOR RENEWED OPERATING LICENSES

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

Volume I

Contents

EXHIBIT A

LICENSE RENEWAL - TECHNICAL INFORMATION

OLRP-1001

License Renewal - Technical Information, OLRP-1001
Record of Revisions

Revision	Summary of Revision
0	July 1996 Initial Issuance
1	February 1997 Added Section 1.4 which discusses the process for identification of Oconee time-limited aging analyses. Revised Section 2.3 to include additional information and figures. Revised Section 3.3 to include additional information and two time-limited aging analyses for the Oconee Containment. Additional background information was provided in Chapter 1. Place holders were provided for other sections of the report.
2	July 1998 Revised title of OLRP-1001 **Chapter 1 -** Added a section to describe Oconee, Keowee, and the Standby Shutdown Facility. Also added sections to discuss the administrative control process following submittal and to address GSIs. **Chapter 2 -** Marked-up drawings showing the mechanical evaluation boundaries are incorporated by reference to OLRP-1002. The listing of mechanical systems mirrors the order in which they are described in the current Oconee UFSAR. This grouping of mechanical systems is more by function than by any other criteria. This chapter provides the information required §§54.21(a)(1) and (a)(2). Revised Section 2.3 to supplement Duke responses to RAIs 2.3-4, 3.3-3, and 3.3-9 as discussed during a meeting with NRC on April 29, 1998. **Chapter 3 -** Previously, Chapter 3 had both Aging Effects and Program Demonstrations. This new Chapter 3 discusses only Aging Effects, while new Chapter 4 provides the Program information. Revised Section 3.3 to supplement Duke responses to RAI s 2.3-3, 3.3-1, 3.3-2, 3.3-3, 3.3-5, and 3.3-10 as discussed during a meeting with NRC on April 29, 1998. **Chapter 4 -** Provides the list of Oconee Programs that are being credited for License Renewal. The demonstration of the effectiveness of these credited programs is provided for each structure and component. The end result of this chapter is the §54.21(a)(3) demonstration and provides the basis for the NRC to make the finding required by §54.29(a)(1).

License Renewal - Technical Information, OLRP-1001
Record of Revisions
(continued)

Revision	Summary of Revision
2	**Chapter 5 -** This chapter covers TLAA and exemptions. Material from previously developed and submitted Section 1.4 plus the TLAA reviews for each of the areas of reviews will be provided in here. This chapter provides the information required by §54.21(c) and provides the basis for the NRC to make the finding required by §54.29(a)(1). Revised Section 5.3 to supplement Duke responses to RAI 3.3-6 as discussed during a meeting with NRC on April 29, 1998

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1. INTRODUCTION

1.1 PURPOSE

As the current operating license holder for Oconee Nuclear Station (Oconee), Duke Energy Corporation (Duke) has prepared this report to provide the technical information required by 10 CFR Part 54 for license renewal applications. This document, "Oconee Nuclear Station, License Renewal-Technical Information, OLRP-1001" (OLRP-1001) complies with the requirements of subsections (a) and (c) in §54.21. Refer to Sections 1.3.1 and 1.3.2 for the text of §§54.21(a) and (c).

OLRP-1001 is Exhibit A of the Application for Renewed Operating Licenses for Oconee Nuclear Station, Units 1, 2, and 3. The complete Application is intended to provide sufficient information for the NRC to complete its technical and environmental reviews and is designed to allow the NRC to make the finding required by §54.29 in support of the issuance of renewed operating licenses for Oconee. [Footnote 1]

§54.29 Standards for issuance of a renewed license

A renewed license may be issued by the Commission up to the full term authorized by §54.31 if the Commission finds that:

(a) Actions have been identified and have been or will be taken with respect to the matters identified in Paragraphs (a)(1) and (a)(2) of this section, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the plant's CLB in order to comply with this paragraph are in accord with the Act and the Commission's regulations. These matters are:

(1) managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under §54.21(a)(1); and

(2) time-limited aging analyses that have been identified to require review under §54.21(c).

(b) Any applicable requirements of Subpart A of 10 CFR Part 51 have been satisfied.

(c) Any matters raised under §2.758 have been addressed.

1. Exhibits B and C to the Application contain the UFSAR Supplement for License Renewal and Technical Specification changes, respectively. Exhibit D to the Application contains the Environmental Report.

Section 1.2 of OLRP-1001 provides brief descriptions of Oconee Nuclear Station, Keowee Hydroelectric Station, and the Standby Shutdown Facility. Section 1.3 provides a brief description of the technical information required in an application for nuclear power plant operating license renewal and an index to the *Oconee Integrated Plant Assessment* results. A description of the process used to update the technical information provided to the NRC in connection with license renewal is described in Section 1.4. Section 1.5 addresses Generic Safety Issues.

1.2 Description of Oconee Nuclear Station

Descriptions of Oconee Nuclear Station and two of its major facilities, Keowee Hydroelectric Station and Standby Shutdown Facility, are provided as background information to aid the reviewers of OLRP-1001. The description of Oconee is provided in Section 1.2.1. The emergency power source for Oconee is provided by Keowee Hydroelectric Station, which is described in Section 1.2.2. The Standby Shutdown Facility, which was installed after the initial plant licensing, is located adjacent to Oconee Unit 2 and is described in Section 1.2.3.

The information provided in this section is general in nature. Additional information on Oconee, Keowee, and Standby Shutdown Facility structures and components is provided in Chapters 2, 3, 4, and 5 of OLRP-1001.

1.2.1 Oconee Nuclear Station

Oconee Nuclear Station is located in Oconee County in northwestern South Carolina and is situated on the shore of Lake Keowee. Lake Keowee was formed by impounding the water of the Little River and the Keowee River. The three-unit nuclear station was constructed from 1967 to 1974. Units 1 and 2 began commercial operation in 1973; Unit 3 began commercial operation in 1974. Each unit consists of a Babcock & Wilcox (B&W) pressurized water reactor nuclear steam supply system designed to generate 2568 MW thermal, or approximately 860 MW electric.

The facility operating license for Oconee Unit 1 (DPR-38) currently expires at midnight February 6, 2013; the Oconee Unit 2 operating license (DPR-47) currently expires at midnight October 6, 2013; and the Oconee Unit 3 operating license (DPR-55) currently expires at midnight July 19, 2014.

Oconee Nuclear Station consists of three individual Reactor Buildings. A common Turbine Building serving all three units, a Unit 1 & 2 Auxiliary Building, and a Unit 3 Auxiliary Building. The reactor and nuclear steam supply system for each unit are contained within its respective Reactor Building.

In 1990, Duke received a Part 72 license from the NRC that permitted the construction and operation of an Independent Spent Fuel Storage Installation (ISFSI) at Oconee. Materials License No. SNM-2503 was issued to Duke on January 29, 1990 with an expiration date of January 31, 2010. Because Oconee's ISFSI is a separately licensed facility, it is not within the scope of review as defined by 10 CFR Part 54.

1.2.2 Keowee Hydroelectric Station

The onsite emergency power source for Oconee is the Keowee Hydroelectric Station, which is located at the Keowee Dam on Lake Keowee. Keowee was licensed (Project No. 2503) by the Federal Power Commission (now the Federal Energy Regulatory Commission) on September 26, 1966, with a license term of fifty years.

The station consists of two hydroelectric units that generate electricity at 13.8 kV and are rated at 87.5 MVA each. Electricity is supplied from both Keowee units to Oconee through two separate and independent power paths. One route is through buried cables to transformer CT4; the other route is through a 230 kV overhead transmission line, through the 230 kV switchyard at Oconee, to transformers CT1, CT2 and CT3.

The Keowee hydroelectric units are located in a building that contains all of the necessary systems and components for the units to operate. Remote startup controls and monitoring instrumentation are located in the Oconee control rooms. Except for the common penstock, each Keowee unit is independent of the other unit including separate electrical and mechanical support systems. The integrated plant assessments of the Keowee mechanical, electrical, and civil/structural components are provided in Chapters 2.5.13, 2.6, and 2.7.6 of OLRP-1001, respectively.

1.2.3 Standby Shutdown Facility

The Standby Shutdown Facility is designed as a standby system for use under certain emergency conditions. It provides additional "defense-in-depth" protection by serving as a backup to existing safety systems. The Standby Shutdown Facility is designed to provide an alternate means to achieve and maintain hot shutdown conditions following a 10 CFR Part 50, Appendix R fire; sabotage; turbine building flood; station blackout; and tornado missile events. Because the Standby Shutdown Facility is a backup to existing safety systems, the single failure criterion is not required. Failures in the Standby Shutdown Facility systems will not cause failures or inadvertent operations in other plant systems. The Standby Shutdown Facility requires manual activation and can be activated if the relevant emergency systems are not available.

The Standby Shutdown Facility is designed to achieve and maintain the reactor in a safe shutdown condition for a period of 72 hours in accordance with criteria of its design basis events. Safe shutdown is accomplished by:

- Re-establishing and maintaining cooling of the reactor coolant pump seals to ensure natural circulation and core cooling by maintaining the primary coolant system filled to a sufficient level in the pressurizer while also maintaining sufficient secondary-side cooling water and

- Maintaining the reactor sub-critical by isolating all sources of makeup water to the Reactor Coolant System except from the Reactor Coolant Makeup System, which supplies water with a sufficient boron concentration.

The Standby Shutdown Facility is primarily comprised of the structure and the Auxiliary Service Water System; the Reactor Coolant Makeup System; the Heating, Ventilating, and Air Conditioning System; and the AC and DC Power Systems, including the diesel generator. These systems are described further in Section 2.5.14 of OLRP-1001 along with several other systems. The structure is described in Section 2.7.8.

1.3 Technical Information Required for an Application

Current NRC regulations (§54.21) require three technical items to support an application for a renewed operating license. The first two items are (1) an integrated plant assessment and (2) an evaluation of time-limited aging analyses and exemptions in effect based on the time-limited aging analyses. These two items are discussed below in Sections 1.3.1 and 1.3.2. The third technical item is a supplement to the Oconee Updated Final Safety Analysis Report (UFSAR) that contains a summary of the programs credited as managing the effects of aging and the evaluation of the time-limited aging analyses. This UFSAR supplement is included in Exhibit B of the Application.

Additionally, §54.21(b) requires that after submittal of an application, amendments thereto must be periodically submitted to the NRC identifying any change to the current licensing basis that materially affects the contents of the application. The Duke process for providing updated technical information to the NRC in connection with license renewal is described in Section 1.4.

1.3.1 Integrated Plant Assessment

The first item of technical information required by §54.21 to be included in an application for a renewed operating license is an integrated plant assessment (IPA). An integrated plant assessment, as defined in §54.3, is a licensee assessment that demonstrates that a nuclear power plant facility's structures and components requiring aging management review in accordance with §54.21(a) for license renewal have been identified and that the effects of aging on the functionality of such structures and components will be managed to maintain the CLB such that there is an acceptable level of safety during the period of extended operation. Table 1.3-1 provides an index to the results of the Oconee Integrated Plant Assessment.

The *Oconee Integrated Plant Assessment* involves the following four major activities:

1. Identification of the structures and components within the scope of license renewal that are subject to aging management review;

2. Identification of the aging effects applicable to these structures and components;

3. Identification of plant-specific programs and activities that will manage these identified aging effects; and

4. A demonstration that these programs and activities will be effective in managing the effects of aging during the period of extended operation.

§54.3 Definitions

Integrated plant assessment (IPA) is a licensee assessment that demonstrates that a nuclear power plant facility's structures and components requiring aging management review in accordance with §54.21(a) for license renewal have been identified and that the effects of aging on the functionality of such structures and components will be managed to maintain the CLB such that there is an acceptable level of safety during the period of extended operation.

§54.21 Contents of application--technical information

Each application must contain the following information:
(a) An integrated plant assessment (IPA). The IPA must —

(1) For those systems, structures, and components within the scope of this part, as delineated in §54.4, identify and list those structures and components subject to an aging management review. Structures and components subject to an aging management review shall encompass those structures and components —

(i) That perform an intended function, as described in §54.4, without moving parts or without a change in configuration or properties. […] and
(ii) That are not subject to replacement based on a qualified life or specified time period.

(2) Describe and justify the methods used in paragraph (a)(1) of this section.

(3) For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The first major activity for the *Oconee Integrated Plant Assessment* is identification of the structures and components within the scope of license renewal that are subject to aging management review. This process is described and justified in OLRP-1001 Chapter 2, "Identification of Structures and Components that are Subject to Aging Management Review," as required by §54.21(a)(2). A description of the process that Duke used to identify the systems, structures, and components within the scope of license renewal is provided in Section 2.2.

Sections 2.3 through 2.7 identify and describe the structures and components within the scope of license renewal that are subject to aging management review at Oconee. Special attention was focused on the Reactor Building (Containment) and the Reactor Coolant System because they are important elements in the radioactive release defense-in-depth. They are described individually in Sections 2.3 and 2.4, respectively. The identification and description of the remaining systems, structures, and components within the scope of license renewal are provided in Sections 2.5, 2.6, and 2.7. These sections of OLRP-1001 are divided along engineering discipline lines traditional to Duke (i.e., mechanical, electrical, and civil/structural). Specifically, Sections 2.2 through 2.7 contain the technical information required by §§54.21(a)(1) and (a)(2).

The second major activity of the *Oconee Integrated Plant Assessment* is the identification of the aging effects applicable to the structures and components identified in Chapter 2 of OLRP-1001. The process used to perform this activity is described and the results provided in OLRP-1001 Chapter 3, "Identification of Applicable Aging Effects." The process used to identify the applicable aging effects is described in Section 3.2. Consistent with the presentation of information in Chapter 2, the aging effects applicable to the Reactor Building (Containment) and the Reactor Coolant System are presented in Sections 3.3 and 3.4, respectively. The aging effects applicable to mechanical, electrical, and civil/structural components are provided in Sections 3.5, 3.6, and 3.7, respectively.

The third major activity of the *Oconee Integrated Plant Assessment* is the identification of plant-specific programs and activities that will manage identified aging effects. These programs and activities are provided in OLRP-1001 Chapter 4, "Aging Management Programs and Activities."

The fourth major activity of the *Oconee Integrated Plant Assessment*, the demonstration of the effectiveness of programs and activities in managing the effects of aging for the period of extended operation, is also presented in Chapter 4. The program descriptions and demonstrations provided in Chapter 4 are deigned to satisfy the requirements in

§54.21(a)(3) and provide the basis for the NRC to make the finding required by §54.29(a)(1). (Refer to Section 1.1 for the citation to §54.29(a)(1).)

The *Oconee Integrated Plant Assessment* for license renewal, along with other information necessary to document compliance with Part 54, is and will continue to be maintained at Oconee in an auditable and retrievable form, in accordance with the requirements of §54.37(a).

§54.37 Additional records and record keeping requirements

> *(a) The licensee shall retain in an auditable and retrievable form for the term of the renewed operating license all information and documentation required by, or otherwise necessary to document compliance with, the provisions of this part.*

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Oconee Mechanical Systems			
Auxiliary Building Ventilation	2.5.8	3.5.8.1	None Required
Auxiliary Service Water System	2.5.6	3.5.6.2	Cast Iron Selective Leaching Inspection (4.3.2) Galvanic Susceptibility Inspection (4.3.3) Preventive Maintenance Activities (4.3.8) Service Water Piping Corrosion Program (4.25) System Performance Testing Activities (4.27)
Breathing Air System	2.5.4	3.5.4.1	None Required
Chemical Addition System	2.5.7	3.5.7.1	Treated Water Systems Stainless Steel Inspection (4.3.13) Chemistry Control Program (4.6)
Component Cooling System	2.5.4	3.5.4.2	Treated Water Systems Stainless Steel Inspection (4.3.13) Chemistry Control Program (4.6)
Condensate System	2.5.9	3.5.9.2	Cast Iron Selective Leaching Inspection (4.3.2) Galvanic Susceptibility Inspection (4.3.3) Preventive Maintenance Activities (4.3.8) Chemistry Control Program (4.6) Service Water Piping Corrosion Program (4.25)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Oconee Mechanical Systems (Continued)			
Condenser Circulating Water System	2.5.6	3.5.6.3	Galvanic Susceptibility Inspection (4.3.3) Preventive Maintenance Activities (4.3.8) Service Water Piping Corrosion Program (4.25)
Containment Hydrogen Control System	2.5.10	3.5.10.1	None Required
Control Room Pressurization and Filtration System	2.5.8	3.5.8.2	None Required
Coolant Storage System	2.5.7	3.5.7.2	Chemistry Control Program (4.6)
Core Flood System	2.5.5	3.5.5.1	Chemistry Control Program (4.6)
Demineralized Water System	2.5.4	3.5.4.3	Treated Water Systems Stainless Steel Inspection (4.3.13)
Emergency Feedwater System	2.5.9	3.5.9.3	Chemistry Control Program (4.6)
Feedwater System	2.5.9	3.5.9.4	Chemistry Control Program (4.6) Piping Erosion/Corrosion Program (4.21)
Filtered Water System	2.5.4	3.5.4.4	Treated Water Systems Stainless Steel Inspection (4.3.13)
Gaseous Waste Disposal System	2.5.4	3.5.4.5	None Required
High Pressure Injection System	2.5.5	3.5.5.2	Chemistry Control Program (4.6) Reactor Coolant Operational Leakage Monitoring (4.23)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Oconee Mechanical Systems (Continued)			
High Pressure Service Water System	2.5.6	3.5.6.4	Cast Iron Selective Leaching Inspection (4.3.2) Galvanic Susceptibility Inspection (4.3.3) Fire Protection Program (4.16) Service Water Piping Corrosion Program (4.25)
Instrument Air System	2.5.4	3.5.4.6	None Required
Leak Rate Test System	2.5.4	3.5.4.7	None Required
Liquid Waste Disposal System	2.5.4	3.5.4.8	Treated Water Systems Stainless Steel Inspection (4.3.13)
Low Pressure Injection System	2.5.5	3.5.5.3	Galvanic Susceptibility Inspection (4.3.3) Preventive Maintenance Activities (4.3.8) Chemistry Control Program (4.6) Heat Exchanger Performance Testing Activities (4.17) Service Water Piping Corrosion Program (4.25)
Low Pressure Service Water System	2.5.6	3.5.6.5	Galvanic Susceptibility Inspection (4.3.3) Preventive Maintenance Activities (4.3.8) Chemistry Control Program (4.6) Service Water Piping Corrosion Program (4.25) System Performance Testing Activities (4.27)
Main Steam System	2.5.9	3.5.9.1	Chemistry Control Program (4.6) Piping Erosion Control Program (4.21)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Oconee Mechanical Systems (Continued)			
Nitrogen Purge and Blanket System	2.5.4	3.5.4.9	Reactor Building Spray System Inspection (4.3.9) Chemistry Control Program (4.6)
Penetration Room Ventilation System	2.5.8	3.5.8.3	None Required
Post Accident Monitoring System	2.5.10	3.5.10.2	None Required
Reactor Building Cooling System	2.5.3	3.5.3.1	Preventive Maintenance Activities (4.3.8) Heat Exchanger Performance Testing Activities (4.17)
Reactor Building Purge System	2.5.4	3.5.4.10	None Required
Reactor Building Spray System	2.5.3	3.5.3.2	Reactor Building Spray System Inspection (4.3.9) Chemistry Control Program (4.6)
Reactor Coolant System	2.4 2.5.12	3.4 3.5.12	Alloy 600 Aging Management Program (4.3.1) OTSG Upper Lateral Support Inspection (4.3.6) Pressurizer Examinations (4.3.7) Reactor Vessel Internals Aging Management Program (4.3.11) Small Bore Piping Inspection (4.3.12) Boric Acid Wastage Surveillance Program (4.5) Chemistry Control Program (4.6) CRDM Nozzle and Other Vessel Closure Penetrations Inspection Program (4.10) Inservice Inspection Plan (4.18) Inspection Program for Civil Engineering Structures and Components (4.19)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Oconee Mechanical Systems (Continued)			
Reactor Coolant System (Continued)	2.4 2.5.12	3.4 3.5.12	Program to Inspect the HPI Connections to the RCS (4.22) Reactor Coolant System Operational Leakage Monitoring (4.23) Reactor Vessel Integrity Program (4.24) Steam Generator Tube Surveillance Program (4.26)
Reactor Coolant Pump Motor Oil Collection System	2.5.11	3.5.11	Reactor Coolant Pump Motor Oil Collection System Inspection (4.3.10)
Spent Fuel Cooling System	2.5.6	3.5.6.1	Chemistry Control Program (4.6)
Keowee Mechanical Systems			
Carbon Dioxide	2.5.13	3.5.13.1	Keowee Air and Gas Systems Inspection (4.3.4)
Depressing Air System	2.5.13	3.5.13.2	Keowee Air and Gas Systems Inspection (4.3.4)
Generator High Pressure Oil System	2.5.13	3.5.13.3	None Required
Governor Air System	2.5.13	3.5.13.4	Keowee Air and Gas Systems Inspection (4.3.4)
Governor Oil System	2.5.13	3.5.13.5	Keowee Oil Sampling Program (4.3.5)
Service Water System	2.5.13	3.5.13.6	Cast Iron Selective Leaching Inspection (4.3.2) Galvanic Susceptibility Inspection (4.3.3) Fire Protection Program (4.16) Service Water Piping Corrosion Program (4.25)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Keowee Mechanical Systems (Continued)			
Turbine Generator Cooling Water System	2.5.13	3.5.13.7	Galvanic Susceptibility Inspection (4.3.3) Preventive Maintenance Activities (4.3.8) Service Water Piping Corrosion Program (4.25) System Performance Testing Activities (4.27)
Turbine Guide Bearing Oil System	2.5.13	3.5.13.8	Keowee Oil Sampling Program (4.3.5)
Turbine Sump Pump System	2.5.13	3.5.13.9	Galvanic Susceptibility Inspection (4.3.3) Service Water Piping Corrosion Program (4.25) System Performance Testing Activities (4.27)
SSF Mechanical Systems			
Air Intake and Exhaust System	2.5.14	3.5.14.1	None Required
Diesel Generator Fuel Oil System	2.5.14	3.5.14.2	Chemistry Control Program (4.6)
Drinking Water System	2.5.14	3.5.14.3	Treated Water Systems Stainless Steel Inspection (4.3.13)
HVAC System	2.5.14	3.5.14.4	Heat Exchanger Performance Testing Activities (4.17)
Reactor Coolant Makeup System	2.5.14	3.5.14.5	Chemistry Control Program (4.6)
Sanitary Lift System	2.5.14	3.5.14.6	Treated Water Systems Stainless Steel Inspection (4.3.13)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
SSF Mechanical Systems (Continued)			
SSF Auxiliary Service Water System	2.5.14	3.5.14.7	Galvanic Susceptibility Inspection (4.3.3) Heat Exchanger Performance Testing Activities (4.17) Service Water Piping Corrosion Program (4.25) System Performance Testing Activities (4.27)
Starting Air System	2.5.14	3.5.14.8	None Required
Structures			
Auxiliary Building	2.7.3	3.7.3	Battery Rack Inspections (4.4) Chemistry Control Program (4.6) Crane Inspection Program (4.11) Fire Protection Program (4.16) Inservice Inspection Plan (4.18) Inspection Program for Civil Engineering Structures and Components (4.19)
Earthen Structures	2.7.4	3.7.4	FERC Five Year Inspection (4.15)
Intake Structure	2.7.5	3.7.5	Inservice Inspection Plan (4.18) Inspection Program for Civil Engineering Structures and Components (4.19)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Structures (Continued)			
Keowee Structures	2.7.6	3.7.6	Battery Rack Inspections (4.4) Crane Inspection Program (4.11) Duke Power Five-Year Underwater Inspection of Hydroelectric Dams and Appurtenances (4.12) FERC Five Year Inspection (4.15) Inservice Inspection Plan (4.18) Inspection Program for Civil Engineering Structures and Components (4.19) Penstock Inspection (4.20)
Reactor Buildings (Containment)	2.3	3.3	Coatings Program (4.7) Containment Inservice Inspection Plan (4.8) Containment Leak Rate Testing Program (4.9)
Reactor Building Internal Structures and Unit Vent	2.7.7	3.7.7	Boric Acid Wastage Surveillance Program (4.5) Chemistry Control Program (4.6) Crane Inspection Program (4.11) Inservice Inspection Plan (4.18) Inspection Program for Civil Engineering Structures and Components (4.19)

Table 1.3-1 Index of the Results of the Oconee Integrated Plant Assessment (Continued)

System, Structure, and Component	Scoping Section	Aging Effect Section	Programs (Section)
Structures (Continued)			
Standby Shutdown Facility	2.7.8	3.7.8	Battery Rack Inspection (4.4) Crane Inspection Program (4.11) Inservice Inspection Plan (4.18) Inspection Program for Civil Engineering Structures and Components (4.19)
Turbine Buildings	2.7.9	3.7.9	Crane Inspection Program (4.11) Fire Protection Program (4.16) Inspection Program for Civil Engineering Structures and Components (4.19)
Yard Structures	2.7.10	3.7.10	Battery Rack Inspections (4.4) Elevated Water Storage Tank Civil Inspection (4.14) Inspection Program for Civil Engineering Structures and Components (4.19) 230 kV Keowee Transmission Line Inspection (4.29)
Electrical	2.6	3.6	None Required

1.3.2 Time-Limited Aging Analyses and Exemptions

Section 54.21 requires that an application for a renewed operating license identify and evaluate plant-specific time-limited aging analyses and exemptions.

The time-limited aging analyses are those licensee calculations and analyses identified by applying the six criteria presented in §54.3. In addition, pursuant to §54.21(c)(2), a list must be provided of plant-specific exemptions granted pursuant to §50.12 and in effect that are based on the time-limited aging analyses defined in §54.3. Based on a review of the docket, Duke has determined that no Oconee exemptions meet this criterion.

§54.3 Definitions

> *Time-limited aging analyses, for the purposes of this part, are those licensee calculations and analyses that:*
>
> *(1) Involve systems, structures, and components within the scope of license renewal, as delineated in §54.4(a);*
>
> *(2) Consider the effects of aging;*
>
> *(3) Involve time-limited assumptions defined by the current operating term, for example, 40 years;*
>
> *(4) Were determined to be relevant by the licensee in making a safety determination;*
>
> *(5) Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in §54.4(b); and*
>
> *(6) Are contained or incorporated by reference in the CLB.*

§54.21Contents of application—technical information

Each application must contain the following information:
[...]
(c) An evaluation of time-limited aging analyses.

(1) A list of time-limited aging analyses, as defined in §54.3, must be provided. The applicant shall demonstrate that —

(i) The analyses remain valid for the period of extended operation;
(ii) The analyses have been projected to the end of the period of extended operation; or
(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

(2) A list must be provided of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on time-limited aging analyses as defined in §54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation.

The technical review of time-limited aging analyses is provided in OLRP-1001 Chapter 5, "Time-Limited Aging Analyses and Exemptions Review." The processes that Duke used to identify the Oconee-specific time-limited aging analyses and to identify exemptions are described in Section 5.2. For each identified time-limited aging analysis, an evaluation is provided for continued operation during the license renewal period. Consistent with the information provided in Chapters 2, 3, and 4, the evaluation of time-limited aging analyses for the Reactor Building (Containment) and the Reactor Coolant System are provided in Sections 5.3 and 5.4, respectively. The evaluation of time-limited aging analyses for mechanical, electrical, and civil/structural components are provided in Sections 5.5, 5.6, and 5.7, respectively. The time-limited aging analyses described and evaluated in Chapter 5 are designed to satisfy the requirements contained in §54.21(c) and to provide the basis for the NRC to make the finding required by §54.29(a)(2). Refer to Section 1.1 for the citation to §54.21(a)(2).

The *Oconee Time-Limited Aging Analyses and Exemptions Review* for license renewal, along with other information necessary to document compliance with Part 54, is and will continue to be maintained at Oconee in an auditable and retrievable form, in accordance with the requirements of §54.37(a).

1.4 Process to Update Technical Information

The process by which Duke will periodically update technical information that has been submitted to the NRC in the Oconee license renewal application is provided in this section. The process addresses the timing and content of revisions to OLRP-1001 (Exhibit A) and the other components of the Application for a renewed operating license, including the UFSAR update. This process is designed to meet the requirements of §54.21(b) to periodically update the contents of the Application by identifying any changes to the current licensing basis that materially affect the contents of the license renewal Application.

§54.21 Contents of application—technical information

> *Each application must contain the following information:*
> *[...]*
> *(b) CLB changes during NRC review of the application. Each year following submittal of the license renewal application and at least 3 months before scheduled completion of the NRC review, an amendment to the renewal application must be submitted that identifies any change to the CLB of the facility that materially affects the contents of the license renewal application, including the FSAR supplement.*

Each year following the submittal of the Application and at least three months before the scheduled completion of the NRC review, Duke will submit amendments to the Application. The revision will identify any changes to the current licensing basis that materially affect the contents of the Application, including OLRP-1001 (Exhibit A), the *Oconee Updated Final Safety Analysis Report Supplement*, and any other aspects of the Application. The amendments will be submitted on a replacement page basis, accompanied by a list that identifies the current pages in the document following the page replacement.

Duke has prepared *Oconee License Renewal Flow Diagrams (OLRFD)* to facilitate the review of the Oconee license renewal technical information. Updates to these diagrams will be provided concurrently with the amendments to the Application as described above. Upon issuance of an NRC safety evaluation report covering the license renewal technical information for Oconee, no further revisions of the *Oconee License Renewal Flow Diagrams* or the Application will be submitted.

1.5 Generic Safety Issues

1.5.1 Background

The NRC Staff evaluates the safety requirements used in its reviews against new information as it becomes available. Information related to the safety of nuclear power plants comes from a variety of sources including experience from operating reactors, research results, NRC staff and Advisory Committee on Reactor Safeguards (ACRS) safety reviews, and vendor, architect/engineer, and utility design reviews. Each time a new concern or safety issue is identified from one or more of these sources, the NRC assesses the need for immediate action to ensure safe operation. This assessment includes consideration of the generic implications of the issue.

In some cases, immediate action is taken to ensure safety. In other cases, interim measures, such as modifications to operating procedures, may be sufficient to allow further study of the issue before licensing decisions are made. In most cases, however, the initial assessment indicates that immediate licensing actions or changes in licensing criteria are not necessary. In any event, further study may be deemed appropriate to determine whether existing NRC requirements should be modified to address the issue for new plants or whether backfitting is appropriate for the long-term operation of existing plants.

These issues have been called “generic safety issues.” Generic safety issues (GSIs) are safety concerns that may affect the design, construction, or operation of all, several, or a class of nuclear power plants and that may result in safety improvements and promulgation of new or revised requirements or guidance. NUREG-0933, *A Prioritization of Generic Safety Issues*, describes the NRC program to identify, prioritize, and ultimately resolve GSIs. NUREG-0933 was initially issued in 1983 and has been revised frequently since then.

In 1995, in the Statements of Consideration (SOC) for the amended license renewal rule (60 Federal Register 22484, May 8, 1995), the Commission stated that:

> “Resolution of a USI or GSI generically for the set of applicable plants is not necessary for the issuance of a renewed license. GSIs and USIs that do not contain issues related to the license renewal aging management review or time-limited aging evaluation are *not* a subject of review or finding for license renewal. However, designation of an issue as a GSI or USI does not exclude the issue from the scope of the aging management review or time-limited aging evaluation.”
>
> “For an issue that is both within the scope of the aging management review or time-limited aging evaluation *and* within the scope of a USI or GSI, there are

several approaches which can be used to satisfy the finding required by section 54.29."

The Nuclear Energy Institute (NEI), on behalf of the nuclear industry, submitted an October 21, 1996, letter that described a review of NUREG-0933 (through Revision 19, dated June 1995) that had been performed by the industry. Table II of NUREG-0933 lists all unresolved safety issues (USIs) and GSIs and identifies a safety priority ranking for each one. The legend accompanying Table II explains the ranking system. For GSIs, the rank is either high, medium, or low or the item has one of the following five notes:

- Note 1: Possible Resolution Identified for Evaluation
- Note 2: Resolution Available
- Note 3: Resolution Resulted in either: (a) The Establishment of New Regulatory Requirements, or (b) No new Requirements
- Note 4: Issue to be Prioritized in the Future
- Note 5: Issue that is not a Generic Safety Issue but should be Assigned Resources for Completion

The conclusions of the NEI review were that items with a status of either Note 1 or Note 4 are the only GSIs that may be considered concurrently with the aging management reviews and time-limited aging analysis evaluation being performed to meet the requirements of license renewal.

The NEI review of NUREG-0933 through Revision 19 initially identified unresolved GSIs that meet the above criteria. Each GSI was subsequently reviewed to determine if it is concerned with aging effects associated with structures and components within the scope of license renewal. This review identified two GSIs that NEI considers applicable to license renewal:

- GSI 166 - Adequacy of Fatigue of Metal Components, and
- GSI 168 - Environmental Qualification of Electrical Equipment

In a January 29, 1998, letter to NEI, the NRC staff described its review of the NEI criteria for performing the review and the list of GSIs identified by NEI as applicable to license renewal. On the basis of this review and further evaluation of the NUREG-0933 process, the staff determined that the criteria for reviewing GSIs should be different from those proposed by NEI. Specifically, the NRC determined that all issues listed in NUREG-0933, Appendix B with the following Safety Priority/Status classifications should be reviewed to identify any generic concerns that may be related to the effects of aging or time-limited aging analyses for system, structures, or components within the scope of license rule:

- USI
- High Priority
- Medium Priority
- Note 1: Possible Resolution Identified for Evaluation
- Note 2: Resolution Available (Documented in NUREG, NRC Memorandum, SER [safety evaluation report], or equivalent)

To illustrate the application of these criteria, the staff reviewed NUREG-0933, updated through Revision 21 (December 1996) and identified the following five GSIs involving potential aging effects that should be evaluated in a license renewal application:

- GSI 23 - Reactor Coolant Pump Seal Failures
- GSI 78 - Monitoring of Fatigue Transient Limits for [Reactor Coolant System]
- GSI 166 - Adequacy of Fatigue Life of Metal Components
- GSI 168 - Environmental Qualification of Electrical Equipment
- GSI 173.A - Spent Fuel Storage Pool: Operating Facilities

Subsequent to the above NRC letter, Revision 22 of NUREG-0933 (December 31, 1997) was released by the NRC. Among the changes included in Revision 22 are the following that are pertinent to license renewal:

- GSI 78 is now resolved
- GSI 166 is now resolved
- GSI 190 has been established to address the impact of a license renewal period of 20 years on fatigue of metal components.

In consideration of the above guidance, Duke has addressed the following list of GSIs concurrently with the license renewal review for Oconee:

(1) GSI 23 - Reactor Coolant Pump Seal Failures
(2) GSI 168 - Environmental Qualification of Electrical Equipment
(3) GSI 173.A - Spent Fuel Storage Pool: Operating Facilities
(4) GSI 190 - Fatigue Evaluation of Metal Components for 60-Year Plant Life

The following discussion reflects Duke's understanding of the current descriptions of the above four GSIs and our position with respect to the operation of Oconee during the period of extended operation (2013 - 2034) pending generic resolution of these four GSIs.

1.5.2 GSI 23 - Reactor Coolant Pump Seal Failures

As stated in NUREG-0933, "This issue deals with the high rate of reactor coolant pump seal failures that challenge the makeup capacity of the ECCS in PWRs." [Footnote 1] The failures of these seals may be age related; however, reactor coolant pump seals are generally replaced prior to the detection of excessive leakage. For Oconee Units 2 and 3 (Bingham reactor coolant pumps) and the first stage of the Westinghouse reactor coolant pumps on Unit 1, the reactor coolant pump seals are replaced approximately every four operating cycles. The second and third stages of the Westinghouse reactor coolant pump seals on Unit 1 are replaced approximately every two operating cycles. Because replacement of reactor coolant pumps seals occurs routinely, they are not subject to aging management review for the license renewal period of extended operation.

In addition, by letter dated November 30, 1990, Duke submitted to the NRC the Individual Plant Examination (IPE) for Oconee. As part of the IPE process, Duke proposed the resolution of several GSIs, one of which was GSI 23. By letter dated March 24, 1995, the NRC staff provided the results of its review of the resolutions of the GSIs proposed by Duke. The NRC concluded that GSI 23 had been adequately addressed for Oconee Units 1, 2, and 3. Duke concludes that GSI 23 is resolved for Oconee.

1. NUREG-0933 description of GSI 23 dated 11/30/83.

1.5.3 GSI 168 - Environmental Qualification of Electrical Components

As discussed in SECY-93-049, the staff reviewed significant license renewal issues and found that several were related to environmental qualification (EQ). A key aspect of these issues was whether the licensing bases should be reassessed or enhanced in connection with license renewal, and whether this reassessment should be extended to the current license term. In late 1993, the Commissioners instructed the staff that the current EQ licensing basis must be used in the license renewal period and that any EQ concerns identified by the staff during the review of EQ for license renewal should be evaluated for the effect on current licenses, independent of license renewal.

The NRC Staff's EQ Task Action Plan (EQ-TAP) was initiated to address the adequacy of current EQ practices. Upon completion of the EQ-TAP review, the focus of Staff concerns was limited to issues related to the adequacy of accelerated aging practices in existing qualifications, and the lack of a "feedback mechanism" in EQ programs (i.e., programmatic requirements to determine the current condition of EQ equipment so that it can be evaluated against the assumptions and parameters for qualification). The EQ-TAP was subsequently closed [Footnote 2] and six remaining open issues were incorporated into GSI 168 for management tracking purposes. The EQ-TAP review did not identify any generic safety issues related to these six open issues. [Footnote 3] NRC research on these six topics is in progress and expected to be completed in 1999.

NRC guidance for addressing GSI 168 for license renewal is contained in a June 1998 letter to NEI [Reference 1.5-1]. In this letter, the NRC states:

> "With respect to addressing GSI 168 for license renewal, until completion of an ongoing research program and staff evaluations, the potential issues associated with GSI 168 and their scope have not been defined to the point that a license renewal applicant can reasonably be expected to address them at this time. Therefore, an acceptable approach described in the SOC is to provide a technical rationale demonstrating that the current licensing basis for EQ pursuant to 10 CFR 50.49 will be maintained in the period of extended operation. Although the SOC also indicates that an applicant should provide a brief description of one or more reasonable options that would be available to adequately manage the effects of aging, the staff does not expect an applicant to provide the options at this time."

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2. Memorandum from L. Joseph Callan, Executive Director for Operations, USNRC, to Chairman and Commissioners, USNRC, Subject: Report on the Status of the Environmental Qualification Task Action Plan (WITS ITEM 9300107), February 5, 1998.

3. Issues which are no longer generic safety issues but which should be assigned resources to complete may be prioritized as "Note 5" and should not be subject to review by license renewal applicants.

Environmental qualification evaluations of electrical equipment are identified as time-limited aging analyses for Oconee. The evaluations of these time-limited aging analyses are considered to be the technical rationale that the current licensing basis will be maintained during the period of extended operation. These evaluation are provided in Section 5.6 of OLRP-1001. Consistent with the above NRC guidance, no additional information is required to address GSI 168 in a renewal application at this time.

1.5.4 GSI 173.A - Spent Fuel Storage Pool: Operating Facilities

As stated in NUREG-0933:

> "The principle concerns included in Part A of the generic action plan [Memorandum to A. Thadani from G. Holahan, Task Action Plan for Spent Fuel Storage Pool Safety, October 13, 1994] involve the potential for a sustained loss of spent fuel pool cooling capability, which was identified through the report filed with the NRC relating to Susquehanna, and the potential for a substantial loss of spent fuel pool coolant inventory, which was given renewed emphasis following the Dresden 1 special inspection. Postulated adverse conditions that may develop following a LOCA or a sustained loss of power to spent fuel pool cooling system components could prevent restoration of spent fuel pool decay heat removal. [Footnote 4]"

In a memorandum to the Commission dated July 26, 1996, the NRC staff reported the findings from the Spent Fuel Pool Action Plan. In that memorandum, the staff concluded that existing structures, systems and components related to the storage of irradiated fuel provide adequate protection for public health and safety. Concurrent with these activities, the staff also performed an independent review of all operating reactor licensees and found that each licensee was operating its spent fuel storage system in compliance with its operating license or would be before the next refueling outage. The results of this compliance review are documented in a memorandum to the Commission dated May 21, 1996. Notwithstanding these findings, the NRC staff also performed plant-specific evaluations of regulatory analyses to determine whether safety enhancement backfits could be justified at certain plants, including Oconee.

The details of the NRC staff's follow-up activities, results of the plant-specific evaluations, and status of other spent fuel pool actions, are documented a memorandum to the Commission dated September 30, 1997. By letter dated November 6, 1997, from the NRC to Duke, the staff stated that based on the probabilistic screening analysis, which indicated a low likelihood of fuel to be uncovered and relatively low risk-significance, no

4. NUREG-0933 description of GSI 173A dated 12/31/95.

further regulatory action associated with the issues identified in the staff's July 26, 1996 memorandum to the Commission is necessary at Oconee [Reference 1.5-2].

Another concern identified in GSI 173A is spent fuel pool criticality control (Boraflex degradation). Generic Letter 96-04 has been issued by the NRC and Duke has responded to this generic letter (Reference 1.5-3). Degradation of Boraflex at Oconee is considered to be a time-limited aging analysis and is addressed in Section 5.7 of OLRP-1001. Duke has implemented a program to monitor the Boraflex to ensure that reactivity control is maintained for the spent fuel storage racks consistent with the licensing basis for the period of extended operation. Accordingly, Duke concludes that GSI 173.A is resolved for Oconee.

1.5.5 GSI 190 - Fatigue Evaluation of Metal Components for 60-Year Plant Life

SECY-95-245 [Reference 1.5-4] and the latest draft of the Standard Review Plan for License Renewal [Reference 1.5-5] require that the license renewal applicant offer a technical rationale for concluding that the effects of fatigue are adequately managed for the extended period of operation or until the resolution of GSI 166 (now GSI 190). The following discussion reflects Duke's understanding of the current scope of GSI 190 and our position with respect to the operation of Oconee during the period of extended operation (2013 - 2034) pending resolution of GSI 190.

1.5.5.1 Background

In SECY-95-245, the NRC staff informed the Commission that it had concluded its efforts on the Fatigue Action Plan (FAP). That SECY paper cited the NRC staff finding that "no immediate staff or licensee action is necessary to deal with the fatigue issues addressed by the FAP." This belief applies to currently licensed and operating plants. However, with respect to license renewal, SECY-95-245 states:

> "The conclusions discussed above [in SECY-95-245, p. 5] are based on the results of the component sample evaluation for a current facility design life [in NUREG/CR-6260]. For facility operation beyond the current design life, the conclusions are less certain. It would be more difficult to demonstrate that all components in the FAP sample, including components from both old and new plants, will not exceed the ASME Code fatigue usage factor limit using environmental fatigue curves for an extended plant life. In addition, the RES risk study used the results of previous technical studies to obtain estimates of the probability of through-wall cracking or failure of the reactor vessel and reactor coolant loop piping. These previous estimates were developed considering a current facility design life. The staff also notes that the evaluation of one vessel location below the top of the core indicated that the current ASME Code CUF limit may be exceeded for a 60-year design life when the environmental fatigue data were used. Therefore, the staff believes that the FAP fatigue issues should be evaluated further, focusing mainly on components in the RCPB with high fatigue usage for any proposed extended period of operation. The

> staff will consider, as part of the resolution of GSI 166, Adequacy of Fatigue Life of Metal Components, the need to evaluate a sample of components with high fatigue usage, using the latest available environmental fatigue data, to ensure that RCPB components will continue to perform their intended functions and maintain a high level of reliability during the extended period of operation for license renewal. If GSI 166 has not been resolved before the issuance of a renewal license, the applicant would have to submit (60 FR 22484, May 8, 1995) its technical rationale for concluding that the effects of fatigue are adequately managed for the extended period or until the resolution of GSI 166 becomes available."

Based on discussions in an EPRI/NRC meeting on December 12, 1996, it appears that the purpose of SECY-95-245 was to provide a regulatory justification for the position that no backfitting of the current designs to consider environmental effects is required. The purpose was not to provide a technical justification that the current design codes do indeed manage environmental effects.

Further, SECY-95-245 could not provide a regulatory justification for not needing to backfit to new standards for the license renewal period. As stated above, the NRC left it to the license renewal applicant to provide the technical rationale for concluding the environmental effects of fatigue are adequately managed for the extended period or until the resolution of GSI 190 (formerly GSI 166). The methodology to be followed here assumes that resolution of GSI 190 will occur following the issuance of the Oconee renewal license.

1.5.5.2 Generic Industry Technical Rationale

The industry, through the efforts of the Electric Power Research Institute (EPRI), the owners groups, and individual utilities, has undertaken to resolve the staff concerns expressed in SECY-95-245 [Reference 1.5-4] generically, by evaluating many of the same fatigue-sensitive locations contained in the NUREG/CR-6260 [Reference 1.5-6] study for a variety of reactor types. Rather than apply reactor water environmental effects indiscriminately through the interim fatigue curves of Reference 1.5-7, a methodology based on selective application of reactor water environmental effects was used [Reference 1.5-8]. This approach involves the adjustment of the ASME Code Section III, Subsection NB-3000 cumulative usage factor calculations only when all of the environmental variables lie within significance thresholds. For example, no environmental adjustment is applied when the temperature is less than or equal 150°C (302°F), or the reactor water dissolved oxygen content is less than 0.05 ppm. The thresholds were taken from the Pressure Vessel Research Council Committee on Cyclic Life Environmental Effects, as determined through the consensus process [Reference 1.5-9].

This selective environmental fatigue methodology was used by EPRI contractors on four separate projects:

(1) a older vintage, two-unit Combustion Engineering pressurized water reactors [Reference 1.5-10];
(2) an older vintage, two-unit Westinghouse pressurized water reactors [Reference 1.5-11];
(3) a older vintage, single-unit boiling water reactors [Reference 1.5-12]; and
(4) a newer vintage, two-unit boiling water reactors[Reference 1.5-13].

The methodology will also be used in a study that remains to be completed for Oconee Nuclear Station.

This application of the latest available information on reactor water environmental effects produces much lower effective environmental fatigue multipliers, F_{en}, than does the indiscriminate application of an environmentally-adjusted design fatigue curve (NUREG/CR-5999) in NUREG/CR-6260. As a result, the industry has determined that actual reactor water environmental effects are more than compensated for by the two existing sources of conservatism contained in the ASME Code fatigue design process – the portion of the low-cycle fatigue design margin factor of 20 that is attributed to moderate environmental effects and the conservatism embodied in the definition of design-basis thermal transients.

For example, the proposed industry technical position, including the selective application of appropriate reactor water environmental effects, was applied to three systems at the Calvert Cliffs Nuclear Power Plant (CCNPP) and the results documented in EPRI TR-107515 [Reference 1.5-10]. The selective environmental fatigue methodology produced much lower effective environmental fatigue multipliers, F_{en}, than did the indiscriminate application of an environmentally-adjusted design fatigue curve (NUREG/CR-5999) in NUREG/CR-6260. The maximum F_{en} applied to the limiting fatigue-sensitive component locations was found to be in the range of 1.4 to 1.6, well below the fraction of the low-cycle factor of 20 (e.g., 3 to 4) contained in the ASME Code Section III design fatigue curves to account for moderate environmental effects.

As an example, for the older vintage Combustion Engineering plant study, the maximum F_{en} applied to the limiting fatigue-sensitive component locations was found to be in the range of 1.4 to 1.6, well below the fraction of the low-cycle factor of 20 contained in the ASME Code Section III design fatigue curves to account for the conversion of smooth specimen laboratory fatigue data obtained in air to design applications. Because of the low environmental multipliers, the projected fatigue usage for both the 40-year design life and the 60-year license renewal period was found to be less than unity for the limiting fatigue-sensitive component locations in the pressurizer surge line and the Chemical - Volume Control System, even with the effects of the reactor water environment applied appropriately during thermal transients.

A related part of the older vintage Combustion Engineering plant study included the parametric evaluation of the effects of actual plant transients relative to the definition of design-basis transients. In this case, the design-basis transient definition is described typically in terms of steep or discontinuous changes in temperature, whereas actual transients are characterized by more gradual changes in temperature. The conservatism implied by the definition of design-basis thermal transients was found to have an effect on the calculated fatigue usage equal to or greater than the maximum calculated F_{en}, with a typical CUF ratio on the order of 20 to 100, compared to environmental multipliers of 1.4 to 1.6 in the worst case.

The results of this study, and the similarity of results in the other three completed studies, [References 1.5-11, 1.5-12 and 1.5-13] confirmed that the industry technical position on fatigue evaluation for metal components contains the essential steps needed to demonstrate that the effects of fatigue are managed adequately for both the current and any license renewal term, including fatigue-sensitive component locations and the effects of reactor water environments. Furthermore, these findings provide evidence that selective application of the effects of reactor water environments, in accordance with an industry consensus approach, produces worst-case environmental multipliers that are already compensated for by two existing sources of conservatism in Class 1 ASME Code fatigue analysis procedures. These conservatisms are (1) the low-cycle portion of the design fatigue curve margin factor of 20 that is appropriately ascribed to moderate environmental effects and (2) the design-basis definitions of thermal transients. The combination of these two existing conservatisms is such that explicit treatment of reactor water environmental effects in fatigue design analysis may not be necessary.

1.5.5.3 Oconee Confirmatory Research

In addition to the results of the four industry studies, additional confirmatory research is ongoing in 1998 at Oconee in support of the generic resolution of issues associated with GSI 190. Consistent with these other studies, the Oconee study, being done in conjunction with EPRI, will apply the industry evaluation methodologies of Reference 1.5-8 to selected locations as a part of the Reactor Coolant System Branch Line Piping reanalysis [References 1.5-14, 1.5-15, and 1.5-16]. The calculations developed to meet this NRC commitment consider the various environmental factors.

1.5.5.4 Oconee License Renewal Position for GSI 190

The results of the four industry studies previously mentioned provide a generic technical rationale for concluding that the effects of fatigue are adequately managed for the extended period, and that GSI 190 should be considered resolved on the basis of these research findings. Oconee plans to continue to participate with EPRI in additional confirmatory research on this issue in order to support any further industry initiatives that may be required in this area.

On the basis of the above considerations, Duke concludes that there is reasonable assurance that Oconee can be safely operated during the period of extended operation pending ultimate resolution of GSI 190.

1.5.6 References for Section 1.5

1.5-1. C. I. Grimes (NRC) letter dated June 2, 1998 to D. Walters (NEI), *Guidance on Addressing GSI 168 for License Renewal*, Project 690.

1.5-2. D. E. LaBarge (NRC) letter dated November 6, 1997 to W. R. McCollum (Duke), *Closeout of Follow-up Activities on the Spent Fuel Pool Regulatory Analysis Audit*, Oconee Nuclear Station, Units 1, 2, and 3, Docket Nos. 50-267, -270, and -287.

1.5-3. M. S. Tuckman (Duke) letter dated October 22, 1996 to Document Control Desk (NRC), *Response to Generic Letter 96-04, Boraflex Degradation in Spent Fuel Storage Racks*, Oconee Nuclear Station, Docket Nos. 50-269, -270, and -287, and supplemented December 22, 1997.

1.5-4. Taylor, James M., NRC Executive Director for Operations, *Completion of the Fatigue Action Plan*, SECY-95-245, U. S. Nuclear Regulatory Commission, Washington, DC, September 25, 1995.

1.5-5. Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants, Working Draft, U. S. Nuclear Regulatory Commission, Washington, DC, September 1997.

1.5-6. Ware, A. G., D. K. Morton, and M. E. Nitzel, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, NUREG/CR-6260 (INEL-95/0045), Idaho National Engineering Laboratory, Idaho Falls, March 1995.

1.5-7. Majumdar, S., O. K. Chopra, and W. J. Shack, *Interim Fatigue Design Curves for Carbon, Low-Alloy, and Austenitic Stainless Steels in LWR Environments*, NUREG/CR-5999, Argonne National Laboratory, April 1993.

1.5-8. Mehta, H. S. and S. R. Gosselin, *An Environmental Factor Approach to Account for Reactor Water Effects in Light Water Reactor Pressure Vessel and Piping Fatigue Evaluations*, Report No. TR-105759, Electric Power Research Institute, Palo Alto, CA, December 1995.

1.5-9. Van Der Sluys, W. A. and S. Yukawa, *Status of PVRC Evaluation of LWR Coolant Environmental Effects on the S-N Fatigue Properties of Pressure Boundary Materials*, ASME PVP-Volume 306 (1995).

1.5-10. Gerber, D. A. and G. L. Stevens, *Evaluation of Thermal Fatigue Effects on Systems on Systems Requiring Aging Management Review for License Renewal for the Calvert Cliffs Nuclear Power Plant*, Report No. TR-107515, Electric Power Research Institute, Palo Alto, CA, January 1998.

1.5-11. Gerber, D. A., *Evaluation of Environmental Fatigue Effects for a Westinghouse Nuclear Power Plant*, Report No. EPRI TR-110043, Electric Power Research Institute, Palo Alto, CA, April 1998.

1.5-12. Mehta, H., *Environmental Fatigue Evaluations of Representative BWR Components*, Report No. EPRI TR-107943, Electric Power Research Institute, Palo Alto, CA, May 1998.

1.5-13. Stevens, G. L., *Evaluation of Environmental Thermal Fatigue Effects on Selected Components in a Boiling Water Reactor Plant*, Report No. EPRI TR-110356, Electric Power Research Institute, Palo Alto, CA, April 1998.

1.5-14. L.A. Wiens (NRC) letter dated April 27, 1995 to J.W. Hampton (Duke), Fatigue Analyses for Reactor Coolant Pressure Boundary Attachment Piping, Oconee Nuclear Station, Docket Nos. 50-269, -270, and -287 (TAC Nos. M90156, M90157 and M90158).

1.5-15. J.W. Hampton (Duke) letter dated June 26, 1995 to Document Control Desk (NRC) Oconee Nuclear Station, Docket Nos. 50-269, -270 and -287, RCS Auxiliary Piping Fatigue Analysis Issue.

1.5-16. L.A. Wiens (NRC) letter dated July 10, 1995 to J.W. Hampton (Duke), Reactor Coolant System (RCS) Auxiliary Piping Fatigue Analysis Schedule, Oconee Nuclear Station, Docket Nos. 50-269, -270 and -287.

2. IDENTIFICATION OF STRUCTURES & COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 INTRODUCTION

This chapter describes the first major activity of the *Oconee Integrated Plant Assessment*, the identification of structures and components subject to aging management review. The information provided in this chapter is intended to meet the requirements of §§54.21(a)(1) and (a)(2). [Footnote 1]

For those systems, structures, and components within the scope of license renewal (defined by §54.4), §54.21(a)(1) requires a license renewal applicant to identify and list the structures and components subject to aging management review. Section 54.21(a)(2) further requires that the methods used to identify and list these structures and components be described and justified. The technical information in this chapter serves to satisfy these requirements. Overall, the technical information provided in Chapters 2, 3, and 4 will provide the basis for the NRC to make the finding required by §54.29(a)(1). [Footnote 2]

The *Oconee Integrated Plant Assessment* is divided into the engineering disciplines traditional to Duke; i.e., mechanical, civil/structural, and electrical. The assessment of Oconee mechanical systems, structures, and components consists of both the identification of systems within the scope of license renewal (scoping) and the identification of the components subject to aging management review (screening). The methodology used by Duke to identify the mechanical systems and components within the scope of license renewal is described in Section 2.2. The resultant list of in-scope mechanical systems used to identify the mechanical components subject to aging management review is described in Section 2.5. The screening results for the Reactor Coolant System, an important element in the defense-in-depth against radioactive release, are described in Section 2.4.

Similarly, the methodology used by Duke to identify the structures within the scope of license renewal is described in Section 2.2. These structures are then screened to determine the structural components subject to aging management review; the results are described in Section 2.7. The Reactor Building (Containment), an important element in the defense-in-depth against radioactive release, is described in Section 2.3.

The *Oconee Integrated Plant Assessment* for the electrical area begins with component screening which is then followed by scoping. The identification of electrical components that are subject to aging management review is described in Section 2.6.

1. Refer to Sections 1.3.1 and 1.3.2 for the text of the requirements in §§54.21(a)(1) and (a)(2).

2. Refer to Section 1.1 for the text of the requirements in §54.29(a)(1).

§54.4 Scope

(a) Plant systems, structures, and components within the scope of this part are—

(1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions—

(i) The integrity of the reactor coolant pressure boundary;
(ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
(iii) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in §50.34(a)(1) or §100.11 of this chapter, as applicable.

(2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section.

(3) All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

(b) The intended functions that these systems, structures, and components must be shown to fulfill in §54.21 are those functions that are the bases for including them within the scope of license renewal as specified in paragraphs (a)(1) - (3) of this section.

2.2 Identification of Systems, Structures, and Components Within the Scope of License Renewal

The methodology used to identify structures and mechanical systems at Oconee that are within the scope of license renewal is described and justified in this section, consistent with the guidance provided by NEI 95-10, Revision 0 [Reference 2.2-1, Section 3.1]. In August 1996, the NRC issued Draft Regulatory Guide DG-1047, *Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses*, for public comment. Therein, the NRC proposed to endorse NEI 95-10, Revision 0, as an acceptable method for complying with the requirements of 10 CFR Part 54 [Reference 2.2-2]. The methodology utilized to identify the electrical components within the scope of license renewal and subject to aging management review is described in Section 2.6 of OLRP-1001.

Section 2.2.1 discusses the review performed to identify structures and mechanical systems that satisfy the criteria contained in §§54.4(a)(1) and (a)(2). Section 2.2.2 describes the review performed to satisfy the criteria contained in §54.4(a)(3). [Footnote 1]

2.2.1 Review To Criteria in §§54.4(a)(1) and (a)(2)

The following sections describe the methodology and results associated with the identification of structures and mechanical systems within the scope of license renewal. This methodology covers the design basis event mitigation scoping requirements of both §§54.4(a)(1) and (a)(2).

2.2.1.1 Mechanical Systems

The mechanical systems at Oconee, Keowee Hydroelectric Station (Keowee), and the Standby Shutdown Facility (Standby Shutdown Facility), as identified on Oconee and Keowee engineering drawings and documents, were the subject of this review. For the purpose of mechanical system scoping, Duke carried out the following activities:

(a) Identify all systems and their functions that are listed in design basis event mitigation calculations at Oconee.

As defined by §§54.4(a)(1) and (a)(2), all safety-related systems, structures, and components required to mitigate design basis events and nonsafety-related systems, structures, and components whose failure would prevent the successful mitigation of design basis events are within the scope of license renewal.

1. Refer to Section 2.1 for the text of §54.4.

Because Oconee was licensed before terms such as “safety-related” were more precisely defined by the NRC, a list of the Oconee safety-related systems, structures, and components, in and of itself, will not meet the intent of §54.4(a)(1). Because the criteria in §54.4(a)(1) are the scoping criteria for many modern-day, regulatory-required programs, Oconee conducted a design study that validated all functions required for the successful mitigation of Oconee design basis events and identified the systems and components relied upon to complete those functions. The individual design basis event mitigation calculations produced as a result of the study contain a list of the system functions required to successfully mitigate each event. Duke determined that the systems that perform these functions are within the scope of license renewal.

(b) Identify all passive pressure boundaries required for the systems identified in step (a).

As part of the design basis event mitigation calculations, the validated functions were mapped onto Oconee system flow diagrams. These functional boundaries then required the additional identification of piping and components to complete the physical piping boundary. In some instances, the pressure boundary for one system may cross the system boundary into another system. Since the additional system does not perform a specific function, but serves only as a pressure boundary for the system that does serve a function, the additional system is not specifically stated as a system within scope. For the purposes of license renewal, the additional components are considered an extension of the functional system that is within scope.

(c) Identify portions of selected mechanical systems whose failure to maintain their pressure boundary or to remain structurally intact would result in impacting the function of any essential system and component. Oconee essential systems and components include the Reactor Coolant System, reactor vessel internals, Reactor Building, Engineering Safeguards System, and electric emergency power sources [Reference 2.2-4, Section 3.1.1].

In this activity, two types of physical interactions must be considered for the purposes of scoping systems, structures and components into license renewal. The first type of interaction to consider is the structural integrity of mechanical components that must remain in place such that they do not fall onto equipment that is performing a safety-related function and prevent it from performing that function. In this case, structural integrity for these mechanical components is the responsibility of the component support which is required to remain intact in order to fulfill the function.

The other type of physical interaction is the leakage of fluid from the mechanical system components onto nearby equipment that is performing a safety-related function which could prevent it from performing that function. In this case, the pressure boundary and the structural integrity of the mechanical component is of concern.

Oconee is licensed to consider the effects of physical interactions on essential systems and components consistent with the original licensing basis. This list of essential systems is in UFSAR, Section 3.1.1. These essential systems and components are not necessarily the systems, structures and components that meet the first scoping criteria of license renewal, 10 CFR 54.4(a)(1)(i), (ii), and (iii). However, they are the systems, structures and components that Oconee is required to protect from postulated failures (due to physical interactions) of nonsafety-related systems, structures and components.

Oconee System Piping Class D [Footnote 2] piping is the nonsafety-related piping whose pressure boundary loss may adversely affect essential systems or components. Systems containing Oconee System Piping Class D piping are within the scope of license renewal.

(d) Some mechanical systems at Oconee contain mechanical safety-related piping and components and seismic-related piping and components that do not meet the criteria of §54.4(a)(1) or (a)(2). To ensure completeness in mechanical scoping, systems or portions of systems containing this piping were evaluated for inclusion in the scope of license renewal, whether or not they meet the criteria of §54.4(a)(1) or (a)(2). Individual components or sets of components are included within the scope of license renewal based on this evaluation and are included within the marked license renewal evaluation boundaries in OLRP-1002 [Reference 2.2-3].

2.2.1.2 Structures

The list of Oconee structures within the scope of license renewal was created by reviewing the Oconee UFSAR, Oconee site plans and general arrangement drawings and other plant-specific documents. The identification of safety-related structures and nonsafety-related structures whose failure could prevent safety-related systems, structures, or components from fulfilling their safety-related functions was based on the classification of each Oconee structure as documented in the Oconee UFSAR, Section 3.2 [Reference 2.2-4].

Oconee structures are designated as either Class 1, 2, or 3. Oconee Class 1 structures are those which prevent uncontrolled release of radioactivity and are designed to withstand all

2. Table 2.5-1 in Section 2.5 contains a list of Oconee System Piping Classifications.

loadings without loss of function as defined in the Oconee UFSAR. This Oconee classification is consistent with the intent of §54.4(a)(1). Therefore, Duke has determined that Oconee Class 1 structures are within the scope of license renewal and meet the criteria contained in §54.4(a)(1).

Oconee Class 2 structures are those whose limited damage (1) would not result in a release of radioactivity, (2) would permit a controlled plant shutdown, but (3) could interrupt power generation. The Oconee UFSAR, Chapter 3.2 states that Class 2 structures do not perform any nuclear safety-related function but that their failure could reduce the function of a safety-related system to an unacceptable level. This Oconee classification is consistent with the intent of §54.4(a)(2). Therefore, Duke has determined that Oconee Class 2 structures are within the scope of license renewal and meet the criteria contained in §54.4(a)(2).

Oconee Class 3 structures are those structures whose failure could inconvenience operation but are not essential to power generation, orderly shutdown, or maintenance of the reactor in a safe shutdown condition. Oconee Class 3 structures do not meet the criteria in either §54.4(a)(1) or §54.4(a)(2) and, therefore, are outside the scope of license renewal.

2.2.2 Review To Criteria in §54.4 (a)(3)

Oconee structures and mechanical systems were also evaluated to determine whether they are required to demonstrate compliance with NRC regulations for events identified in §54.4(a)(3). Each of the following sections includes a brief discussion of the regulated event and the associated Oconee documents which identify the Oconee structures and mechanical systems relied upon in the safety analyses or plant evaluation to demonstrate compliance with the regulated event.

Structures and mechanical systems which are relied upon to perform or support performance of a function that demonstrates compliance with the NRC regulations described in §54.4(a)(3) are within the scope of license renewal.

2.2.2.1 Fire Protection

Section 54.4(a)(3) requires that all systems, structures, and components relied upon in safety analyses or plant evaluations to demonstrate compliance with §50.48, the NRC regulation governing fire protection, be included within the scope of license renewal. The Oconee Fire Protection Program is based on compliance with General Design Criteria (GDC) 3 [Reference 2.2-5]. Oconee conforms to GDC 3, as described in NRC Safety Evaluation Reports dated August 11, 1978 and April 28, 1983 [Reference 2.2-6, Sections III.G, III.J, and III.O].

The Oconee fire protection program is based on an evaluation of the potential fire hazards throughout the plant and the effect of postulated design basis fires relative to maintaining the ability to perform safe shutdown functions and minimize radioactive releases to the environment. As part of the response to BTP 9.5-1, Oconee proposed a dedicated Standby Shutdown Facility (see Section 1.2.3 of OLRP-1001) to comply with more recent separation and protection requirements than those addressed in the original Oconee design. The NRC Safety Evaluation for the Standby Shutdown Facility identifies the systems and structures required for the fire protection program.

Pre-1979 plants, including all three Oconee units, were required to comply with the backfit provisions of 10 CFR 50, Appendix R. The following documents were reviewed to determine the Oconee structures and mechanical systems relied upon to meet the requirements of 10 CFR 50, Appendix R:

- U. S. Nuclear Regulatory Commission, *Fire Protection Safety Evaluation Report by the Office of Nuclear Reactor Regulation U. S. Nuclear Regulatory Commission in the Matter of Duke Power Company Oconee Nuclear Station, Units 1, 2, & 3*, dated August 11, 1978.

- U. S. Nuclear Regulatory Commission, *Exemption from the Fire Protection Requirements of Section III.G of 10 CFR Part 50, Appendix R*, dated August 21, 1989.

- U. S. Nuclear Regulatory Commission, *Safety Evaluation of the Office of Nuclear Reactor Regulation, Oconee Nuclear Station Standby Shutdown Facility*, dated April 28, 1983.

The structures and mechanical systems required to demonstrate compliance with BTP 9.5-1 and 10 CFR 50, Appendix R, are identified by reviewing the Oconee-specific documents addressing each topic. A structure or mechanical system is within the scope of license renewal when a portion is relied upon for compliance with the NRC fire protection regulations.

2.2.2.2 Environmental Qualification (EQ)

Section 54.4(a)(3) requires that all systems and structures relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with §50.49, the NRC regulation governing environmental qualification, be included within the scope of license renewal. A master list of all equipment contained in the Environmental Qualification (EQ) Program has been compiled for each of the Oconee units. The identification of structures and mechanical systems containing environmentally qualified equipment required a review of the components in the EQ list.

Based upon a review of these documents, Duke determined that no Oconee structures are required to demonstrate compliance with the environmental qualification requirements in §54.4(a)(3). Furthermore, no systems at Keowee Hydroelectric Station or the Standby Shutdown Facility contain EQ equipment.

2.2.2.3 Pressurized Thermal Shock (PTS)

Section 54.4(a)(3) requires that all systems, structures, and components relied upon in safety analyses or plant evaluations to demonstrate compliance with §50.61, the NRC regulation governing pressurized thermal shock, be included within the scope of license renewal. Pressurized thermal shock [Footnote 3] is a phenomenon limited to the reactor vessel in the Reactor Coolant System. The identification of mechanical systems relied on to demonstrate compliance with §50.61, other than the Reactor Coolant System, required a review of docketed licensing correspondence.

Duke determined that the only mechanical system required to demonstrate compliance with §50.61 is the Reactor Coolant System. None of the Oconee reactor vessels will exceed the PTS screening criteria during their current operating licenses. Therefore, no systems or components other than the reactor vessels are required to comply with §50.61. Since the vessels are a part of the Reactor Coolant System, the Reactor Coolant System is within the scope of license renewal.

Oconee structures are not required to demonstrate compliance with §50.61. If future Pressurized Thermal Shock analyses require the addition of other systems and components to comply with §50.61, these systems and components will be evaluated in accordance with the regulatory requirements in effect at that time.

3. Pressurized Thermal Shock is an Oconee time-limited aging analysis which is evaluated in Section 5.4.2 of OLRP-1001.

2.2.2.4 Anticipated Transient Without Scram (ATWS)

Section 54.4(a)(3) requires that all systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with §50.62, the NRC regulation governing anticipated transient without scram, are required to be included within the scope of license renewal. The Duke response to this regulation was the installation at Oconee of a dual-purpose control system as outlined in §50.62. Although this is not a mechanical system, it monitors and actuates mechanical systems. Oconee installed the Diverse Scram System and the ATWS Mitigation System Actuation Circuitry to address the requirements of this regulation. Systems that provide input into this control system or respond to an output of this control system are part of the commitment to §50.62 and are within the scope of license renewal.

Duke reviewed the design of these systems to identify structures and mechanical systems relied upon to demonstrate compliance with §50.62. This review identified the required Oconee mechanical systems. However, structures or mechanical systems at Keowee or the Standby Shutdown Facility are not required to demonstrate compliance with the ATWS requirements in §54.4(a)(3).

2.2.2.5 Station Blackout

Section 54.4(a)(3) requires that all systems, structures, and components relied upon in safety analyses or plant evaluations to demonstrate compliance with §50.63, the NRC regulation governing station blackout, be included within the scope of license renewal.

The Duke response to §50.63 for Oconee was approved by an NRC Safety Evaluation Report (SER) dated March 10, 1992, and NRC Supplemental SER dated December 3, 1992 [References 2.2-7 and 2.2-8]. Oconee complies with §50.63 by conforming to NUMARC Report 8700 and Nuclear Regulatory Guide 1.155. The equipment relied upon to comply with this regulation is within the scope of license renewal. Based upon a review of these documents, as well as other Oconee-specific documents, Duke identified the structures required to demonstrate compliance with the station blackout requirements in §54.4(a)(3) and their intended functions.

The mechanical systems relied upon to meet the requirements of station blackout were included as a part of the Oconee design study discussed in Section 2.2.1.1 (a). Mechanical systems at Keowee Hydroelectric station are not required for station blackout.

2.2.3 RESULTS

The Reactor Building (Containment) has been determined to be within the scope of license renewal and subject to aging management review; it is described in Section 2.3 of OLRP-1001. All other Oconee, Keowee, and Standby Shutdown Facility structures that have been determined to be within the scope of license renewal and subject to aging management review are listed and described in Section 2.7 of OLRP-1001. The intended functions of the Reactor Building and other Oconee structures are listed in Sections 2.3 and 2.7, respectively.

The Reactor Coolant System has been determined to be within the scope of license renewal and subject to aging management review; it is described in Section 2.4 of OLRP-1001. All other Oconee, Keowee, and Standby Shutdown Facility mechanical systems, or portions thereof, which have been determined to be within the scope of license renewal and subject to aging management review are listed and described in Section 2.5 of OLRP-1001. The intended functions of the Reactor Coolant System and other Oconee mechanical systems are listed in Sections 2.4 and 2.5, respectively.

The Oconee, Keowee, and Standby Shutdown Facility electrical components that are included in the aging management review, along with their intended functions, are listed and identified in Section 2.6 of OLRP-1001.

2.2.4 References for Section 2.2

2.2-1. *NEI 95-10 Revision 0, Industry Guideline for Implementing the Requirements of 10 CFR Part 54--The License Renewal Rule,* Nuclear Energy Institute, March 1996.

2.2-2 *Draft Regulatory Guide; Issuance, Availability*, 61 Federal Register 43792, August 26, 1996.

2.2-3 OLRP-1002, *Oconee License Renewal Flow Diagrams,* Duke Energy, transmitted by W. R. McCollum (Duke) letter dated July 1, 1998 to Document Control Desk (NRC), Docket Nos. 50-269, 50-270, 50-287.

2.2-4. *Oconee Nuclear Station, Updated Final Safety Analysis Report,* as revised.

2.2-5. *10 CFR Part 50 - General Design Criteria for Nuclear Power Plants*, Appendix A, Criteria 3, Fire Protection.

2.2-6. 10 CFR Part 50 Appendix R - *Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979.*

2.2-7. L. A. Weins (NRC) letter dated March 10, 1992 to J. W. Hampton (Duke), *Safety Evaluation for Station Blackout (10 CFR 50.63) - Oconee Nuclear Station, Units 1, 2, and 3 (TACS M68574/M68575/M68576).*

2.2-8. L. A. Weins (NRC) letter dated December 3, 1992 to J. W. Hampton (Duke), *Supplemental Safety Evaluation for Station Blackout (10 CFR 50.63) - Oconee Nuclear Station, Units 1, 2, and 3 (TACS M68574/M68575/M68576).*

2.3 REACTOR BUILDING (CONTAINMENT) STRUCTURAL COMPONENTS

2.3.1 DESCRIPTION OF THE PROCESS TO IDENTIFY REACTOR BUILDING CONTAINMENT) STRUCTURAL COMPONENTS

The determination of Oconee structures within the scope of license renewal is made by initially identifying all Oconee structures and then reviewing each structure to determine which ones satisfy one or more of the criteria contained in §54.4. This process is described in Section 2.2 of OLRP-1001. Section 2.3 contains the information required by §§54.21(a)(1) and (a)(2) for the Oconee Reactor Building (Containment) structural components that are subject to aging management review for license renewal.

The Oconee Reactor Buildings are identified as Class 1 structures in the Oconee UFSAR [Reference 2.3-1, Section 3.8]. Class 1 structures are those which prevent uncontrolled release of radioactivity and are designed to withstand all loadings without loss of function. Accordingly, Class 1 structures have been determined to meet the intent of §54.4(a)(1) and are within the scope of license renewal. Therefore, the Oconee Reactor Buildings are within the scope of license renewal. A portion of the Reactor Building, the Containment, serves as an important element in the radioactive release line-of-defense and therefore receives special focus in the integrated plant assessment. The Containment includes the concrete Containment structure, liner, and all penetrations. This section of OLRP-1001 covers the Containment. The interior structures of the Reactor Building are addressed in Section 2.7 of OLRP-1001.

The intended functions of the Containment were determined by reviewing information contained in the Oconee UFSAR [Reference 2.3-1, Section 3.8] and Oconee engineering documents, as well as NEI 95-10, Revision 0 [Reference 2.3-2, Section 4.1, Table 4.1-1]. These functions are listed in Table 2.3-1.

Each Oconee Containment is a composite structure consisting of a post-tensioned, reinforced concrete structure with cylindrical wall, a flat foundation slab, and a shallow dome roof. An illustration of the Oconee prestressed concrete Containment is shown in Figure 2.3-1. The Containment completely encloses the reactor and the associated Reactor Coolant System along with other vital electrical, mechanical and structural components. The cylinder wall integrity is provided by a post-tensioning system consisting of horizontal and vertical tendons in the cylinder wall. The dome integrity is provided by three sets of tendons, each set oriented 120 degrees from the other. The concrete foundation slab is conventionally reinforced. The entire structure is internally lined with a steel liner plate to assure a high degree of leaktightness. The principal dimensions of the Containments are provided in the UFSAR [Reference 2.3-1, Chapter 3.8 and Figure 3-19].

The Containment structure is subdivided into component groupings in preparation for the aging management review. Many structural components are not typically associated with unique equipment identifiers and thus are not individually identified during the identification of components subject to aging management review. Specific structural component identifiers are not needed because the aging management review process and any resulting programmatic oversight will be performed across an entire component grouping.

A list of Containment structural components was developed based upon a review of NUMARC PWR Containment Industry Report [Reference 2.3-3], NEI 95-10, Revision 0, Appendix B [Reference 2.3-2], and Oconee specific documents. The functions of each of the Containment structural components were determined by reviewing information contained in the Oconee UFSAR [Reference 2.3-1], Oconee engineering documents, as well as NEI 95-10, Revision 0 [Reference 2.3-2, Section 4.1, Table 4.1-1]. These functions are the same as the Containment functions and serve to provide specific component-level focus which will be needed for the component aging management review. Components which do not perform an intended function are not within the scope of license renewal. The list of Containment component groups within the scope of 10 CFR Part 54 and their intended functions is provided in Table 2.3-2. This list has been derived from individual Containment components identified in Oconee specific documents maintained onsite.

The Oconee Containment structural components within the scope of 10 CFR Part 54 were reviewed to determine those components which are subject to aging management review in accordance with §54.21(a)(1). The aging management review of a structural component is directly related to whether the component performs an intended function without moving parts or without a change in configuration or properties (i.e., passive) and whether it is subject to replacement based on a qualified life or specified time period (i.e., long-lived). Consistent with the guidance provided in NEI 95-10, Revision 0 [Reference 2.3-2, Section 4.1], the Containment structural components within the scope of the Rule are long-lived and passive and will require an aging management review.

The Containment structural components have been divided into three groups based on material of construction and component-level function. These component groups are described in the following sections.

2.3.2 CONCRETE COMPONENTS

2.3.2.1 Dome and Cylinder Walls

The reinforced concrete dome and cylinder walls are prestressed by a post-tensioning system, as shown in Figure 2.3-2. The combined strength provided by the concrete, conventional reinforcing steel, and the post-tensioning system is used to satisfy the design loads. Although these three material components act together as one composite system, the post-tensioning system is addressed as a separate component because it is installed and stressed after the reinforced concrete components are complete and because of the unique tendon surveillance program.

Conventional reinforcing is provided near the surface of the cylinder walls and dome primarily to resist local moment and shear loads at discontinuities and for temperature and shrinkage crack control. The conventional reinforcing is accounted for in the strength design of the concrete sections for the internal shear forces and moments resulting from the design loadings.

The concrete sections are thickened and the conventional reinforcing steel is increased at the structural discontinuities to account for the increased stresses in those local areas. Primary structural discontinuities occur at the base of the cylinder and at the transition of the cylinder walls and dome to the ring girder. The ring girder serves as the anchorage area for the upper end of the vertical tendons and for both ends of the dome tendons. Six vertical buttresses are provided along the exterior face of the cylinder to serve as the anchorage points for the hoop tendons. The hoop tendons extend for 120 degrees of arc. Supplementary reinforcing steel is provided at tendon anchorage zones to account for the local forces at the anchorages. The concrete cylinder walls are also thickened and additional reinforcing is provided locally at the equipment hatch to account for the flow of forces in the walls around the relatively large diameter opening required for the hatch. Additionally, the concrete dome is coated with silicone rubber on the exterior to protect the dome from weathering conditions.

2.3.2.2 Floor

A reinforced concrete floor is provided in the Containment above the embedded portion of the liner plate to protect the liner plate from punctures and corrosion that could breech the essentially leaktight barrier.

2.3.2.3 Foundation Slab

The conventionally reinforced concrete foundation slab serves as the structural foundation support for the Containment. The vertical tendons extend through the foundation slab thickness and are anchored on the underside of the slab. A reinforced concrete enclosure, the lower tendon access gallery, shown in Figure 2.3-1, is provided at the underside of the foundation slab for access to the lower vertical tendon anchorages for tendon installation and surveillance purposes. The lower tendon access gallery and the foundation slab are constructed of separate concrete pours with horizontal and vertical isolation joints provided. The lower tendon access gallery does not support the intended functions of the Containment and is therefore not within the scope of license renewal.

2.3.3 Steel Components

2.3.3.1 Liner Plate

The interior of the Containment is lined with steel liner plates that are welded together. The liner plate covers the dome, the cylinder wall and also runs between the floor and the foundation slab to form an essentially leaktight barrier. The Oconee Containment liner plate is ASTM A36 or A516 plate attached to the concrete by means of an angle grid system of ASTM A36 material stitch welded to the liner plate and embedded in the concrete. The liner plate is anchored in both the longitudinal and hoop direction. The anchor spacing and welds are designed to preclude failure of an individual anchor. The frequent anchoring is designed to prevent significant distortion of the liner plate during accident conditions and to ensure that the liner maintains its essentially leak tight integrity.

All penetrations were continuously welded to the liner plate before the concrete in which they are embedded was placed. The entire length of every seam was leak tested following fabrication. Radiographs were taken for at least one foot in each fifty feet of welding completed by each welder during fabrication.

The liner plate is coated [Footnote 1] on the inside with inorganic zinc primer and Phenoline 305 for corrosion protection. There is no coating on the side in contact with the concrete. At all penetrations, the liner plate is thickened to reduce stresses in accordance with the ASME Code, 1965 [Reference 2.3-4]. The liner was designed as a free standing vessel for erection loads including use of the liner as the internal form for the concrete. The liner plate is thickened at large attachments such as the polar crane brackets to accommodate strength and welding requirements for the attachment and anchorage. The general liner configuration is shown in Figure 2.3-2.

ASME Section III [Reference 2.3-4] is used as the basis for establishing allowable liner plate strains and stresses. ASME Section III requires that the liner material be prevented from experiencing significant distortion due to thermal loads and that stresses be considered from a fatigue standpoint.

1. The Oconee Coatings Program is described in Chapter 4 of OLRP-1001.

2.3.3.2 Anchors/Embedments/Attachments

Anchors/embedments are steel commodities, such as angles and anchor studs, that are welded to the liner and serve to anchor the liner to the Containment concrete shell. The liner anchors are shown in Section 1-1 of Figure 2.3-2. In addition, other anchors/embedments are provided that serve to transfer loads into the concrete cylinder wall or foundation mat from attachments to the liner. Figure 2.3-3 provides a detail of the anchors for major equipment. In these cases a thickened insert plate is welded to the liner and is used as the point of attachment for the anchorages. The polar crane bracket as shown in Figure 2.3-2 is anchored to the concrete shell by a welded plate assembly that is embedded in the concrete.

The anchors/embedments serve to maintain the essentially leaktight barrier by preserving the integrity of the liner. The structural integrity of the liner insert part of other anchorages, such as shown in Figure 2.3-3, is also necessary to maintain the essentially leaktight barrier of the liner. The load carrying capacity of these anchorages is also required to assure that the supported equipment, such as the polar crane or the steam generators, can continue to perform safely as required.

Attachments to the liner that are integral with the liner and concrete structure (i.e., attachment has corresponding anchor in concrete), include those equipment or system supports that are connected to the inside face of the liner and thus exposed to the interior of the Containment. The polar crane brackets are examples of attachments to the liner. These attachments are shown in Figure 2.3-2. The polar crane brackets consist of welded carbon steel plate construction of the same material and fabrication, and were inspected using similar requirements for the liner. Other miscellaneous attachments to the liner include structural steel attachments which are welded directly to the liner to support various structures and components.

Attachment welds are not considered to be within the evaluation boundary of the Reactor Building (Containment). However, these attachment welds are considered to be within the evaluation boundary of Reactor Building internal structural components which are addressed in Section 2.7.7 of OLRP-1001. [Footnote 2]

2. This section has been revised to supplement the initial Duke response to RAI 2.3-4 which was provided by Duke letter dated January 14, 1998. The initial Duke response to RAI 2.3-4 was discussed during a meeting with the NRC staff on April 29, 1998.

2.3.3.3 Personnel Hatch

Two hatches are provided into each Containment for personnel access and egress (See Figure 2.3-4). The larger personnel hatch is used as the primary access point into the Containment. The smaller personnel hatch is used for emergency egress.

The personnel hatch consists of a double-door, welded steel assembly. The hatch is designed to withstand all Containment design conditions with either or both doors closed and locked. The doors open toward the center of the Containment which prevents unseating of the door during Containment pressurization. The personnel hatch may be individually pressurized to demonstrate leaktightness. Quick acting equalizing valves connect the personnel hatch with the interior and exterior of the Containment for the purposes of equalizing pressure between the two systems when entering or leaving the Containment. The equalizing valves are active components of the hatches and do not require an aging management review. Functionality of the equalizing valves is verified periodically when the hatches are pressurized and tested for leakage.

The personnel hatches contain operating mechanisms, which include gears, latches, hinges, linkages, etc. which operate to open and close the doors of the hatch to allow passage into and out of Containment. These operating mechanisms perform their intended function with moving parts and with a change of configuration. Operation of the hatches is governed by Oconee ITS 3.6.3, *Containment Air Locks.* Both the personnel hatch and the emergency hatch are required to be operable in Modes 1, 2, 3, and 4 (as define by Improved Technical Specifications). Surveillance requirements are also included in ITS 3.6.2. Actions are required to be taken up to and including plant shutdown in the event one or more of the hatch doors become inoperable. Furthermore, the Statement of Considerations of the final Part 54 rule states that:

> … many licensee programs that ensure compliance with technical specifications are based on surveillance activities that monitor performance of systems, structures, and components that perform active functions. As a result of the continued applicability of existing programs and regulatory requirements, the Commission believes that active functions of systems, structures, and components will be reasonably assured in any period of extended operation.

Accordingly, because the hatch operating mechanisms perform their intended functions with moving parts and a change of configuration, and because §54.21(a)(1)(i) states that:

> structures and components subject to an aging management review shall encompass those structures and components that perform an intended function, as described in §54.4, without moving parts or without a change in configuration or properties…

Duke has determined that the Containment hatch operating mechanisms are not subject to an aging management review. [Footnote 3]

The two personnel hatch doors are interlocked to prevent both being opened simultaneously and to ensure that containment integrity is always maintained by one door being completely closed before the other door can be opened. The interlocking system has the capability to be bypassed allowing the doors to be left open during plant cold shutdown. The interlock system is also an active component of the personnel hatch and is not within the scope of this report. Serviceability of the interlock system is verified during periodic personnel hatch leakage testing as well as during the periodic maintenance.

Each personnel hatch door is provided with flexible seals. The exterior door is provided with double seals to allow for local leakage testing between the seals. The seals are replaced when warranted by their condition. The seals are not long-lived components and therefore do not require an aging management review.

Hatches are designed and fabricated in accordance with the ASME Section III requirements for Class B vessels [Reference 2.3-4].

The plate materials that comprise the personnel hatch pressure vessel components are painted carbon steel complying with ASME material specification A-516, Grade 70, made to ASTM A300 specification, for fine grained materials with ductile material properties suitable for low temperature use.

2.3.3.4 Equipment Hatch

A single equipment hatch as shown in Figure 2.3-5 is provided for each of the Containments. The equipment hatch design and fabrication conform to the ASME Code [Reference 2.3-4] for Class B vessels. As with the personnel hatches, the equipment hatch is fabricated using A-516 Grade 70, painted carbon steel made to ASTM A300 specification.

3. This section has been revised to supplement the initial Duke response to RAI 3.3-9 which was provided by Duke letter dated January 14, 1998. The initial Duke response to RAI 3.3-9 was discussed during a meeting with the NRC staff on April 29, 1998.

The equipment hatch is furnished with a double sealed flange and bolted, dished head. The barrel portion of the equipment hatch is thicker than required based on permissible stresses. The space between the double seals on the equipment hatch flange can be pressurized for local leakage testing. As with the personnel hatches, the flexible seals are tested and replaced when warranted by condition. The seals are not long-lived, passive components and do not require an aging management review.

2.3.3.5 Mechanical Penetrations

All penetrations through the Containment pressure boundary are designed to maintain the essentially leaktight barrier to prevent uncontrolled release of radioactivity. In addition to supporting the essentially leaktight barrier function, each penetration performs service related functions depending on the particular type of penetration. Penetrations may also serve as support points for systems such as piping passing through the Containment boundary.

Penetration plate and sleeve material is ASTM A516 Grade 70 material. The plate material is also fabricated to firebox quality and ASTM A300 [Reference 2.3-5].

Mechanical penetrations provide the means for passage of process piping transmitting liquids or gases across the Containment boundary. A typical mechanical piping penetration is shown in Figure 2.3-6 which shows a single barrier piping penetration with a single closure between the process pipe and the Containment liner. The penetrations are solidly anchored to the Containment wall or foundation slab precluding any requirements for expansion bellows. In accordance with the design requirement of ASME Section III, piping penetration reinforcing plates and the weldment of the pipe closure to it were stress relieved, UFSAR [Reference 2.3-1, Section 3.8.1.4.5].

The mechanical penetration boundaries for this report include the entire penetration assembly including the weld to the process piping but exclusive of the process piping within the penetration. Penetrations are designed to maintain the adjacent concrete within an acceptable temperature range. Bellows are not installed in Containment penetrations at Oconee. The Containment evaluation boundary is shown on Figure 2.3-6. [Footnote 4]

Spare penetrations consist of a sleeve with welded end cap closure(s) or bolted blind flange plate(s) with gaskets at both ends of the penetration sleeve. Spare penetrations can readily be converted during an outage into additional permanent mechanical or electrical

4. This section has been revised to supplement the initial Duke response to RAI 3.3-3 which was provided by Duke letter dated January 14, 1998. The initial Duke response to RAI 3.3-3 was discussed during a meeting with the NRC staff on April 29, 1998.

penetrations, if required, during the life of the plant. The entire spare penetration assembly is included in the boundary of this report.

The Containment sump penetrations provide passage of the Low Pressure Injection System (LPI) and Containment spray piping across the Containment boundary. The LPI system serves to remove heat from the Containment in the event of an accident. The sump penetration detail is shown in Figure 2.3-7. During normal operation, the inside end of the sump piping is open. The Containment evaluation boundary is shown in Figure 2.3-7 is at the weld to the inside end of the piping excluding the piping.

2.3.3.6 Electrical Penetrations

Electrical penetrations provide the means for electrical and instrumentation conductors to cross the Containment boundary while maintaining the essentially leaktight barrier.
An electrical penetration through the Containment is shown in Figure 2.3-8. The scope of the evaluation in this section includes all metallic components of the electrical penetration that are part of the Containment essentially leaktight barrier. The inside steel header plate for the electrical terminals are included in the scope. The wiring, sealing compound, fixtures to hold the sealing compound, and seal welds of the fixtures to the header plate are addressed in Environmental Qualification reports. The associated electrical wiring and sealing materials addressed in the Environmental Qualification reports will be addressed separately in Section 5.6 of OLRP-1001. The electrical penetration evaluation boundary is shown in Figure 2.3-8.

2.3.3.7 Fuel Transfer Tube

Two fuel transfer tubes penetrate the Containment and link the refueling canal inside the Containment with the fuel transfer canal in the fuel handling building. They serve as the underwater pathway for moving the fuel assemblies into and out of the Containments as part of the refueling operations occurring during plant shutdown. As part of the Containments, the tubes must assure the essentially leaktight barrier function for the design basis conditions.

The fuel transfer tube arrangement through the Containment is shown in Figure 2.3-9. As shown in the figure, the closure between the transfer tube and the sleeve that is integrally welded to the Containment liner, consists of a circular plate shop welded to the tube and a short segment of pipe to mate with the sleeve. During normal operation, a blind flange is in place on the fuel transfer tube penetration and serves as part of the Containment essentially leaktight barrier. Closure on the Fuel Handling Building end outside of the Containment consists of a gate valve supported from the end of the transfer tube.

The boundary of this report includes the closure detail between the Containment liner and the transfer tube as shown in Figure 2.3-9. The transfer tube, blind flange, and gate valve are part of the spent fuel pool system and are not within the scope of this report. The transfer tube, blind flange, gate valve and other spent fuel pool cooling system components are addressed in Sections 2.5 and 3.5 of this report.

2.3.4 POST-TENSIONING SYSTEM

For information, an elevation section of the Oconee Containment is provided in Figure 2.3-2 which shows the orientation of the tendons. A section of a typical post-tensioned tendon assembly is also shown in Figure 2.3-10.

The Containment cylinder wall is prestressed by 176 vertical tendons anchored at the top surface of the upper ring girder at the top of the concrete cylinder and at the bottom of the foundation slab and six groups of 105 hoop tendons plus two additional tendons enclosing 120° of arc for a total of 632 tendons anchored at the six vertical buttresses. The dome is prestressed by three groups of 54 tendons oriented at 120° to each other for a total of 162 tendons anchored at the vertical face of the upper ring girder. Each tendon consists of 90 wires bundled together. The design of the tendon system provides for the loss of any three adjacent tendons in any of the groups without significantly affecting the load carrying capacity of the Containment. Conduits and bearing plates are cast into the concrete shell to receive the tendons which are installed after construction of the reinforced concrete is complete. The tendons are continuous from anchorage to anchorage, being deflected around penetrations.

A tendon assembly consisting of the buttonheaded tendon wires (Birkenmeier Brandestinin Ros Vogt or BBRV system), anchorage and conduit is shown in Figure 2.3-10. The BBRV system uses parallel wires with cold-formed buttonheads at the ends which bear upon a perforated steel anchor head, thus providing a positive mechanical means for transferring the prestress force into the concrete shell. Extensive prototypical static, dynamic, and low-temperature testing have been performed on the BBRV anchorage system to assure that the ultimate capacity of the tendons can be developed. This testing is described in detail in the Oconee UFSAR [Reference 2.3-1]. The testing and evaluation of tendon prestress as a function of time is a TLAA and is discussed in Section 3.3 of this report.

The post-tensioning system is the primary means of satisfying the controlling design loads of the structure, although the conventional mild steel reinforcing is taken into account when checking representative sections of the structure internal forces and moments resulting from the load combinations. The tendon stress remains in the elastic range for the controlling design load combinations.

2.3.5 References for Section 2.3

2.3-1. *Oconee Nuclear Station, Updated Final Safety Analysis Report,* as revised.

2.3-2. *NEI 95-10, Revision 0, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule,* Nuclear Energy Institute, March 1996.

2.3-3. *Pressurized Water Reactor Containment Structures License Renewal Industry Report*, NUMARC Report Number 90-01, Nuclear Management and Resources Council, Revision 1, September 1991.

2.3-4. ASME Boiler and Pressure Vessel Code, Section III, "Nuclear Vessels," 1965.

2.3-5. ASA N6.2-1965, "Safety Standard for the Design, Fabrication and Maintenance of Steel Containment Structures for Stationary Nuclear Power Reactors."

Table 2.3-1 Reactor Building (Containment) Intended Functions

1. Provides essentially leaktight barrier to prevent uncontrolled release of radioactivity.
2. Provides structural and/or functional support to safety related systems, structures, and components. More specifically for the post-tensioning systems, this function means to impose compressive forces on the concrete containment structure to resist the internal pressure resulting from a design basis accident with no loss of structural integrity.
3. Provides shelter/protection to safety related systems, structures, and components (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Serves as an external missile barrier.
6. Provides structural and/or functional support to non-safety related systems, structures, and components where failure of this structure could directly prevent satisfactory accomplishment of any of the required safety related functions.
7. Provides heat sink during design basis accidents or station blackout.

Table 2.3-2 Reactor Building (Containment) Structural Components and Their Intended Functions

Key: Structural function numbers identified in table correspond to functions listed following the table. Shaded cells indicate that the component is not required to perform an intended function.

	Intended Functions (Identified in the note below)						
	1	2	3	4	5	6	7
Concrete Components							
Cylinder Wall		2	3	4	5	6	7
Dome		2	3		5	6	7
Floor		2	3		5	6	7
Foundation Slab		2	3		5	6	7
Steel Components							
Anchorage/Embedments/Attachments	1	2				6	
Electrical Penetrations	1						
Emergency Personnel Hatch	1						
Equipment Hatch	1						
Fuel Transfer Tubes	1						
Liner Plate	1						7
Mechanical Penetrations	1	2					
Personnel Hatch	1						
Post Tensioning System							
Tendon Wires		2					
Tendon Anchorage		2					

Reactor Building Containment Component Intended Functions:

1. Provides essentially leaktight barrier to prevent uncontrolled release of radioactivity.
2. Provides structural and/or functional support to safety-related SSCs. More specifically for the post-tensioning system, this function means to impose compressive forces on the concrete containment structure to resist the internal pressure resulting from a design basis accident with no loss of structural integrity.
3. Provides shelter/protection to safety-related SSCs (including radiation protection).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Serves as external missile barrier.
6. Provides structural and/or functional support to non-safety related SSCs where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
7. Provides heat sink during design basis accidents or station blackout.

Figure 2.3-1 Oconee Prestressed Concrete Containment

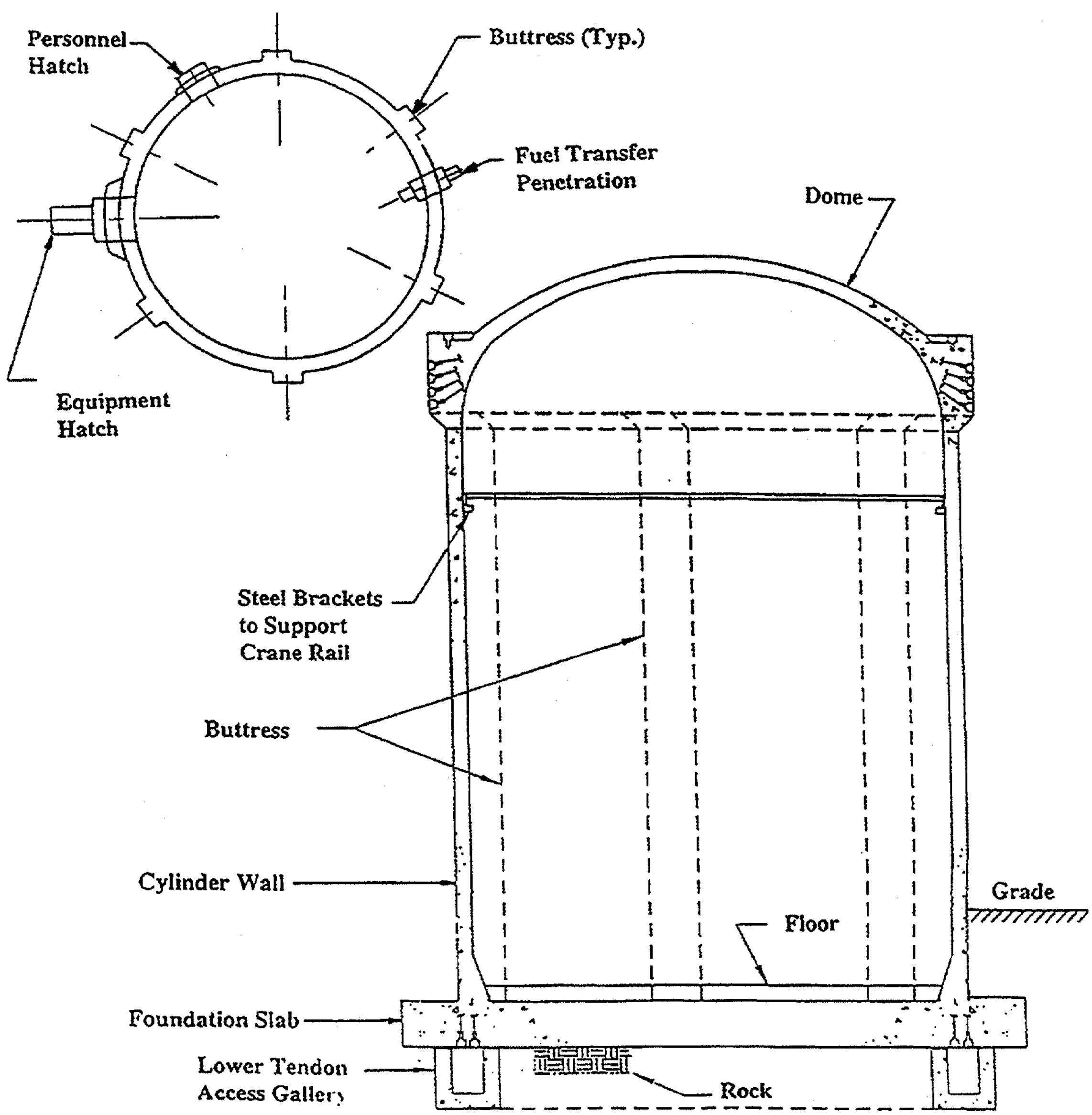


Figure 2.3-2 Containment - Tendon Locations

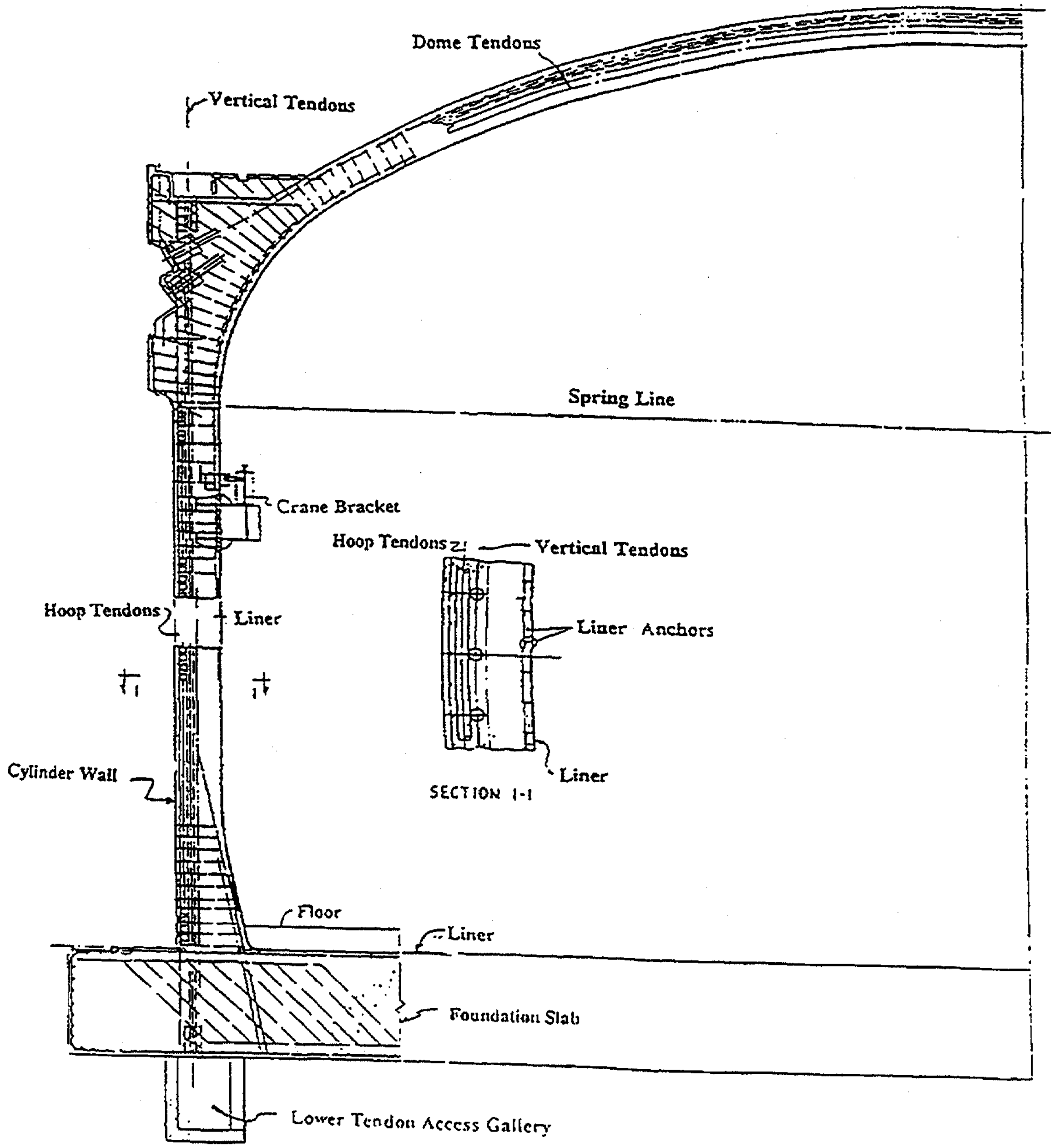


Figure 2.3-3 Attachments - Anchorages Across Liner

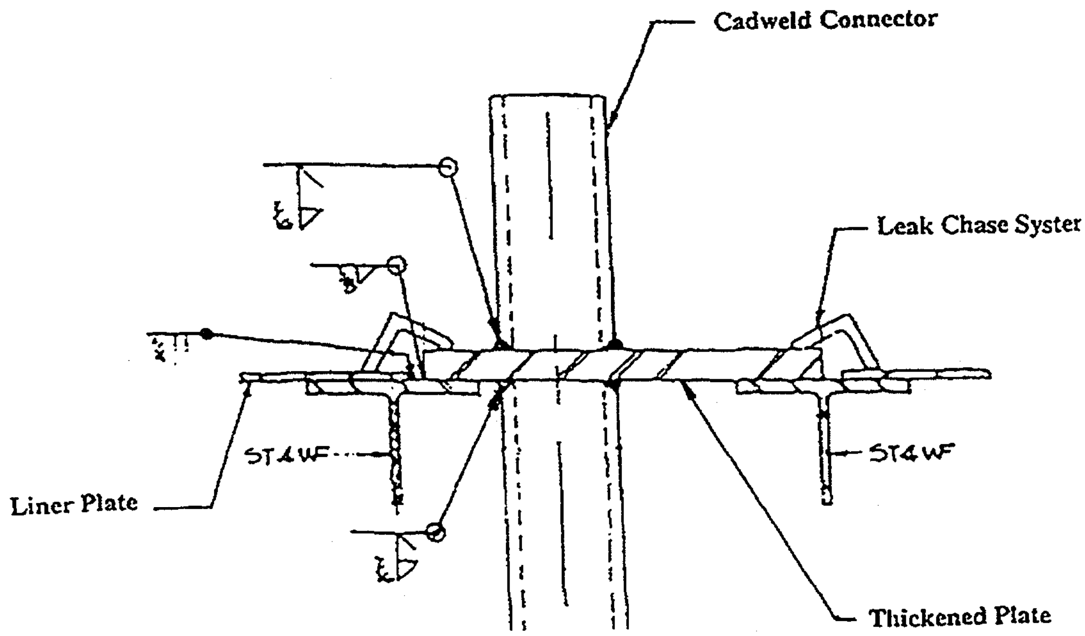


Figure 2.3-4 Personnel Hatch

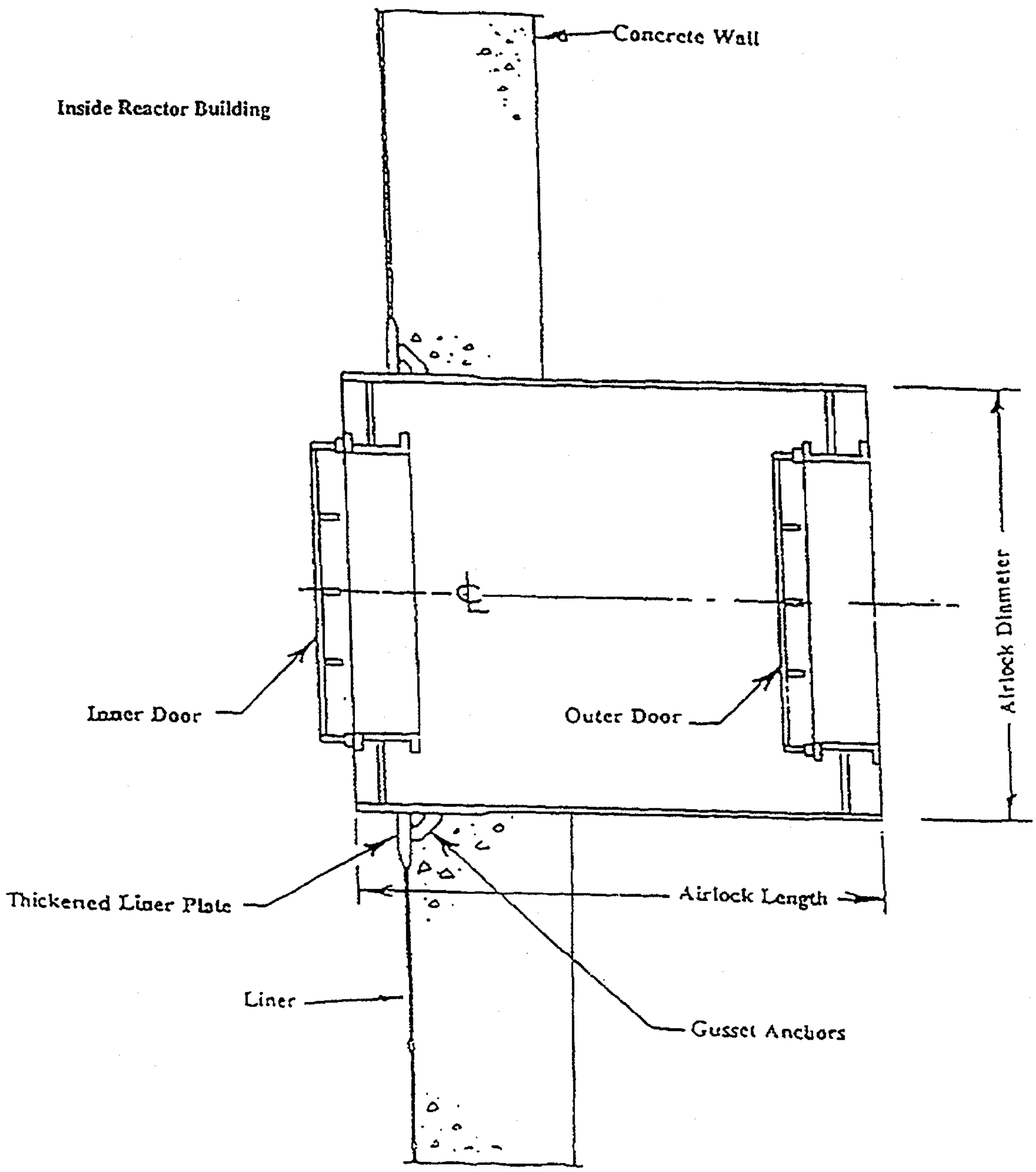


Figure 2.3-5 Equipment Hatch

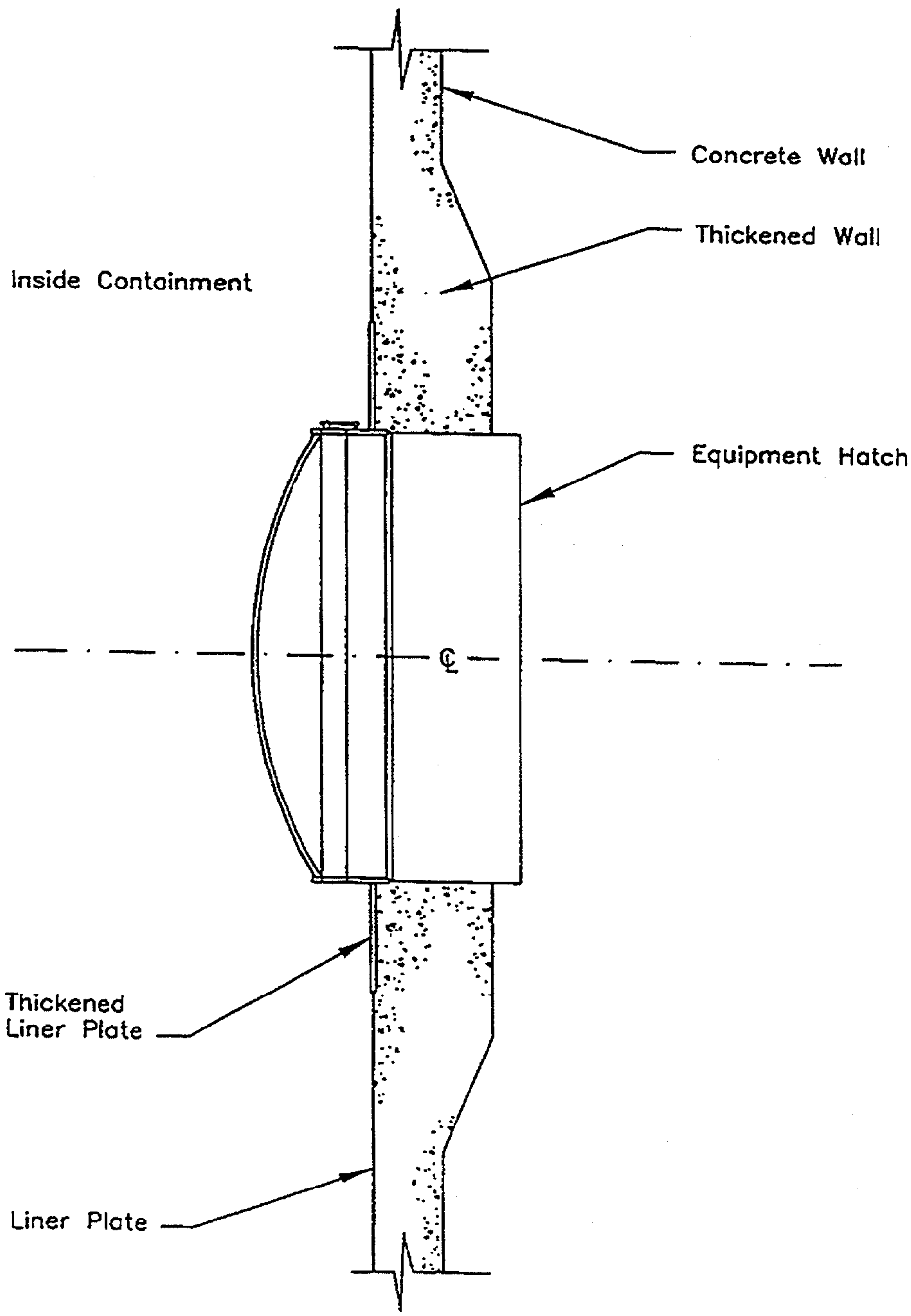


Figure 2.3-6 Mechanical Penetrations - Single Barrier

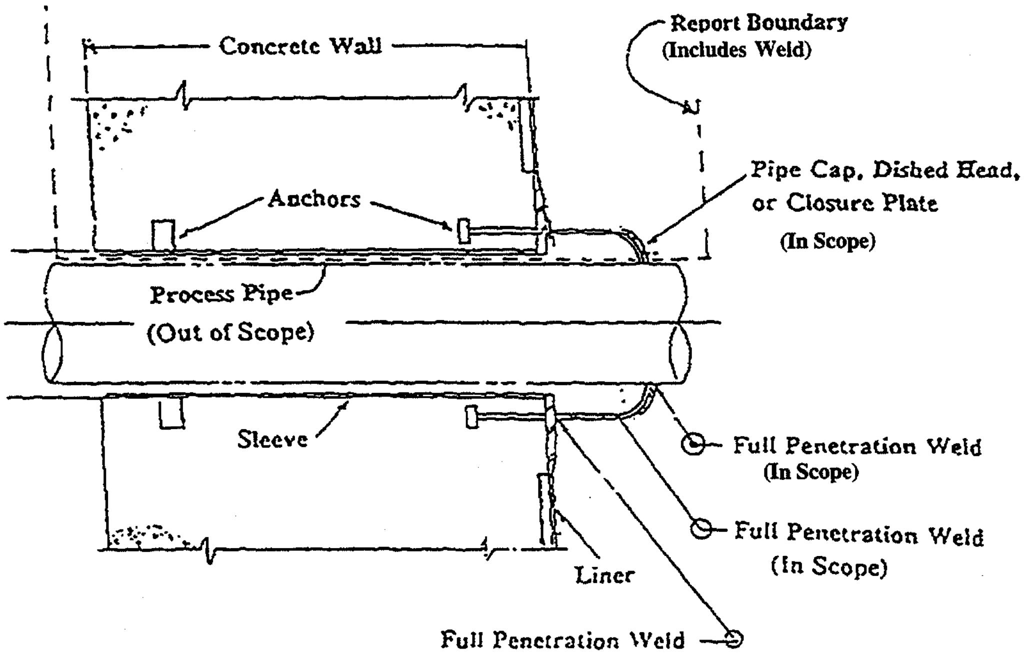


Figure 2.3-7 Sump Penetration

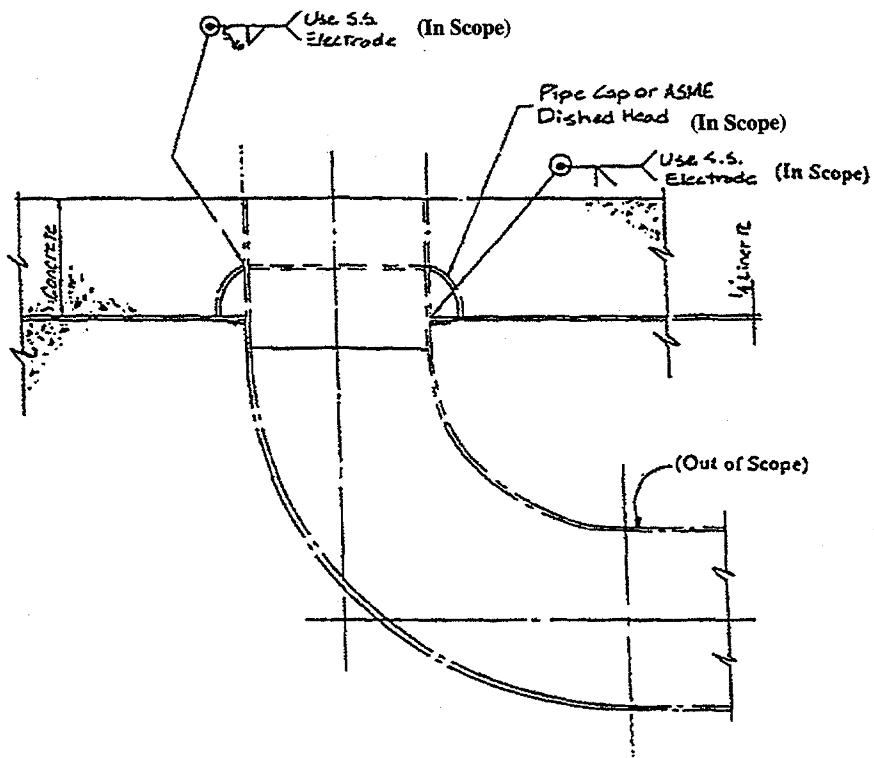


Figure 2.3-8 Electrical Penetration

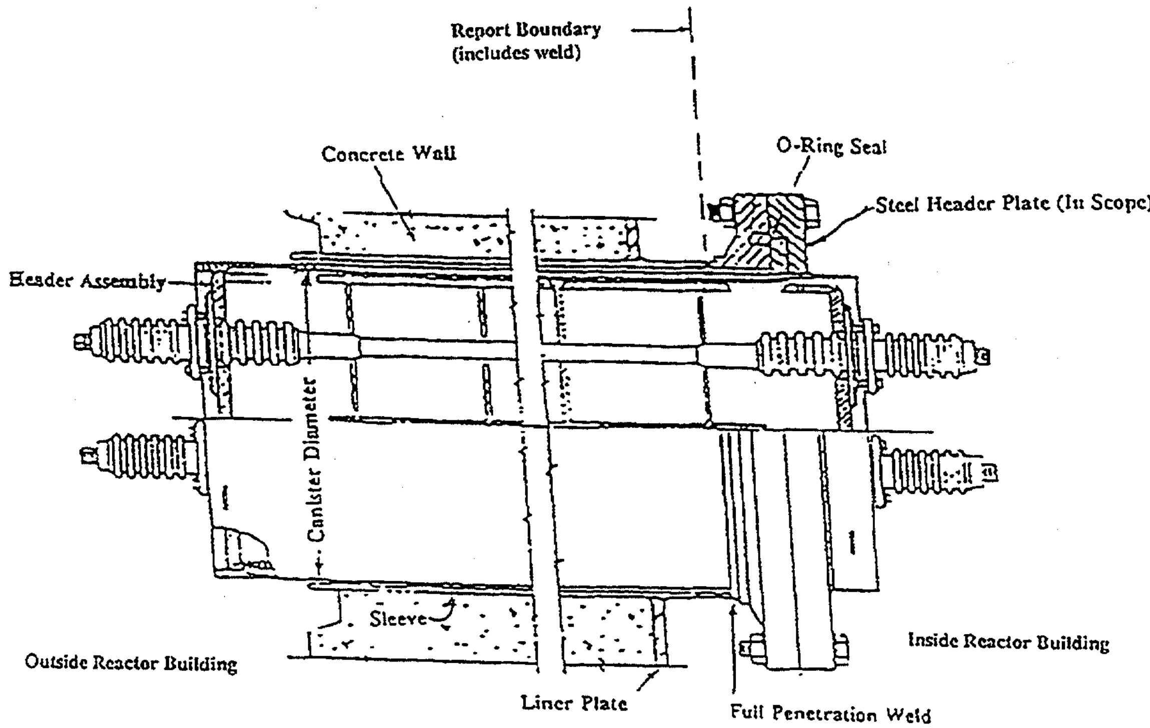


Figure 2.3-9 Fuel Transfer Tube Penetration

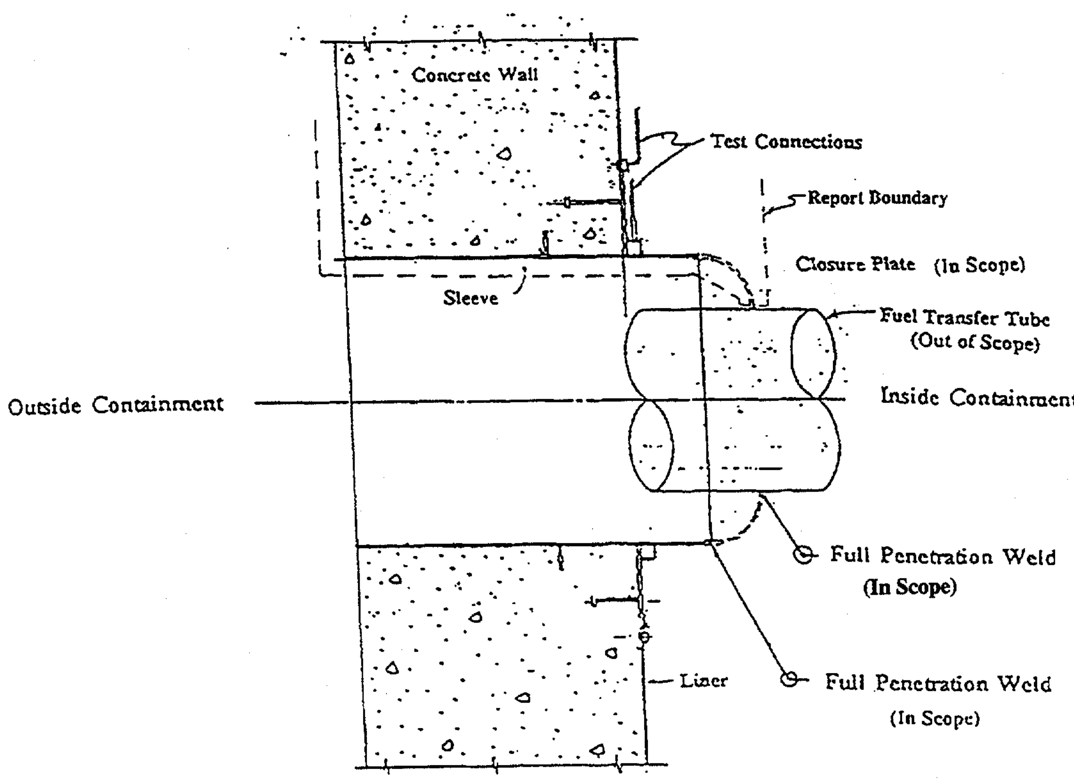
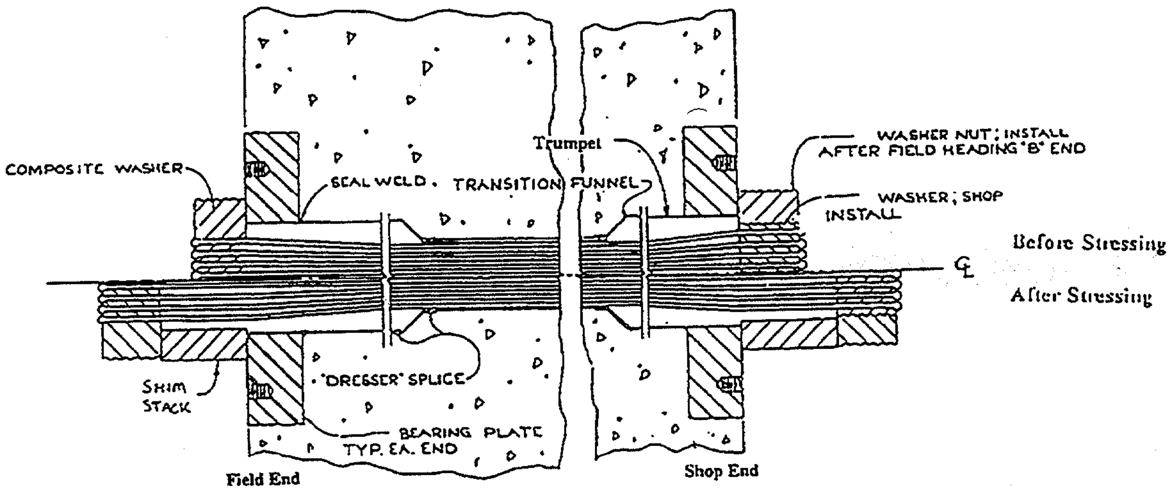


Figure 2.3-10 Typical Post-Tensioned Tendon Assembly



2.4 REACTOR COOLANT SYSTEM MECHANICAL COMPONENTS AND CLASS 1 COMPONENT SUPPORTS

2.4.1 DESCRIPTION OF THE PROCESS TO IDENTIFY REACTOR COOLANT SYSTEM COMPONENTS AND CLASS 1 COMPONENT SUPPORTS SUBJECT TO AGING MANAGEMENT REVIEW

The determination of Oconee mechanical systems within the scope of license renewal is made by initially identifying all Oconee mechanical systems and then reviewing them to determine which ones satisfy one or more of the criteria contained in §54.4. This process is described in Section 2.2 of OLRP-1001. Section 2.4 contains the information required by §§54.21(a)(1) and (a)(2) for the Oconee Reactor Coolant System components that are subject to aging management review for license renewal.

The Oconee Reactor Coolant System is within the scope of license renewal because it is relied upon to remain functional during and following design bases events, and is relied upon to perform a function that demonstrates compliance with the NRC regulations for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout in safety analyses or plant evaluations. Reactor Coolant System components are designed to maintain their functional integrity during seismic events.

The list of those Reactor Coolant System components that are subject to aging management review was made by reviewing Oconee flow diagrams for the Reactor Coolant System and marking the Duke ISI [Footnote 1] Class A boundary. For the purpose of license renewal, Class A ISI and Class 1 are hereafter equivalent. Evaluation boundaries for the portions of the Reactor Coolant System that are within the scope of license renewal (e.g., §54.4) are shown on the flow diagrams listed in Table 2.4-1 and provided in OLRP-1002 [Reference 2.4-1].

The Reactor Coolant System mechanical components subject to aging management review were identified by reviewing the following documentation: marked-up Oconee flow diagrams, Chapters 3.0, 4.0 and 5.0 of the Oconee UFSAR [Reference 2.4-2], and Oconee design documents. Reactor Coolant System mechanical components subject to aging management review include B&W designed vessels (i.e., reactor vessel and control rod drive mechanism pressure boundary, pressurizer, and once through steam generator) and reactor vessel internals, reactor coolant pumps, and all Oconee Class 1 piping and valves. Oconee Class 1 piping includes B&W-supplied piping (i.e., main coolant, pressurizer surge, pressurizer spray, and incore monitoring system) and Bechtel-supplied piping (i.e.,

1. ISI = Inservice Inspection

vents, drains, instrumentation lines, and Class 1 portions of ancillary systems attached to the B&W scope of supply and the reactor coolant pumps). Ancillary systems include low pressure injection, core flood, high pressure injection, and chemical addition. In addition to pressure retaining items, reactor vessel internals and Reactor Coolant System Class 1 component supports are subject to aging management review.

The Class 1 Reactor Coolant System boundary extends to either the first or second isolation valve within the Bechtel-supplied piping attached to the B&W scope of supply. Bechtel-supplied piping includes vent lines, drain lines, instrumentation lines, and ancillary system piping. Ancillary system piping includes low pressure injection/core flood injection, decay heat drop line (including dump-to-sump), high pressure injection (emergency injection and normal makeup), high pressure injection letdown piping, and chemical addition and sampling piping.

In addition, Class 1 Reactor Coolant System component supports that support Class 1 mechanical components and that are subject to aging management review include Reactor Coolant System Class 1 piping supports, pressurizer support plate assemblies and support frame assembly, reactor vessel support skirt, control rod drive service structure, once through steam generator support skirt, once through steam generator upper lateral support structure, and reactor coolant pump lateral and vertical support assemblies.

Other Reactor Coolant System components that are within the scope of license renewal include the non-Class 1 instrumentation tubing, piping, valves and the non-Class 1 reactor coolant pump oil collection system. These are addressed in Section 2.5 of OLRP-1001.

Supports for the letdown heat exchanger, the non-Class 1 instrumentation tubing, piping, and valves and the non-Class 1 reactor coolant pump oil collection system are addressed in Section 2.7 of OLRP-1001.

The B&W-supplied vessels were designed in accordance with ASME Section III, 1965 Edition, with Addenda through the Summer of 1967. Reactor coolant pumps were designed in accordance with ASME Section III, 1965 Edition, with Addenda through Summer 1967; however, the pumps were not code stamped. Oconee Reactor Coolant System piping supplied by B&W was designed to Nuclear Piping Code, USAS B31.7 Class I; this classification corresponds to Regulatory Guide 1.26 Class 1 and Duke Piping Class A. Bechtel-supplied piping was designed to Nuclear Piping Code, USAS B31.7, Class II. This classification corresponds to Duke Piping Class AC, which is Class 1 in material, fabrication, and erection, but Class 2 in design. The design of the reactor vessel internals meets the intent of ASME Section III with qualification of the design accomplished through a combination of analysis and testing. Class 1 component supports were designed to either ASME Section III, 1965 Edition, with Addenda through 1967, or the AISC Manual of Steel Construction. Additional descriptions of the Oconee reactor coolant system components are contained in the Oconee UFSAR, Chapters 3, 4 and 5 [Reference 2.4-2].

Component intended functions have been determined based on a review of the Oconee UFSAR and design documents. Components within the boundary of the Reactor Coolant System that perform their intended functions without moving parts or without a change in configuration or properties are listed in Table 2.4-4, along with the intended functions they must maintain. The method used to determine the Reactor Coolant System structures and components subject to aging management review is consistent with the guidance contained in NEI 95-10, Revision 0 [Reference 2.4-3, Section 4.1].

Duke actively participated in a B&W Owners Group (B&WOG) effort that developed a series of topical reports whose purpose was to demonstrate that the aging effects for Reactor Coolant System components are adequately managed for the period of extended operation. The following is a list of the B&WOG topical reports applicable to the Reactor Coolant System at Oconee that have been submitted to the NRC:

- BAW-2243A , Reactor Coolant System Piping [Reference 2.4-4] (submitted and approved by the NRC)

- BAW-2244A, Pressurizer [Reference 2.4-5] (submitted and approved by NRC)

- BAW-2251, Reactor Vessel [Reference 2.4-6] (submitted, under review by the NRC as of June 1998)

- BAW-2248, Reactor Vessel Internals [Reference 2.4-7] (submitted, under review by the NRC as of June 1998)

NRC approved reports may be incorporated by reference pursuant to §54.17(e) provided the conditions of approval contained in the safety evaluation of the specific report are met.

Each of the components of the Oconee Reactor Coolant System that are subject to aging management review are described in the following sections.

2.4.2 PROCESS TO INCORPORATE APPROVED B&WOG TOPICAL REPORTS BY REFERENCE

Duke used the following process to incorporate approved B&WOG Topical Reports by reference into OLRP-1001:

(1) **Comparison of the component intended functions for the Reactor Coolant System components under review.** The Oconee-specific component screening review first identifies the component intended functions and then compares these functions to those identified in the generic B&WOG Topical Reports. Differences are noted and justification for the variances provided.

(2) **Identification of the items that are subject to aging management review.** Oconee drawings and pertinent design and field change data are reviewed. The process establishes the full extent to which the scope of the generic B&WOG Topical Reports bound the Oconee Reactor Coolant System components.

(3) **Identification of the applicable aging effects**. An independent assessment of the applicable aging effects is performed by reviewing plant operating environment, operating stresses (qualitative), and plant-specific operating experience. This reveals potential aging effects not identified in the generic B&WOG Topical Reports. Aging effects for items that are determined to be subject to aging management review that were not identified in the generic B&WOG Topical Reports are evaluated.

The results of performing Steps (1) and (2) are provided in Section 2.4 of OLRP-1001, while the results of performing Step (3) are provided in Section 3.4 of this report.

2.4.3 Reactor Coolant System Piping

For Oconee, the following components are within the reactor coolant pressure boundary: reactor vessel, once-through steam generators (primary side), pressurizer, reactor coolant pump, main coolant piping and portions of systems attached to these components. The attached systems that contain Class 1 components include the Core Flood System, High Pressure Injection System, Low Pressure Injection System, and Chemical Addition System. In addition, vents, drains, and instrumentation lines also contain Class 1 components. The non-Class 1 portions of all of these attached systems are addressed in Section 2.5 of this report. Reactor coolant system piping includes piping (including fittings, branch connections, safe ends, and thermal sleeves); valve bodies (pressure retaining parts of Reactor Coolant System isolation/boundary valves); and bolted closures and connections. Additional descriptions of the Oconee Reactor Coolant System piping are contained in the Oconee UFSAR [Reference 2.4-2, Section 5.4.3].

Non-Class 1 portions of the Reactor Coolant System are included in the following sections of OLRP-1001:

Section 2.5.5.1 - Core Flood
Section 2.5.5.2 - High Pressure Injection
Section 2.5.7.1 - Chemical Addition
Section 2.5.4.9 - Nitrogen Purge and Blanket

As noted in Section 2.4.1, one of the B&WOG topical reports that has been approved by the NRC for use by applicants for a renewed operating license is BAW-2243A [Reference 2.4-4]. As a result of NRC review of this report, several Renewal Applicant Action Items were identified. These Action Items are described in Section 4.1 of the Safety Evaluation issued by the NRC concerning BAW-2243A [Reference 2.4-8]. The Oconee-specific responses to these Action Items relevant to the identification of Reactor Coolant System piping components subject to aging management review are provided in Table 2.4-1.

2.4.4 PRESSURIZER

The pressurizer is a vertical cylindrical vessel with a bottom surge line penetration connected to the hotleg piping by the surge line piping. The pressurizer contains electric heaters in its lower section and a water spray nozzle in its upper section. Since all sources of heat in the Reactor Coolant System are interconnected by piping with no intervening isolation valves, relief protection is provided on the pressurizer. Overpressure protection consists of two code safety valves and one power operated relief valve. Piping attached to the pressurizer is Class 1 up to and including the first isolation valve and is discussed in Section 2.4.3 of OLRP-1001. Additional descriptions of the Oconee pressurizer are contained in the Oconee UFSAR [Reference 2.4-2, Section 5.4.6] and BAW-2244A [Reference 2.4-5]. The pressurizer is shown on Figure 2.4-1. Pressurizer supports are addressed in Section 2.4.11.2.

The following items support the Oconee pressurizer spray function but are not within the scope of BAW-2244A: spray line piping (stainless steel pipe and stainless steel fittings) and spray head (cast austenitic stainless steel).

As noted previously in Section 2.4.1, one of the B&WOG topical reports that has been approved by the NRC for use by applicants for a renewed operating license is BAW-2244A. As a result of NRC review of this report, several Renewal Applicant Action Items were identified. These Action Items are described in Section 4.1 of the Safety Evaluation issued by the NRC concerning BAW-2243A [Reference 2.4-9]. The Oconee-specific responses to the Renewal Applicant Action Items relevant to the pressurizer are provided in Table 2.4-3 Renewal Applicant Action Items Associated with BAW-2244A.

2.4.5 REACTOR VESSEL

The reactor vessel consists of the cylindrical vessel shell, lower vessel head, closure head, nozzles, interior attachments and all associated pressure retaining bolting. Coolant enters the reactor through the inlet nozzles, passes down through the annulus between the thermal shield and vessel inside wall, reverses at the lower head, passes up through the core, turns around through the plenum assembly, and leaves the reactor vessel through the outlet nozzles. The reactor vessels for Units 1, 2, and 3 are shown on Figures 2.4-2, 2.4-3, and 2.4-4, respectively.

The reactor vessel has two outlet nozzles through which the coolant is transported to the steam generators and four inlet nozzles, through which coolant enters the reactor vessel from the discharge of the reactor coolant pumps. Two smaller nozzles located between the inlet nozzles serve as inlets for decay heat removal and emergency core cooling water injection. The reactor vessel is vented through the control rod drives. Instrumentation nozzles penetrate the lower vessel head. Piping attached to the reactor vessel is discussed in Section 2.4.3 of OLRP-1001. The reactor vessel support skirt is addressed in Section 2.4.11.3.

Control rod drive mechanisms are attached to flanged nozzles which penetrate the closure head. The control rod drive mechanisms are not within the scope of license renewal; however, the control rod drive motor tube housings are subject to aging management review and are discussed in Section 2.4.9 of OLRP-1001. Additional descriptions of the Oconee reactor vessels are contained in the Oconee UFSAR, Section 5.3 [Reference 2.4-2] and BAW-2251 [Reference 2.4-6].

As noted previously in Section 2.4.1, one of the B&WOG topical reports that is currently under NRC review is BAW-2251. Duke has reviewed the current design and operation of the Oconee reactor vessels using the process described in Section 2.4.1 and has confirmed that they are bounded by the description contained in BAW-2251.

2.4.6 Reactor Vessel Internals

The reactor vessel internals consist of two structural subassemblies that are normally located within the reactor vessel. The reactor vessel internals can be removed during refueling outages when necessary. These two subassemblies of the internals are the plenum assembly and the core support assembly. Descriptions of the reactor vessel internals for Oconee are contained in BAW-2248 [Reference 2.4-7] and in the Oconee UFSAR [Reference 2.4-2, Section 4.5]. The reactor vessel internals are shown on Figure 2.4-5.

As noted previously in Section 2.4.1, one of the B&WOG topical reports that is currently under NRC review is BAW-2248. Duke has reviewed the current design and operation of the Oconee reactor vessel internals using the process described in Sections 2.4.1 and 2.4.2, and has determined that they are bounded by the description contained in BAW-2248, with the exception of the thermal shield and thermal shield upper restraint.

The thermal shield and thermal shield upper restraint were omitted from the generic report; however, these items support an Oconee reactor vessel internals intended function and are subject to aging management review. The thermal shield surrounds the core barrel and is constructed of austenitic stainless steel. The thermal shield upper restraint is also constructed of austenitic stainless steel. The aging effects evaluation of the thermal shield and thermal shield upper restraint is contained in Chapter 3.4.6 of OLRP-1001.

2.4.7 Once Through Steam Generators

Each Oconee unit has two once through steam generators. Each is a vertical, straight tube, once through, counterflow, shell-and-tube heat exchanger with shell-side boiling. The steam generator consists of upper and lower hemispherical heads welded to tubesheets that are separated by a seven-course shell assembly. Over 15,000 straight Alloy 600 tubes are held in alignment by fifteen tube support plates. The once through steam generator is shown on Figure 2.4-6.

Primary coolant from the reactor enters the steam generator through a single inlet nozzle in the top of the upper head. Coolant flows downward through the straight parallel tubes, is cooled by the secondary coolant on the shell side, and then exits through two outlet nozzles in the lower head.

Secondary coolant enters through a ring of ports that penetrate the shell approximately midway up the shell assembly. The feedwater travels downward through an annulus between the lower baffle and the shell. Near the lower tubesheet the feedwater turns inward, and then flows upward around the tubes and through the tube support plates. As the feedwater absorbs heat from the primary coolant, it boils and then becomes superheated. The dry steam exits the steam generator through two steam outlet nozzles just above the feedwater inlet ports.

Once through steam generator items that are subject to aging management review include the hemispherical heads, secondary shell, tubes, plugs, mechanical sleeves, tubesheets, primary nozzles, main and auxiliary feedwater nozzles, steam outlet nozzles, instrumentation nozzles, drain nozzles, all associated pressure retaining bolting, and integral attachments inspected in accordance with ASME Section XI, Subsections IWB and IWC. Class 1 Reactor Coolant System piping attached to the primary once through steam generators nozzles, including the welded joints, is addressed in Section 2.4.3. Secondary piping attached to the once through steam generators nozzles, including the main and auxiliary feedwater headers and riser piping, is addressed in Section 2.5.9, “Steam and Power Conversion Systems” in OLRP-1001. The steam generator supports are addressed in Section 2.4.11.5.

Once through steam generator items fabricated from low-alloy steel include the hemispherical heads, tubesheets, and pressure retaining bolting. Items fabricated from carbon steel include primary inlet and exit nozzles, secondary shell, secondary outlet nozzles, primary and secondary manway covers, secondary hand hole covers, secondary vent and level sensing nozzles, and main and auxiliary feedwater nozzles. Items fabricated from Alloy 600 include the primary drain nozzle, nozzle dam support rings, tubes, plugs, sleeves, and secondary temperature sensing connections.

The once through steam generators were designed as Class A vessels in accordance with ASME B&PV Code Section III "Rules for Construction of Nuclear Vessels," 1965 Edition, with Addenda through Summer of 1967, using Section II "Materials Specifications" and Section IX "Welder Qualifications."

2.4.8 REACTOR COOLANT PUMPS

The reactor coolant pump provides the head required to transport the reactor coolant through the reactor core, piping and steam generators. All four reactor coolant pumps of each Oconee unit are required during normal operation. The four reactor coolant pumps installed on Oconee Unit 1 are Westinghouse Model 93A, while those installed on Oconee Units 2 and 3 are Bingham. The reactor coolant pumps were designed, fabricated, tested, and inspected as Class A vessels in accordance with ASME Section III 1965 Edition and Summer 1967 Addendum [Reference 2.4-12]. The reactor coolant pumps were not code stamped.

The reactor coolant pump items that are subject to aging management review include the casing, cover, and associated pressure-retaining bolting. Non-class 1 piping, flexhose, instrumentation, and similar components attached to the reactor coolant pump are addressed in Section 2.5. Class 1 piping connected to the pump, including the welded joints, are not within the scope of this report and are included in Section 2.4.3. The portion of the reactor coolant pump rotating element above the pump coupling, the electric motor, and the flywheel are not subject to aging management review in accordance with §54.21(a)(1).

The reactor coolant pump casings include not only the casings themselves, but also the bolted closures and connections. These are constructed of stainless steel, except for the pressure retaining bolting which is fabricated from low-alloy steel.

The upper and lower halves of the Westinghouse pump casings are cast austenitic stainless steel joined using electroslag welding. In addition, the Westinghouse pump casings received two heat treatment cycles. The first was a solution annealing where the pump casing halves were furnace heated to approximately 2020-2050°F, held for a specified period of time, and then water quenched. The second heat treatment was a stabilizing treatment in which the welded pump casing was heated to approximately 740-760°F, held for a specified period of time, and then air cooled.

The Bingham pump casing is a cast austenitic stainless steel design that utilizes a quad-volute inner case permanently welded to a pressure containing outer case. Electroslag welding was used to make the circumferential butt weld which joins the upper and lower halves of the outer casing. This weld was performed in accordance with ASME Code Case 1355-2, which permits electroslag welding of Class A pressure vessels. The pump casing received two heat treatment cycles. The first was a solution annealing treatment where the pump casing halves were furnace heated to approximately 1900-2050°F, held for a specified period of time, and then water quenched. The second heat treatment was a stabilizing treatment in which the welded pump casing was heated to approximately 750°F for a specified period of time and then air cooled.

The pump cover is a generic term used to describe the pressure-retaining closure to the pump casing. The cast austenitic stainless steel cover (stuffing box for Bingham pumps) serves as a housing for the mechanical seals, radial bearing, thermal barrier, and recirculating impeller for the Sulzer-Bingham pumps. The cover is clamped between the carbon steel driver mount (motor stand for Sulzer-Bingham pumps) and the stainless steel pump casing. The main flange serves as the cover for the Westinghouse design. The Westinghouse cover closure includes the main flange, thermal barrier, and pump casing.

Bolting used to secure the cover to the case includes cover-to-case studs and nuts for the Westinghouse and Sulzer-Bingham designs. All cover-to-case studs are greater than 2 inches in diameter and are fabricated from low-alloy steel. Bolting used to secure the seal housing and/or seal glands to the cover includes studs and nuts that secure the upper seal gland to the stuffing box in the Sulzer-Bingham design, and cap screws used to secure the lower seal housing to main flange in the Westinghouse design. These bolting materials are less than 2 inches in diameter and are fabricated from low alloy-steel and martensitic stainless steel.

Each reactor coolant pump is supported by the cold leg piping during all modes of operation; the weight of each reactor coolant pump motor is supported by two vertical constant load supports. The piping and heat exchangers attached to the reactor coolant pump are discussed in Section 2.4.3 of OLRP-1001. Additional descriptions of the Oconee reactor coolant pumps are contained in Oconee UFSAR [Reference 2.4-2, Section 5.4.1]. A drawing of the Unit 1 reactor coolant pump design is contained in the Oconee UFSAR [Reference 2.4-2, Figure 5-17]. A drawing of the reactor coolant pumps for Units 2 and 3 is provided in the Oconee UFSAR [Reference 2.4-2, Figure 5-19].

2.4.9 CONTROL ROD DRIVE MECHANISM MOTOR TUBE HOUSINGS

Control rod drive mechanism motor tube housings provide the reactor coolant pressure boundary around the control rod drive mechanisms. During normal operation, the control rod drive mechanism motor tube housings are filled with borated reactor coolant at the system operating pressure. Thermal barriers in the lower motor tube mechanism, the control rod drive mechanism cooling system, and vessel head cooling fans maintain the temperatures in the housings below system temperature.

Control rod drive mechanism motor tube housings were designed, fabricated, tested, and inspected in accordance with ASME Section III 1965 Edition and Summer 1967 Addendum [Reference 2.4-12]. The material of construction is stainless steel or Alloy 82/182 clad low-alloy steel (motor tube center section only for Type A and B drives).

Two different designs of control rod drive mechanisms are currently in use at Oconee: Type A at Oconee Units 1 and 2, and Type C at Oconee Unit 3. Control rod drive mechanisms themselves are active and not considered to be subject to aging management review for license renewal.

2.4.10 LETDOWN COOLERS

The letdown coolers are used during normal operation to cool the letdown flow from the Reactor Coolant System to prevent damage to the purification system ion exchange resins. The coolers are of the shell and spiral tube design. Borated water from the Reactor Coolant System is on the tube side and treated water from the Component Cooling system is on the shell side. The tubes, tubesheets, and channel heads in the coolers are stainless steel. The cooler shell is carbon steel. Each unit has two letdown coolers.

2.4.11 CLASS 1 COMPONENT SUPPORTS

The following component supports are included within the Reactor Coolant System evaluation boundary:

- Reactor Coolant System Class1 Piping Supports
- Pressurizer Supports
- Reactor Vessel Support Skirt
- Control Rod Drive Service Structure
- Once Through Steam Generator Supports
- Reactor Coolant Pump Supports

Anchorages and embedments of these structural components are addressed in Sections 2.3.3.2 and 2.7.7 of OLRP-1001.

2.4.11.1 Reactor Coolant System Class 1 Piping Supports

Supports associated with the Reactor Coolant System piping include standard unit pipe supports, LOCA restraints, and snubbers. Snubbers are active and are not subject to aging management review in accordance with §54.21 (a)(1). Pins that are used to connect the snubbers to the piping are addressed in this section of OLRP-1001. Connections of the snubbers to the Reactor Building structure are addressed in Section 2.7 of OLRP-1001.

Reactor Coolant System piping supports provide structural support of the Class 1 piping during seismic events, specifically to provide structural and functional support in accordance with design basis loads. LOCA restraints provide structural support during seismic events and prevent pipe whip in the event of a postulated rupture of a pipe. Piping supports and LOCA restraints may be classified according to the size of the pipe that they support or protect. Class 1 piping supports and LOCA restraints were constructed in accordance with the AISC *Manual of Steel Construction* [Reference 2.4-10].

Class 1 piping greater than 14-inch NPS [Footnote 2] include the 36-inch and 28-inch hot and cold leg piping. The hot and cold leg piping is supported by the once through steam generator and the reactor vessel. Two LOCA restraints surround each hot leg: one at the 90-degree elbow that directs coolant flow to the vertical riser section, and the second that envelops the vertical riser. Each cold leg contains a LOCA restraint at the reactor coolant pump inlet. All LOCA restraints are shimmed such that a gap exists between the restraint and the piping during all modes of operation.

2. NPS = Nominal Pipe Size

Class 1 piping less than or equal to 14-inch NPS includes the decay heat drop line, core flood/decay heat injection lines, pressurizer surge line, pressurizer spray and auxiliary spray lines, high pressure injection/makeup lines, letdown lines, vent and drain lines, instrumentation lines, and incore monitoring system piping. Piping supports associated with these lines (with the exception of the pressurizer surge line which is supported by the hot leg and the pressurizer) include the following standard support units: variable spring hangers, constant load supports, threaded rods with fasteners, pipe clamps, U-bolts, and swing sway braces. Items that support the intended function include the standard support units and the exposed portion of the connection to the building structure.

2.4.11.2 Pressurizer Supports

Pressurizer supports consist of the support plate assemblies, support frame assembly, and a loss-of-coolant accident (LOCA) restraint. The pressurizer support plate assemblies and the support frame assembly provide structural support for the pressurizer. The LOCA restraint minimizes the movement of the pressurizer following a postulated break of the surge line.

Eight support plate assemblies are welded to the exterior shell of the pressurizer and each support plate assembly is bolted to the support frame assembly. The support frame assembly is attached to and supported by the secondary shield wall. In addition, a LOCA restraint surrounds the pressurizer surge nozzle to limit motion of the vessel following a postulated rupture of the pressurizer surge line. The LOCA restraint is hung from the support frame assembly. One end of the LOCA restraint is clamped around the pressurizer surge nozzle and the other end is suspended with its end very close to the secondary shield wall.

The support plate assemblies were fabricated from carbon steel. Structural members that support the intended functions of the support frame assembly and LOCA restraint include beams, brackets, stiffeners, plates, hanger rods, and structural bolting. Support frame and LOCA restraint structural members were fabricated from carbon steel and alloy steel. In addition, the exposed portion of the connection to the building structure is within the scope of this section. The integrity of the connection that transfers the load from the support frame assembly to the secondary shield wall is addressed in Section 2.7 of OLRP-1001.

The support plate assemblies were constructed in accordance with ASME Section III, 1965 Edition, Summer 1967 Addenda [Reference 2.4-12]. The support frame assembly and LOCA restraint were constructed in accordance with the AISC *Manual of Steel Construction* [Reference 2.4-10] and the AEC publication entitled *Nuclear Reactors and Earthquake*, AEC Publication TID 7024 [Reference 2.4-11].

2.4.11.3 Reactor Vessel Support Skirt

The reactor vessel supports include a support skirt and support flange. The reactor vessel support skirt is a cylindrical structure that supports each reactor vessel. The support skirt rests on a sole plate that is supported by a reinforced concrete pedestal and is fixed to the pedestal through a steel flange that is bolted to the pedestal by prestressed bolts. The reactor vessel support skirt is shown on Figure 2.4-7. The evaluation boundary of the reactor vessel support skirt begins at the weld of the skirt to the reactor vessel transition forging and terminates at the bottom of the skirt flange. The evaluation boundary also includes the exposed surface of the anchor bolts and shear pins. The sole plate, grout, and concrete are addressed in Section 2.7 of OLRP-1001.

The reactor vessel support skirt was designed, fabricated, tested, and inspected in accordance with ASME Section III, 1965 Edition, with Addenda through Summer 1967 [Reference 2.4-12]. The support skirt consists of two carbon steel semi-circular rings welded together longitudinally to form a cylinder. This cylinder is welded to the bottom of the reactor vessel transition forging. The cylinder has holes for ventilation of the reactor vessel cavity. The anchor bolts are prestressed to accommodate the loads of a design basis seismic event.

Information on the reactor vessel support skirt is contained in the Oconee UFSAR [Reference 2.4-2, Section 5.4.8].

2.4.11.4 Control Rod Drive Service Structure

The control rod drive service structure is located on top of the reactor vessel and functions to support the control rod drive mechanisms from excessive lateral motion to ensure that the control rods can drop into the core under design basis loading conditions. The control rod drive service structure consists of five major assemblies:

- Lower Control Rod Drive Service Structure Skirt - A slotted carbon steel cylinder that is welded to the upper surface of the reactor vessel closure head. A mating flange is welded to the to skirt and provides a seating surface to which the upper control rod drive service structure is bolted.

- Upper Control Rod Drive Service Structure Skirt - A carbon steel cylindrical shell with a lower flange that connects to the lower control rod drive service structure skirt and an upper flange that connects to the closure head service structure shell flange.

- Closure Head Service Structure Shell - A carbon steel cylinder that is attached to the upper control rod drive service structure skirt and supports the control rod drive service structure platform assembly.

- Control Rod Drive Service Structure Strut Support Assembly - Horizontal carbon steel beams oriented in a radial direction which are welded to the closure head service structure shell on one end and supported on the other by angled beams.

- Control Rod Drive Service Structure Platform Assembly - A horizontal platform made of carbon steel beams that is attached to the top of the closure head service structure shell and the control rod drive service structure strut support assembly. Control rod drive service structure platform assembly restrains the top ends of the control rod drive mechanisms from lateral movement during design basis loadings.

The control rod service structure is shown on Figure 2.4-8. A detail of the attachment of the service structure to the closure head is shown in Figure 2.4-9.

2.4.11.5 Once Through Steam Generator Support Skirt and Upper Lateral Support Structure

Once through steam generator supports that are subject to aging management review include the support skirt and upper lateral support structure. The intended function of the steam generator support skirt is to transfer lateral and vertical loads from the once through steam generator to the reinforced steam generator foundation. The intended function of the upper lateral support structure is to provide support during seismic events or, specifically, to transmit pipe rupture forces and dynamic forces to the secondary concrete shield wall. The once through steam generator support skirt is shown on Figure 2.4-10.

The once through steam generator support skirt consists of a perforated alloy steel cylinder that is welded to a carbon steel support plate. Reinforcement of the joint that connects the cylinder to the support plate is provided through equally-spaced carbon steel gusset plates that are welded to the inside of the cylinder and the support plate. The support plate contains holes that are equally spaced around the support plate. These holes match up with the anchor bolts embedded in the steam generator foundation that supplies the vertical support of the steam generator. The exposed portion of the anchor bolts and nuts that connect the steam generator support skirt to the steam generator foundation is addressed in this section. The imbedded portion of anchor bolts and reinforced concrete that transfers the load from the steam generator support skirt to the steam generator foundation is addressed in Section 2.7 of OLRP-1001.

The steam generator support skirt is attached to the lower steam generator head by means of a rolled low-alloy steel plate transition ring, which is welded to the exterior of the lower head. For Oconee Units 1 and 2 , the support skirt is welded to the transition forging with full penetration welds. The transition ring at Oconee Unit 3 is a low-alloy steel ring forging that is part of the lower head pressure boundary assembly and includes a shaped transition that projects out to accept the support skirt attachment weld.

The upper lateral support structure surrounds each steam generator at the elevation of the upper tube sheet. The structure consists of five lateral support sub-assemblies that are attached to the secondary shield wall at five azimuthal locations surrounding the steam generator. Each subassembly extends from the secondary shield wall to the steam generator, and each subassembly is connected to an adjacent sub-assembly with tie plates (Figure 2.4-11). Attached to the end of each sub-assembly is a spring head that consists of a carbon steel backing plate, carbon steel shims, and a machined lubrite pad fabricated from bridge bearing bronze. The external face of each lubrite pad is concave and faces a convex carbon steel bearing plate that is bolted to the exterior shell of the steam generator. The bearing plates were machined to dimensions for the cold position and the lubrite pads were machined to dimensions for the hot position. The lubrite pads were shimmed in the field to ensure proper fit-up with the bearing plates during cold and hot conditions. The lateral support sub-assemblies and tie plates were fabricated from carbon steel and alloy steel fasteners.

All structural members used to construct the upper lateral support structure, including the exposed portion of the anchor bolts and nuts that connect the upper lateral support sub-assemblies to the secondary shield wall, are subject to aging management review. The integrity of the connection that transfers the load from the upper lateral support to the secondary shield wall is addressed in Section 2.7 of OLRP-1001.

The steam generator support skirt was constructed in accordance with ASME Section III, 1965 Edition, Summer 1967 Addenda [Reference 2.4-12], while the upper lateral support structure was constructed in accordance with the AISC *Manual of Steel Construction* [Reference 2.4-10] and the AEC publication entitled *Nuclear Reactors and Earthquake*, AEC Publication TID 7024 [Reference 2.4-11].

2.4.11.6 Reactor Coolant Pump Supports

Reactor coolant pump supports consist of vertical support assemblies and lateral support assemblies. Two vertical support assemblies are provided for each reactor coolant pump motor. Each vertical assembly consists of: (1) two coated constant load supports; (2) two galvanized rods manufactured from alloy steel; and (3) galvanized washers and nuts that connect the rods to the motor and the constant load support to the rods. The constant load supports are designed to accept the weight of the reactor coolant pump motor at normal operating temperature.

The reactor coolant pump lateral support assemblies include snubbers and turnbuckles. Snubbers are not subject to aging management review in accordance with §54.21(a)(1). However, the pins that connect the snubbers to the pumps and the secondary shield wall are addressed in Section 2.7 of OLRP-1001. Turnbuckles (two per pump) limit lateral displacement of the pump and motor following a postulated loss-of-coolant accident.

2.4.12 References for Section 2.4

2.4-1. OLRP-1002, *Oconee License Renewal Flow Diagrams*, Duke Energy, transmitted by W. R. McCollum (Duke) letter dated July 1, 1998 to Document Control Desk (NRC), Docket Nos. 50-269, 50-270, 50-287.

2.4-2. *Oconee Nuclear Station, Updated Final Safety Analysis Report*, as revised.

2.4-3. *NEI 95-10, Revision 0, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule*, Nuclear Energy Institute, March 1996.

2.4-4. BAW-2243A, *Demonstration of the Management of Aging Effects for the Reactor Coolant System Piping,* The B&W Owners Group Generic License Renewal Program, June 1996.

2.4-5. BAW-2244A, *Demonstration of the Management of Aging Effects for the Pressurizer,* The B&W Owners Group Generic License Renewal Program, December 1997.

2.4-6. BAW-2251, *Demonstration of the Management of Aging Effects for the Reactor Vessel*, The B&W Owners Group Generic License Renewal Program, June 1996.

2.4-7. BAW-2248, *Demonstration of the Management of Aging Effects for the Reactor Vessel Internals,* The B&W Owners Group Generic License Renewal Program, July 1997.

2.4-8. D. M. Crutchfield (NRC) letter dated March 21, 1996 to Don Croneberger (BWOG/GLRP), Acceptance for Referencing of Topical Report BAW-2243A, "Demonstration of the Management of Aging Effect for the Reactor Coolant System Piping."

2.4-9. C. I. Grimes (NRC letter dated November 26, 1997 to D. J. Firth (BWOG/GLRP/FTI), Clarification in the Final Safety Evaluation Report for BAW-2244A, "Demonstration of the Management of Aging Effects for the Pressurizer."

2.4-10. *Manual of Steel Construction*, 6th Edition, American Institute of Steel Construction.

2.4-11. Nuclear Reactors and Earthquake", AEC Publication TID 7024.

2.4-12. ASME Boiler and Pressure Vessel Code, Section III, *Rules for Construction of Nuclear Vessels*, American Society of Mechanical Engineers, 1965 Edition with Addenda through Summer 1967.

Table 2.4-1 Flow Diagrams Indicating Evaluation Boundaries of the Reactor Coolant System

Flow Diagram	Revision	Unit
OLRFD-100A-1.1	0	1
OLRFD-100A-1.2	0	1
OLRFD-100A-1.3	0	1
OLRFD-100A-2.1	0	2
OLRFD-100A-2.2	0	2
OLRFD-100A-2.3	0	2
OLRFD-100A-3.1	0	3
OLRFD-100A-3.2	0	3
OLRFD-100A-3.3	0	3
OLRFD-101A-1.1	0	1
OLRFD-101A-1.4	0	1
OLRFD-101A-2.1	0	2
OLRFD-101A-2.4	0	2
OLRFD-101A-3.1	0	3
OLRFD-101A-3.4	0	3
OLRFD-102A-1.1	0	1
OLRFD-102A-1.2	0	1
OLRFD-102A-1.3	0	1
OLRFD-102A-2.1	0	2
OLRFD-102A-2.2	0	2
OLRFD-102A-2.3	0	2
OLRFD-102A-3.1	0	3
OLRFD-102A-3.2	0	3
OLRFD-102A-3.3	0	3
OLRFP-110A-1.1	0	1
OLRFD-110A-2.1	0	2
OLRFD-110A-3.1	0	3

Table 2.4-2 Renewal Applicant Action Items Associated with BAW-2243A

Renewal Applicant Action Item **(BAW-2243A, Section 4.1)**	**Oconee-Specific Response**
When incorporating the B&WOG topical report in its renewal application, the license renewal applicant is to verify that the plant is bounded by the topical report.	Duke participated in the development of BAW-2243A by providing Oconee-specific design and operational information. Duke has reviewed the current design and operation of the Oconee Reactor Coolant System piping using the process as described in Section 2.4.1 and confirms that this piping is bounded by the description contained in BAW-2243A.
Further, the renewal applicant is to commit to programs described as necessary in the report to manage the effects of aging during the period of extended operation on the functionality of the RCS piping components.	Program descriptions contained in the Oconee UFSAR are considered by Duke to be commitments.
A summary description of these programs is to be provided in the license renewal FSAR supplement in accordance with 10 CFR §54.21(d).	Descriptions of these programs are provided in Exhibit B (UFSAR Supplement) of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.
Any deviations from the aging management programs described within this report as necessary to manage the effects of aging during the period of extended operation to maintain the functionality of RCS piping components or other information presented in the report, such as materials of construction, and edition of the ASME Section XI code (including mandatory appendices), will have to be identified by the renewal applicant and evaluated on a plant specific basis in accordance with 10 CFR §54.21(a)(3).	No deviations from the aging management programs described in BAW-2243A or other information presented in the report have been identified by Duke.

Table 2.4-2 Renewal Applicant Action Items Associated with BAW-2243A (continued)

Renewal Applicant Action Item **(BAW-2243A, Section 4.1)**	**Oconee-Specific Response**
Further, the B&WOG defers the development of details of (1) the inspection of the Alloy 82/182 clad hot leg segment and plant selection for that inspection, and (2) the sample inspection of small bore RCS piping, to the renewal applicant referencing this topical report. The renewal applicant will have to provide details of these two augmented inspection programs in its renewal application for staff review and approval.	Descriptions of these programs are provided in Chapter 4 of OLRP-1001, which is Exhibit A of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.
The B&WOG elected to exclude TLAAs applicable to the RCS piping components from the scope of the topical report and indicated that they will be resolved on a plant specific basis. Thus, any renewal applicant referencing this report will have to evaluate TLAAs applicable to the RCS piping components in its renewal application in accordance with the requirements in 10 CFR §54.21(c).	Evaluations of Oconee-specific TLAAs are provided in Chapter 5 of OLRP-1001, which is Exhibit A of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.
Additionally, since the staff does not make any finding relative to whether the B&WOG report constitutes the complete list of RCS piping components subject to an aging management review or the adequacy of the scoping methodology, the individual applicants will need to identify and list the structures and components subject to an aging management review and a methodology for developing this list as part of their license renewal application.	The list of structures and components of the Reactor Coolant System that are subject to an aging management review is provided in Section 2.4 of OLRP-1001. The identification of individual components are also contained in Oconee specific documents maintained onsite. The methodology for developing and maintaining this list of components is consistent with the guidance contained in NEI 95-10, Revision 0 [Reference , Sections 4.1 and 4.3].

Table 2.4-3 Renewal Applicant Action Items Associated with BAW-2244A

Renewal Applicant Action Item (BAW-2244A, Sections 4.1 and 4.2)	**Oconee-Specific Response**
4.1 Renewal Applicant Action Items When licensees participating in the B&WOG GLRP reference BAW-2244 in their license renewal application, these applicants must address the action items listed below:	
(1) When incorporating the B&WOG topical report in its renewal application, the license renewal applicant is to verify that its plant is bounded by the topical report This includes confirming that the design of the pressurizer is consistent with that described in the report such that no important pressurizer components exist that have not been addressed in the report.	Duke participated in the development of BAW-2244A by providing Oconee-specific design and operational information. Duke has reviewed the current design and operation of the Oconee pressurizers using the process described in Sections 2.4.1 and 2.4.2 and has determined that they are bounded by the description contained in BAW-2244A with the exception of the internal spray line and spray head. The internal spray line and spray head were omitted from the generic report; however, these items are credited with mitigation of a steam generator tube rupture in the Oconee UFSAR and are subject to aging management review. Aging management review of the internal spray line items is addressed in Section 3.4 and Chapter 4 of OLRP-1001.
(2) The renewal applicant is to commit to programs identified as necessary in the report to manage the effects of aging on the functionality of the pressurizer.	Program descriptions contained in the Oconee UFSAR are considered by Duke to be commitments.
(3) A summary description of these programs is to be provided in the license renewal final safety analysis report supplement in accordance with 10 CFR §54.21(d)	Summary descriptions of these programs are provided in Exhibit B of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.

Table 2.4-3 Renewal Applicant Action Items Associated with BAW-2244A (continued)

Renewal Applicant Action Item **(BAW-2244A, Sections 4.1 and 4.2)**	**Oconee-Specific Response**
(4) Any deviations from the aging management programs described within this report as necessary to manage the effects of aging during the period of extended operation to maintain the functionality of the pressurizer or other information presented in the report, such as materials of construction, and edition of the ASME Section XI code (including mandatory appendices), will have to be identified by the renewal applicant and evaluated on a plant specific basis in accordance with 10 CFR §54.21(a)(3).	No deviations from the aging management programs described in BAW-2243A have been identified by Duke. Duke has identified the Oconee internal spray line and spray head as within the scope of license renewal and subject to aging management review.
(5) Since the B&WOG defers the development of details of the additional sample volumetric inspection program of small-bore nozzles and safe ends to the renewal applicant referencing this topical report, the renewal applicant will have to provide details of the additional sample inspection program in its renewal application for staff review and approval.	Descriptions of these programs are provided in Chapter 4 of OLRP-1001, which is Exhibit A of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.
(6) Since the B&WOG elected to exclude TLAAs applicable to the pressurizer from the scope of the topical report and indicated that they will be resolved on a plant-specific basis, any renewal applicant referencing this report will have to evaluate TLAAs applicable to the pressurizer in its renewal application in accordance with the requirements of 10 CFR §54.21(c).	Evaluations of Oconee-specific TLAAs are provided in Chapter 5 of OLRP-1001, which is Exhibit A of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.
4.2 Open Items When licensees participating in the B&WOG GLRP reference BAW-2244 in their license renewal application, these applicants must address the open items listed below:	
(1) Cracking of Stainless Steel Cladding inside the pressurizer vessel (discussed in Section 3.2.1	

Table 2.4-3 Renewal Applicant Action Items Associated with BAW-2244A (continued)

Renewal Applicant Action Item (BAW-2244A, Sections 4.1 and 4.2)	**Oconee-Specific Response**
of this SER) The staff notes that cracking in cladding could potentially propagate into the base metal material and should be addressed by an aging management program. Industry experience at one site has shown that this is a potential aging effect. The staff maintains that cracking of the stainless steel is a potential aging effect that must be addressed by an aging management program for the period of extended operation. A program to provide a reasonable demonstration of the integrity of the pressurizer cladding could be a one-time inspection for license renewal. The inspection should include the cladding and any attachment welds to the cladding. The additional inspection would provide information on the condition of the cladding or, if cracking is discovered, the condition of the underlying base metal as a result of the cracked cladding. The staff notes that the inspection technique chosen (e.g. visual, surface, or volumetric) must be capable of determining the condition of the cladding and must be submitted for staff review and approval. Without such additional aging management program activities, the staff cannot conclude that all aging effects applicable to the pressurizer vessel cladding have been adequately addressed by the aging management programs delineated in BAW-2244.	 Description of this program is provided in Chapter 4 of OLRP-1001, which is Exhibit A of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.
(2) Aging management of pressurizer heater penetration welds (discussed in Section 3.3.2.2.3 of this SER) The staff regards the provision for examination of pressurizer heater penetration welds in ASME Code, Section XI, ISI Examination Category B-E as applicable to pressurizer heater	Description of this program is provided in Chapter 4 of OLRP-1001, which is Exhibit A of the Application for Renewal Operating Licenses, Oconee Nuclear Station Units 1, 2, and 3.

Table 2.4-3 Renewal Applicant Action Items Associated with BAW-2244A (continued)

Renewal Applicant Action Item (BAW-2244A, Sections 4.1 and 4.2)	Oconee-Specific Response
partial-penetration welds. The B&WOG considers the Examination Category B-E requirement not applicable to the B&W design because Examination Category B-E concerns pressure-retaining partial-penetration welds in vessels. The B&WOG stated that, "Although the 'Parts Examined' listing under Item B4.20 of Examination Category B-E uses the term 'Heater Penetration Welds,' the 'Extent and Frequency of Examination' specifically requires only 'All Nozzles' to have examination." "There are no heater penetration nozzles or pressure-retaining heater nozzle partial-penetration welds in the vessels of the B&W pressurizer design." The staff disagrees with the B&WOG assessment. The B&W pressurizer heaters are inserted through holes in the pressurizer heater bundle diaphragm plates and the heater sheaths (or heater sleeves at ONS-1 and TMI-1) are attached to the diaphragm plates on the inside by partial-penetration welds. The staff does not believe that the B&W heater penetrations are sufficiently different from other vendor designs, except that the B&W heaters are mounted horizontally on the diaphragm plates inserted through the side of the pressurizer shell, while other vendor designs mount the heaters vertically, inserted through the bottom of the pressurizer. In addition, Examination Category B-E explicitly states that the pressurizer heater penetration welds are to be examined. Therefore, the staff considers the pressurizer heater partial-penetration welds pressure-retaining, and subject to the requirements set forth in ASME Code, Section XI, ISI Examination Category B-E. Operating experience has also shown that pressurizer heater partial-penetration welds are	

Table 2.4-3 Renewal Applicant Action Items Associated with BAW-2244A (continued)

Renewal Applicant Action Item (BAW-2244A, Sections 4.1 and 4.2)	**Oconee-Specific Response**
susceptible to cracking. To provide reasonable assurance that cracking of the heater penetration welds and the heater sheath-to-sleeve welds (ONS-1 and TMI-1) will be managed during the period of extended operation, the staff is requesting an additional, more intrusive inspection technique. Specifically, the staff will consider ASME Code, Section XI, ISI Examination Category B-E together with an inspection program consisting of surface examinations (the criteria and technique of which would be developed at a later date and subject to staff approval) for the pressurizer partial-penetration heater sheath-to-heater bundle diaphragm plate welds, heater sleeve-to-heater bundle diaphragm plates welds and heater sheath-to-heater sleeve welds acceptable for managing the effects of cracking for the period of extended operations.	

Table 2.4-4 Reactor Coolant System Components and Their Intended Functions

Component	Intended Function(s)
Reactor Coolant System Piping (Class 1)	Maintain primary pressure boundary so the Reactor Coolant System can perform its system functions.
Pressurizer	Maintain primary pressure boundary so the Reactor Coolant System can perform its system functions. Provide Reactor Coolant System pressure control [Footnote 1].
Reactor Vessel	Maintain the reactor vessel pressure boundary. Provide structural support for the reactor vessel internals and the reactor core.
Reactor Vessel Internals	Provide support and orientation of the reactor core. Provide support, orientation, guidance, and protection of the control rod assemblies. Provide a passageway for the distribution for the reactor coolant flow to the reactor core. Provide a passageway for support, guidance, and protection for incore instrumentation. Provide a secondary core support for limiting the core support structure downward displacement. Provide gamma and neutron shielding. [Footnote 2]

1 The pressure control function was not identified as an intended function in BAW-2244A.
2 Provide gamma and neutron shielding was not identified as an intended function in BAW-2248.

Table 2.4-4 Reactor Coolant System Components and Their Intended Functions (continued)

Component	Intended Function(s)
Once Through Steam Generator	Maintain primary pressure boundary so the Reactor Coolant System can perform its system functions Provide decay heat removal under design basis conditions.
Reactor Coolant Pumps	Maintain primary pressure boundary so the Reactor Coolant System can perform its system functions.
Control Rod Drive Motor Tube Housings	Maintain primary pressure boundary so the Reactor Coolant System can perform its system functions.
Letdown Coolers	Maintain primary pressure boundary so the Reactor Coolant System can perform its system functions.
Class 1 Component Supports	
Reactor Coolant Piping Supports	Provide support to the Class 1 components during design basis events.
Pressurizer Supports	Provide support to the Class 1 components during design basis events.
Reactor Vessel Support Skirt	Provide support to the Class 1 components during design basis events.
Control Rod Drive Service Structure	Provide lateral support for the top of the control rod drive mechanisms so that proper alignment is maintained and control rod insertion into the core will be achieved.
Once Through Steam Generator Supports	Provide support to the Class 1 components during design basis events.
Reactor Coolant Pump Supports	Provides structural and/or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any safety-related function.

Figure 2.4-1 Pressurizer

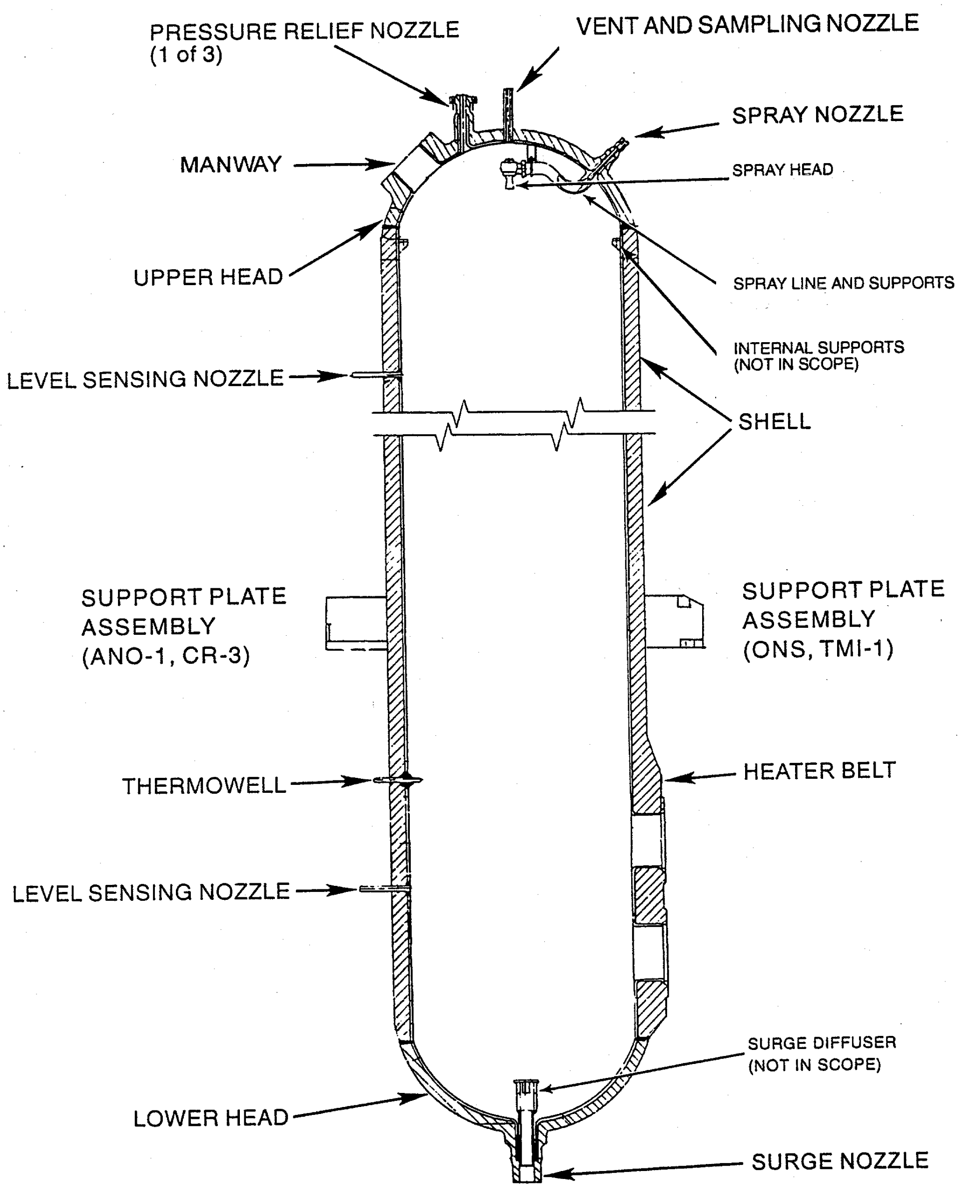


Figure 2.4-2 Reactor Vessel, Unit 1

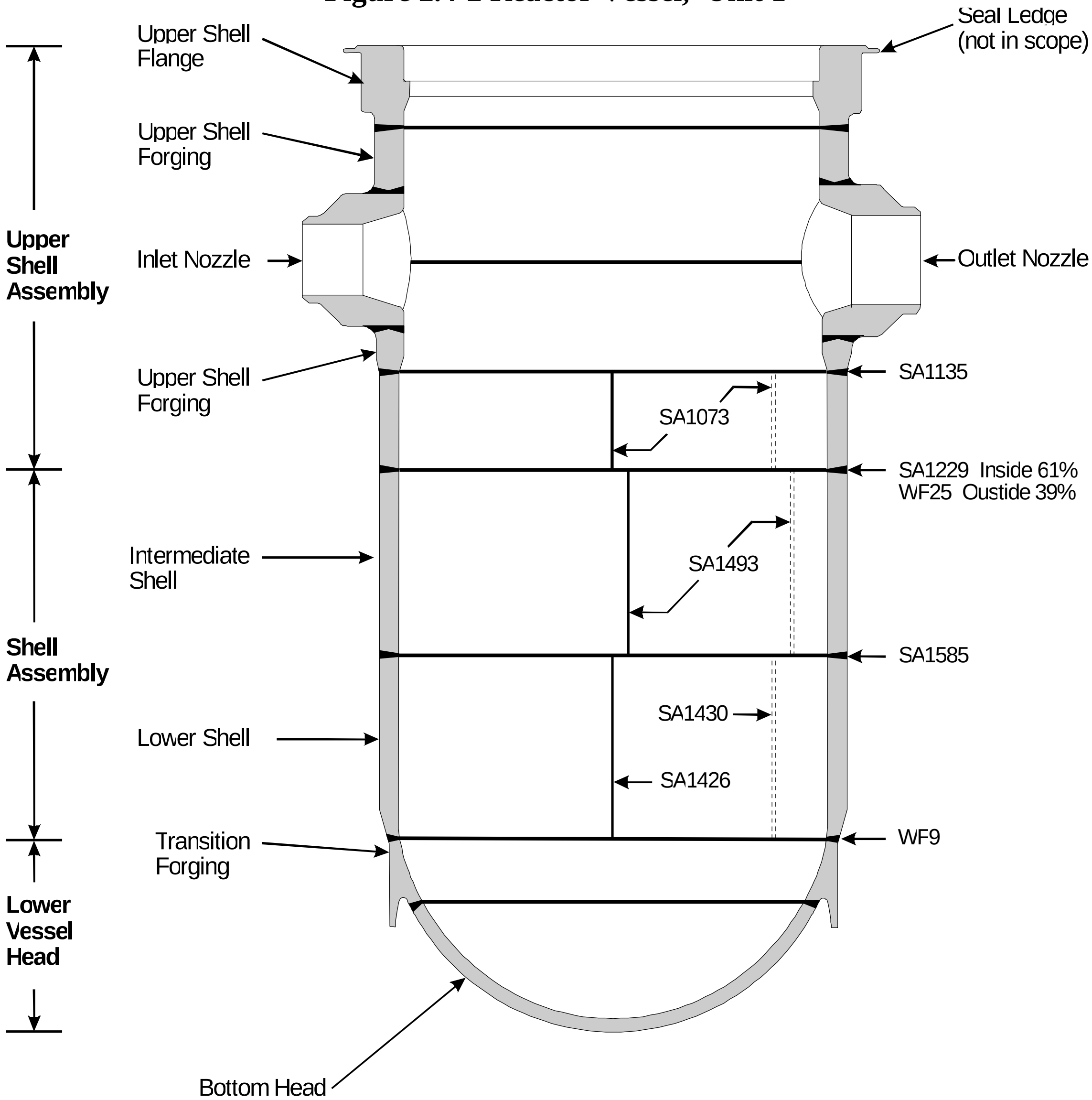


Figure 2.4-3 Reactor Vessel, Unit 2

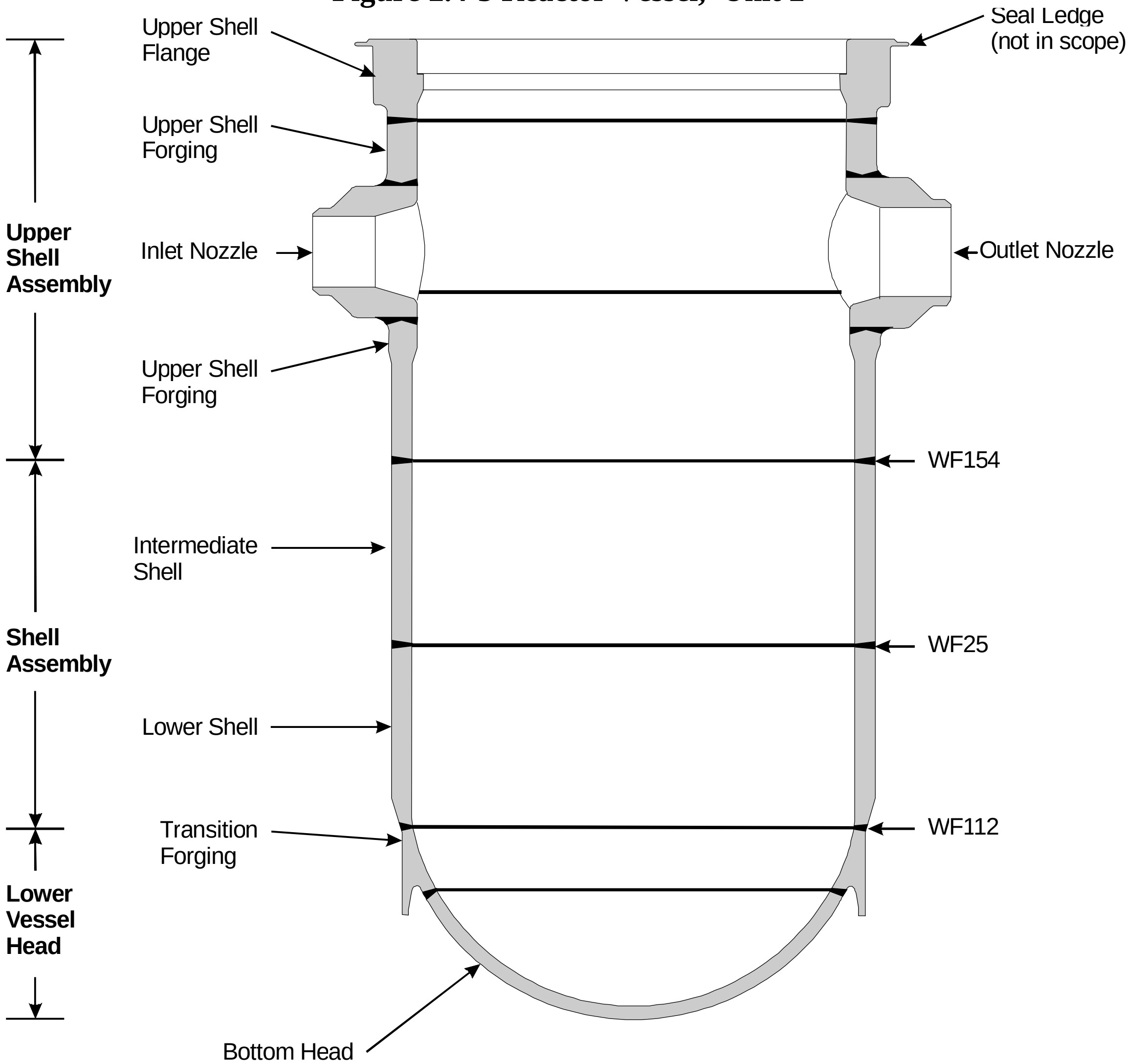


Figure 2.4-4 Reactor Vessel, Unit 3

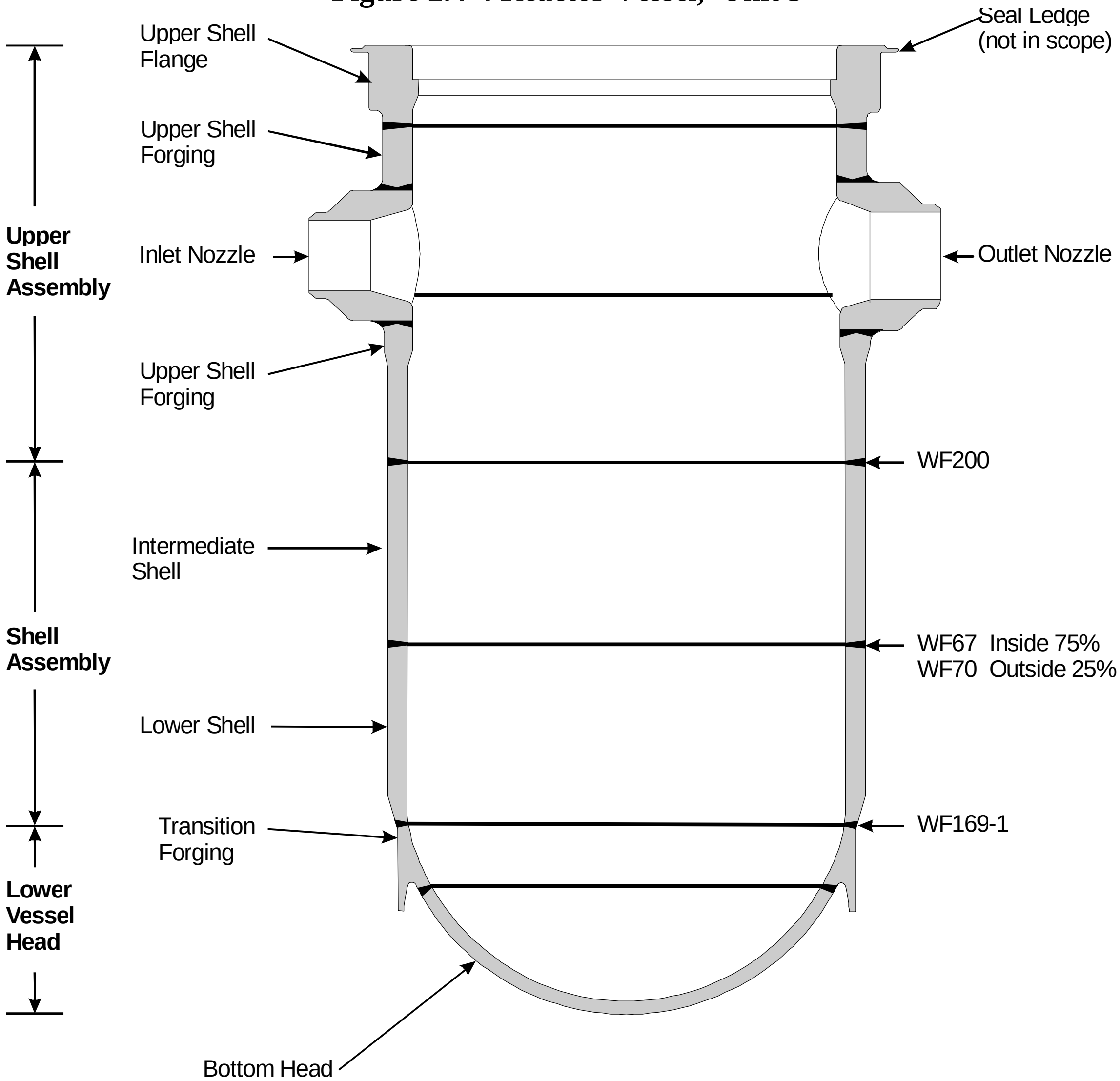


Figure 2.4-5 Reactor Vessel Internals

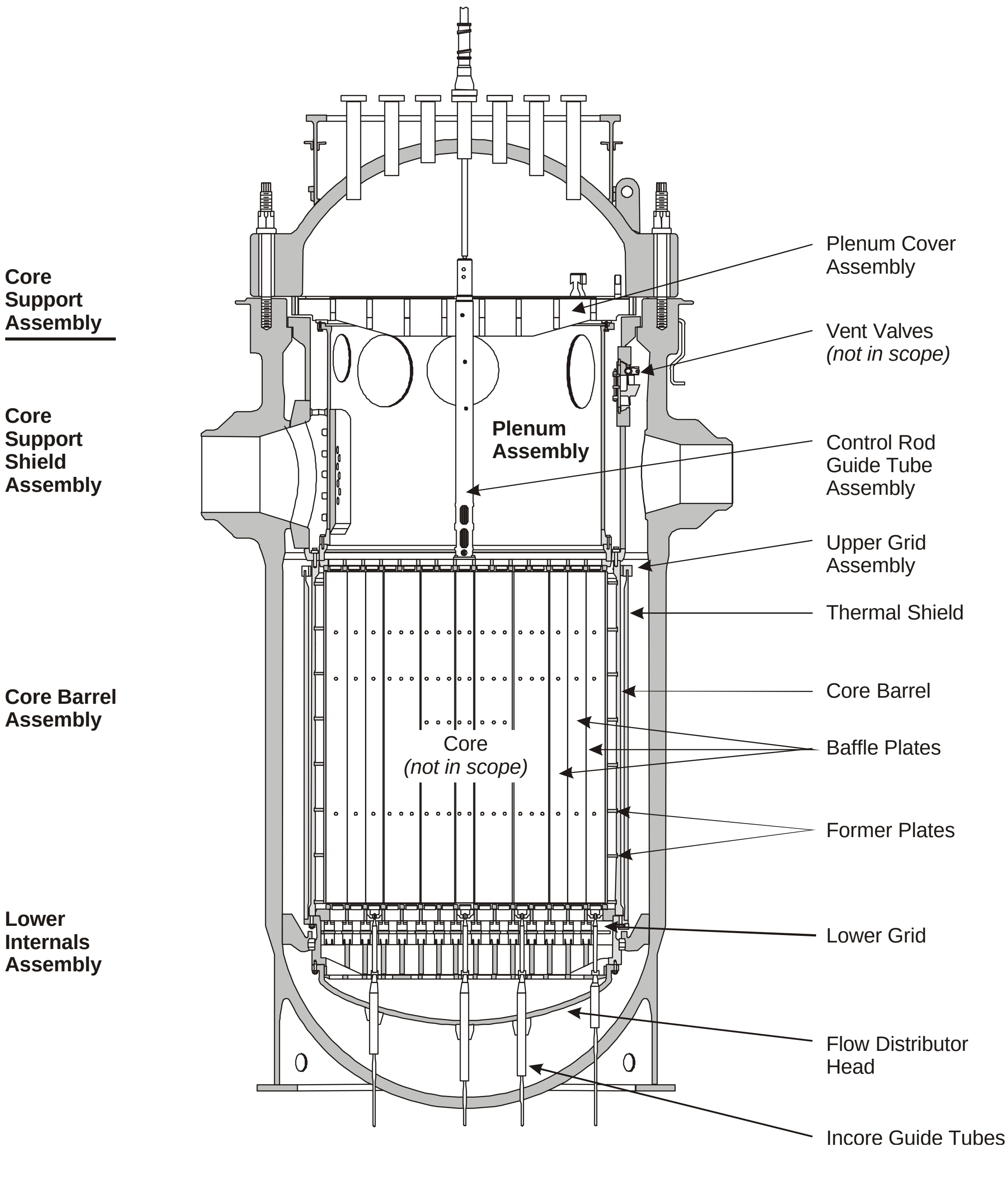


Figure 2.4-6 Once Through Steam Generator

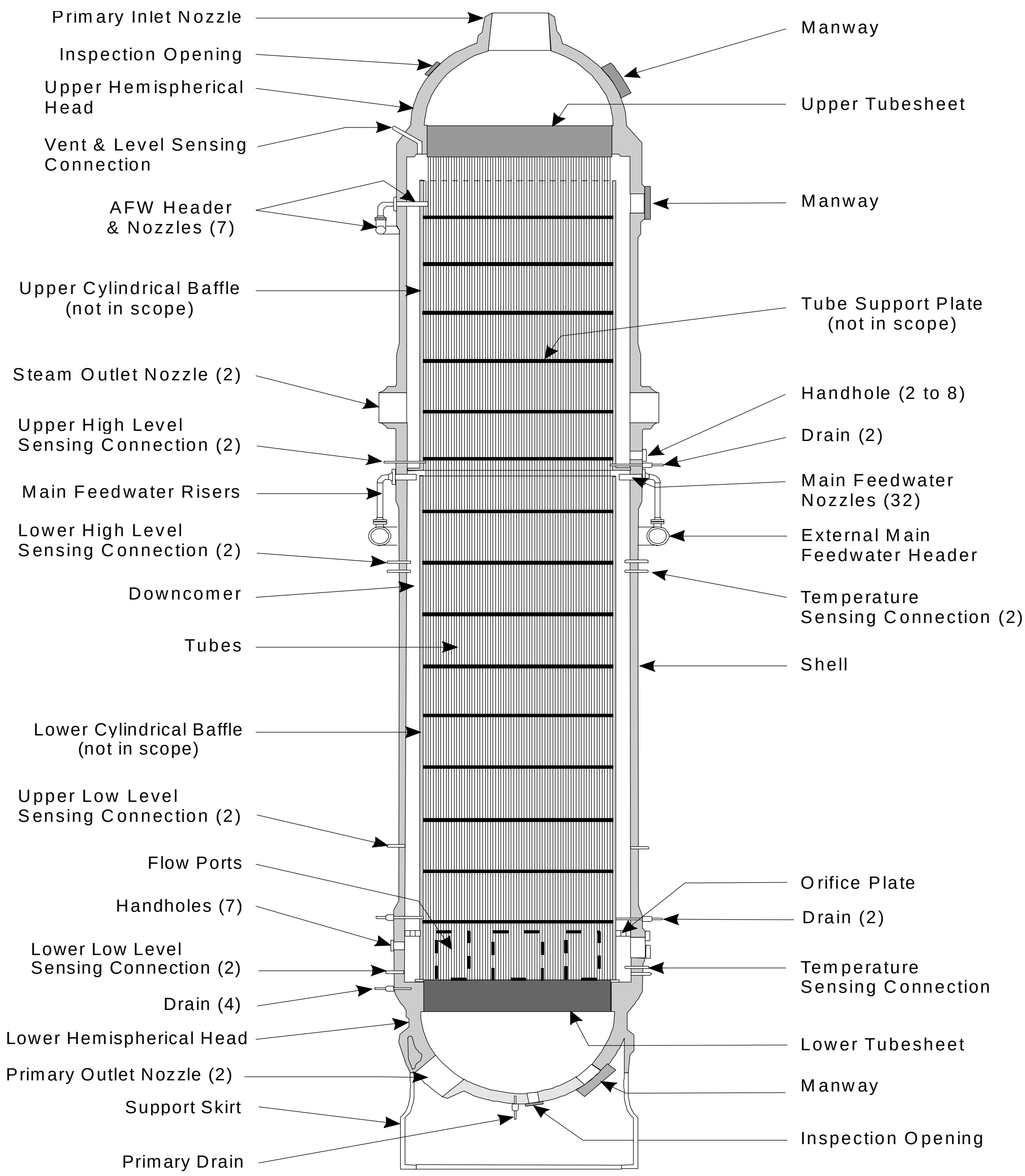


Figure 2.4-7 Reactor Vessel Support Skirt

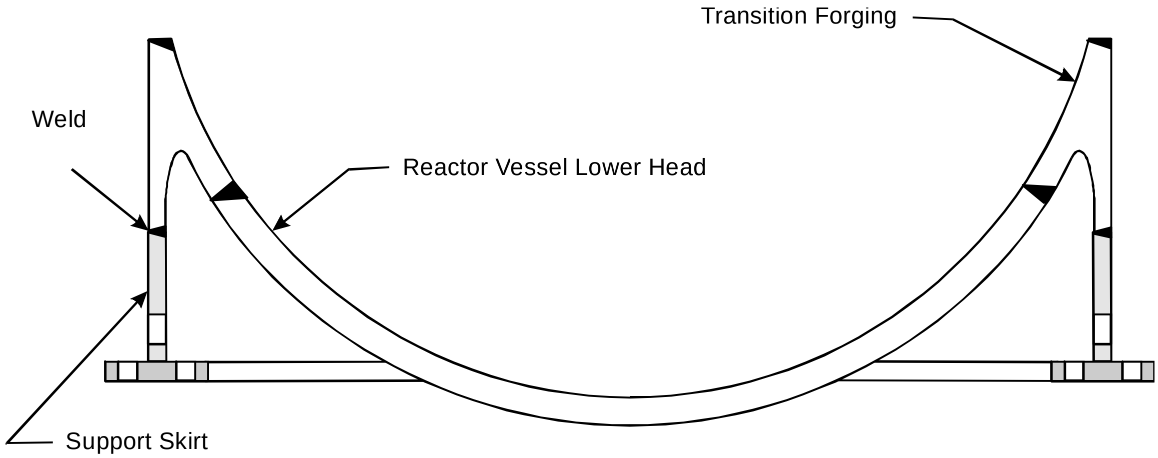


Figure 2.4-8 Control Rod Drive Service Structure

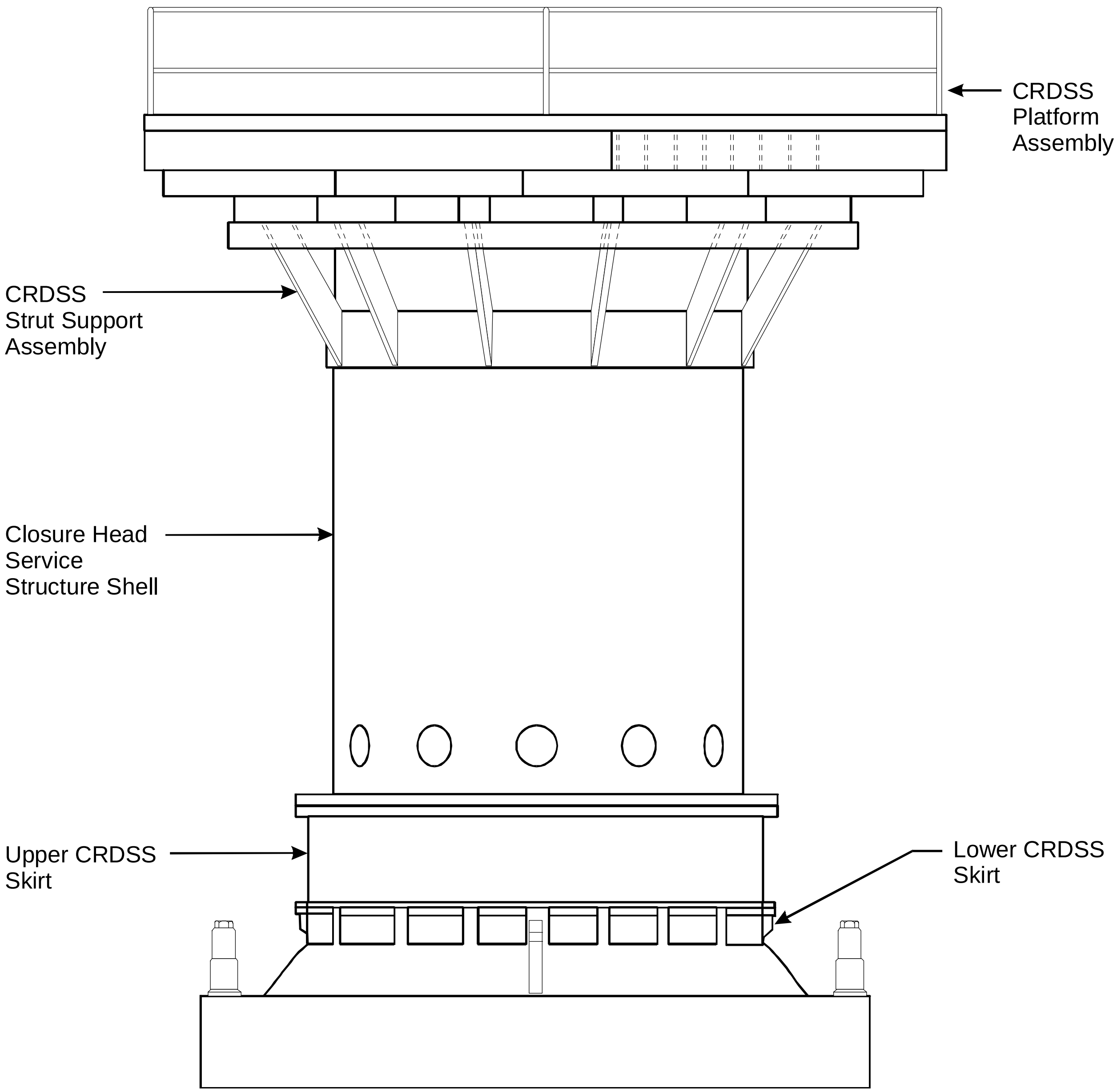


Figure 2.4-9 Control Rod Drive Service Structure (Detail)

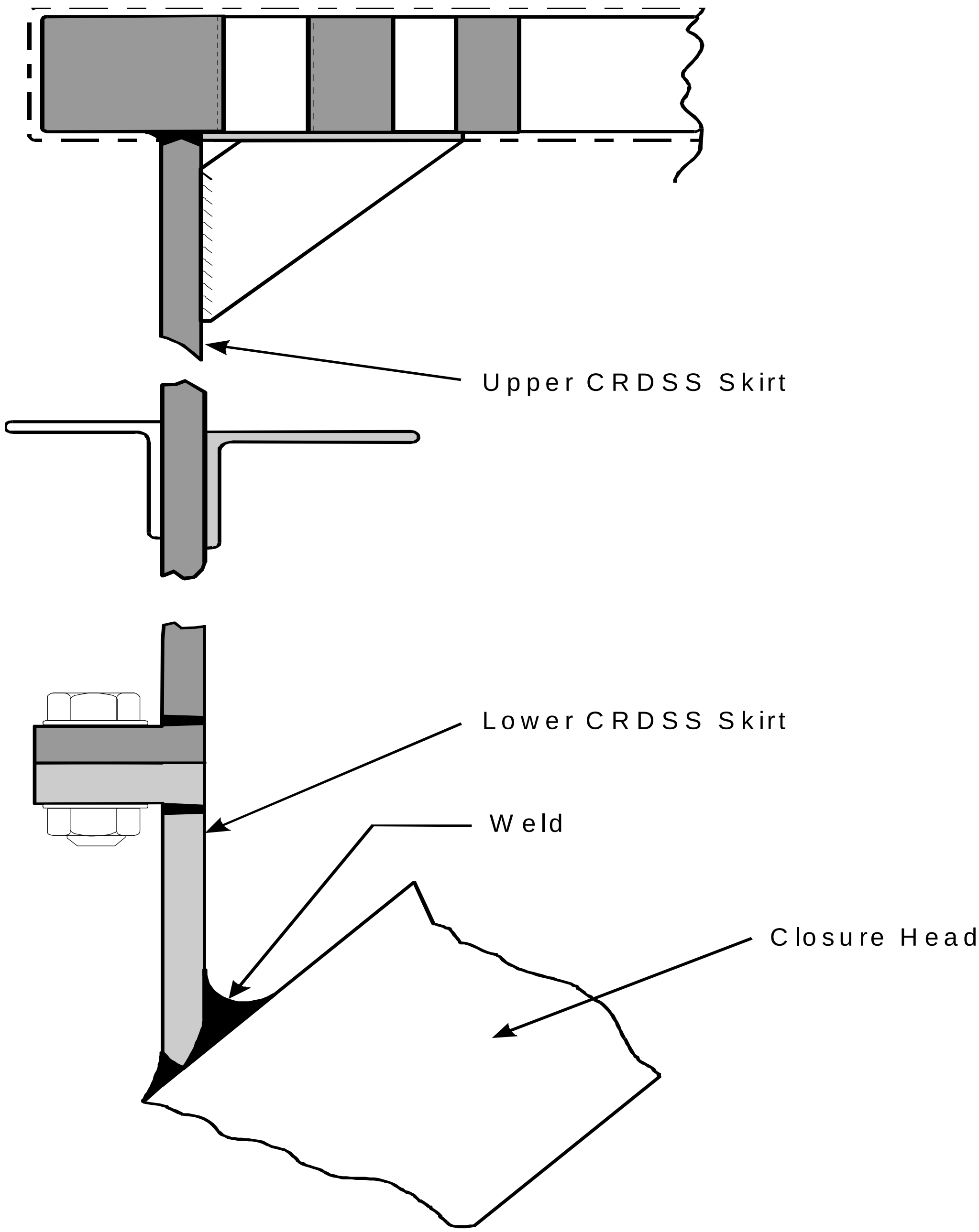


Figure 2.4-10 Steam Generator Support Skirt

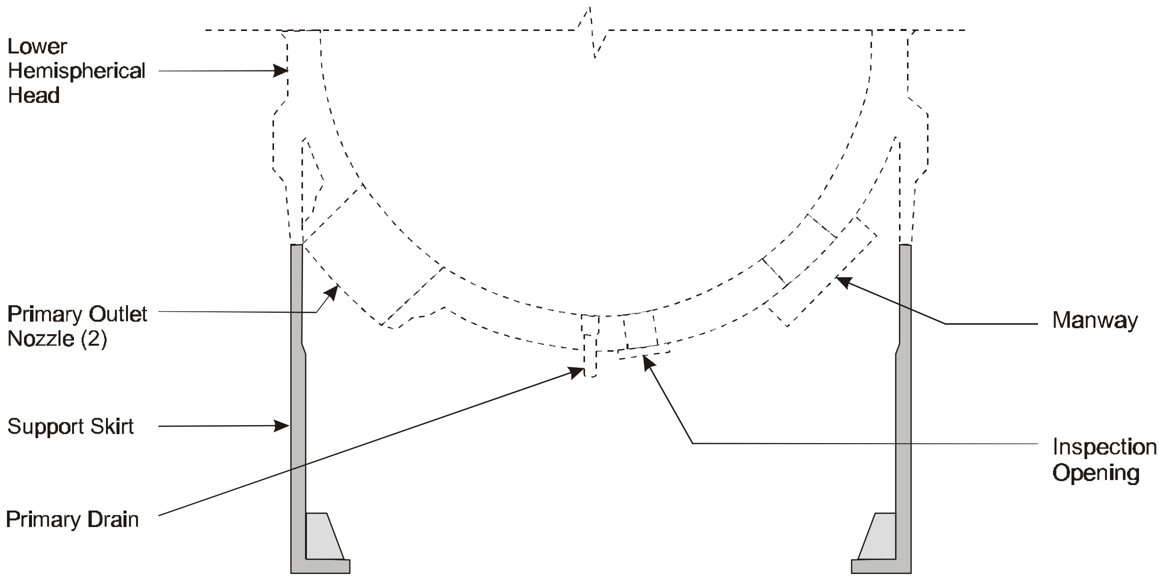
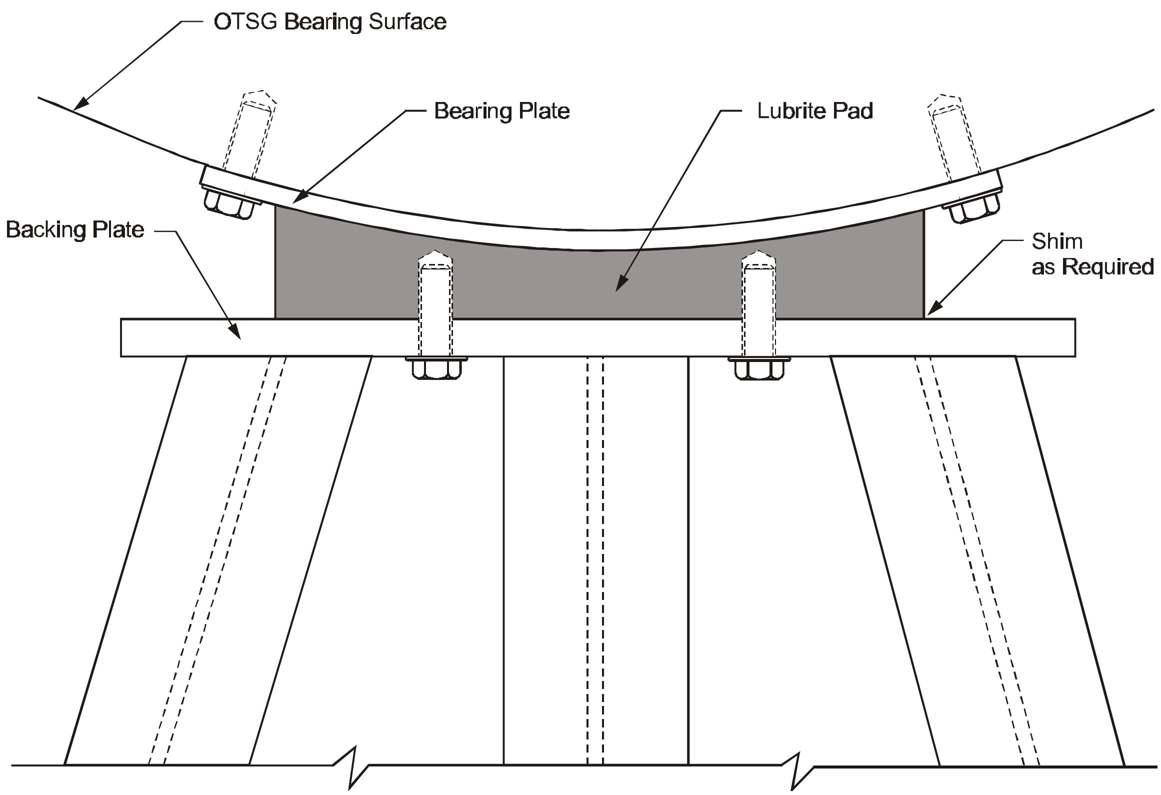


Figure 2.4-11 Once Through Steam Generator Upper Lateral Support



2.5 MECHANICAL SYSTEM COMPONENTS

2.5.1 PROCESS USED TO IDENTIFY MECHANICAL COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

The license renewal evaluation boundaries of the Oconee Nuclear Station (Oconee) mechanical systems, including those contained in Keowee Hydroelectric Station (Keowee) and in the Standby Shutdown Facility were determined on the basis of the mechanical systems review described in Section 2.2 of OLRP-1001. The methodology used to identify the individual mechanical components subject to aging management review is described in the following paragraphs.

Mechanical components are considered to be those installed components that contain a fluid, including air or gas. Supports and anchorage are considered structural components and are addressed in Section 2.7 of OLRP-1001.

The methodology used to identify the mechanical components subject to aging management review at Oconee is consistent with the guidance provided in NEI 95-10, Revision 0 [Reference 2.5-1]. Specifically, Section 4.1 of NEI 95-10, Revision 0, describes an acceptable method for the identification of structures and components that are subject to aging management review. It is a two step process: (1) Section 4.1.1 describes establishing evaluation boundaries; and (2) Section 4.1.2 describes determining structures and components within these boundaries subject to aging management review.

The mechanical components that are subject to aging management review are determined in the following manner:

- An evaluation boundary is established for each Oconee, Keowee, and Standby Shutdown Facility mechanical system that has been determined to be in scope; and

- The mechanical components and their intended functions within the evaluation boundary that are subject to aging management review are identified.

Each of these steps is described further in the following section.

2.5.2 DETAILED PROCESS DESCRIPTION

2.5.2.1 Establishment of Evaluation Boundaries for License Renewal

Oconee and Keowee flow diagrams were used to clearly indicate the evaluation boundaries for license renewal. Flow diagrams are process functional drawings, as distinguished from plant physical layout drawings. A separate set of flow diagrams specifically for use in the license renewal process was produced for Oconee, including Keowee mechanical systems and the Standby Shutdown Facility mechanical systems. The evaluation boundaries of mechanical systems are indicated on these Keowee license renewal flow diagrams and Oconee license renewal flow diagrams [Reference 2.5-2]. For the purpose of this document, they will be collectively referred to as the Oconee license renewal flow diagrams.

2.5.2.2 Identification of Mechanical Components Subject To An Aging Management Review

The first step in the identification of the mechanical components subject to aging management review was to develop a menu of mechanical component types at Oconee. This step provides a basis for identifying the mechanical components within the license renewal evaluation boundary (the Oconee and license renewal flow diagrams) that are subject to aging management review.

The Oconee license renewal flow diagrams and Appendix B of NEI 95-10, Revision 0 [Reference 2.5-1] have been reviewed to determine the mechanical component types that exist in Oconee. The hydrogen recombiner (NEI 95-10, Revision 0, Appendix B, Item 68) requires a plant-specific determination of whether or not it is subject to aging management review. The Oconee-specific determination is provided in Section 2.5.10.1 of OLRP-1001.

The second step is the identification of mechanical components and component types within the evaluation boundaries that are subject to aging management review, along with their component intended functions. Component intended functions include only those functions that are required to enable the system intended function(s) to be performed. This step results in the identification of the component intended functions for each component in each system. This step is described within each system description and the results are summarized in a table for each system at the end of this chapter.

The mechanical components subject to aging management review at Oconee, Keowee, and Standby Shutdown Facility resulting from the application of this process are identified in Sections 2.5.3 through 2.5.14. The results are presented by system in an order that parallels the system descriptions contained in the Oconee UFSAR [Reference 2.5-3]: Containment Heat Removal, Containment Isolation, and Emergency Core Cooling Systems are described in Chapter 6 of the Oconee UFSAR; Auxiliary Systems, Process Auxiliaries, Air Conditioning, Heating, Cooling and Ventilation are described in Chapter 9; and Steam And Power Conversion Systems are described in Chapter 10.

In addition, Post-Accident Hydrogen Control, Reactor Coolant Pump Motor Oil Collection System, and Reactor Coolant System Vents, Drains, and Instrument Lines are described in Sections 2.5.10, 2.5.11, and 2.5.12, respectively. Keowee mechanical systems are described in Section 2.5.13 and Standby Shutdown Facility mechanical systems are described in Section 2.5.14

2.5.3 Containment Heat Removal Systems

The Containment heat removal systems are those systems designed to remove heat from the Reactor Building following a design basis event. Chapter 6 of the Oconee UFSAR, *Engineered Safety Features*, provides additional descriptions of Containment heat removal systems. The following systems are addressed in this section:

- Reactor Building Cooling System
- Reactor Building Spray System

The license renewal flow diagrams listed in Table 2.5-2 show the evaluation boundaries for the portions of the Containment heat removal systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified within Table 2.5-3.

2.5.3.1 Reactor Building Cooling System

The Reactor Building Cooling System is designed to provide cooling to the Reactor Building during both normal plant operation and following a loss-of-coolant accident. Following a loss-of-coolant accident, the steam-air mixture within the Reactor Building passes over the cooling coils in one of three Reactor Building cooling units to transfer heat from the containment atmosphere to the Low Pressure Service Water System. Ductwork directs the cooled air to the heat sources inside the Reactor Building. The heated air rises by convection and re-enters the Reactor Building cooling units to be subsequently cooled and redistributed.

The Reactor Building Cooling System is capable of withstanding a design basis earthquake from the inlet of each Reactor Building cooling fan through the cooling coils. The seismic portion is designed such that a postulated collapse or deformation of the non-seismic portion would not prevent airflow. The materials of construction for the Reactor Building Cooling System are stainless steel, aluminum, and galvanized steel. The internal environment of the applicable portions of the system is air. The external surfaces of these same portions of the system are exposed to the Reactor Building environment.

2.5.3.2 Reactor Building Spray System

The Reactor Building Spray System is designed to remove heat from the containment atmosphere after a design basis accident. The system also removes the fission product iodine from the post-accident containment atmosphere. The Reactor Building Spray System consists of two redundant trains, each including a pump with associated valves (bodies only) and piping, and an array of spray nozzles located on spray headers in the upper containment. The Reactor Building Spray System takes suction from the header in the Low Pressure Injection System suction upstream of the low pressure injection pumps (casings) and delivers borated water through the spray nozzles to the containment atmosphere during an accident. The borated water sprayed through the spray nozzles is collected in the Reactor Building sump and is recirculated for long-term cooling of Containment atmosphere.

Piping for the Reactor Building Spray System located outside the Reactor Building that is required to handle recirculated Reactor Building sump water following a loss-of-coolant accident is Oconee System Piping Class B. [Footnote 1] Reactor Building Spray System piping and equipment downstream of the check valve inside the Reactor Building including the spray headers and nozzles are Class C. The portions of the Reactor Building Spray System applicable to license renewal are designed to withstand a design basis earthquake without a loss of function. The material of construction in this system is stainless steel. During normal unit operation, the system is wetted upstream of the pump discharge valve and is an air environment downstream of the discharge valve. The Reactor Building Spray System external surfaces are exposed to the Auxiliary Building and Reactor Building environments.

1. Refer to Table 2.5-1 Oconee System Piping Classifications for further information about the Oconee System Piping Class designations.

2.5.4 Containment Isolation System

The containment isolation system is an engineered safety feature that provides for the closure of all fluid penetrations not required for operation of the Engineered Safeguards System to prevent the leakage of uncontrolled or unmonitored radioactive materials to the environment. Containment isolation is described further in Section 6.2.3 of the Oconee UFSAR. The following mechanical systems are included in this section:

- Breathing Air
- Component Cooling
- Demineralized Water
- Filtered Water
- Gaseous Waste Disposal
- Instrument Air
- Leak Rate Test
- Liquid Waste Disposal
- Nitrogen Purge and Blanketing
- Reactor Building Purge

The license renewal flow diagrams listed in Table 2.5-4 show the evaluation boundaries for the portions of the systems relevant to Containment isolation that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified in Table 2.5-5.

2.5.4.1 Breathing Air System

The purpose of the Breathing Air System is to provide a source of air inside the Reactor Building for use by plant personnel. The only portion of the Breathing Air System applicable to license renewal, however, is the containment isolation portion. This includes the containment isolation valves (bodies only) and associated piping.

The portions of the Breathing Air System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class F, and are thus required to remain operable after a design basis earthquake. The material of construction of the license renewal portion of this system is stainless steel. The internal environment of the Breathing Air System is air. The system external surfaces are exposed to the Auxiliary Building and Reactor Building atmosphere.

2.5.4.2 Component Cooling System

The Component Cooling System provides cooling water to various components in the Reactor Building, including the control rod drives, letdown heat exchangers, quench tank coolers, and reactor coolant pump coolers and jackets. Only containment isolation portions of the system are within the scope of license renewal.

The portions of the Component Cooling System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class F. The Class F piping is capable of withstanding a design basis earthquake without loss of function. The materials of construction in this system are stainless steel and carbon steel. The internal environment of the Component Cooling is treated water. The system external surfaces are exposed to the Auxiliary Building and Reactor Building atmosphere.

2.5.4.3 Demineralized Water System

The Demineralized Water System provides demineralized water to equipment in the Reactor Building that is not used during power operation. The only part of the Demineralized Water System within the scope of license renewal is the containment isolation portion. This includes the containment isolation valves (bodies only) and associated piping.

The portions of the Demineralized Water System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class F. With the exception of the containment isolation portion of the system, the Demineralized Water System is not required to remain operable after a design basis earthquake. The material of construction of the license renewal portion of this system is stainless steel. The internal environment of the Demineralized Water System is treated water. The system external surfaces are exposed to the Auxiliary Building and Reactor Building atmosphere.

2.5.4.4 Filtered Water System

The Filtered Water System provides filtered water to equipment in the Reactor Building that is not used during normal operation. The only part of the Filtered Water System within the scope of license renewal is the containment isolation portion, including the containment isolation valves (bodies only) and associated piping.

The portions of the Filtered Water System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class F. With the exception of the containment isolation portion of the system, the Filtered Water System is not required to remain operable after a design basis earthquake. The material of construction of the license renewal portions of this system is stainless steel. The internal environment of the Filtered Water System is treated water. The system external surfaces are exposed to the Auxiliary Building and Reactor Building atmosphere.

2.5.4.5 Gaseous Waste Disposal System

The Gaseous Waste Disposal System is designed to collect, hold-up, and process potentially radioactive gaseous waste generated in the plant. The system is designed to control and minimize releases of radioactivity to the environment. Only the containment penetration portion of the system is within the scope of license renewal. This portion includes a vent off the quench tank, containment isolation valves (bodies only) and associated piping.

The Gaseous Waste Disposal System piping at each Reactor Building penetration is Oconee System Piping Class C. This portion of the system is capable of withstanding the design basis earthquake without a loss of function. The material of construction of the license renewal portions of the Gaseous Waste Disposal System is stainless steel. The internal environment of the Gaseous Waste Disposal System piping is nitrogen. The external surfaces of the license renewal portions of the system are exposed to the Auxiliary Building and Reactor Building environments.

2.5.4.6 Instrument Air System

The Instrument Air System provides a reliable source of clean, dry, oil-free compressed air at the proper pressure to air-operated valves, instruments, and other miscellaneous components in the plant. The Instrument Air System is shared among all three Oconee units. Only the containment penetration portion of the Instrument Air System is within the scope of license renewal, which includes the containment isolation valves (bodies only) and associated piping.

The containment isolation portion of the Instrument Air System piping is designed and constructed in accordance with the requirements associated with Oconee System Piping Class F. This portion of the Instrument Air System is designed to withstand a design basis earthquake without a loss of function. The materials of construction for the containment isolation portion of the Instrument Air System are stainless steel and carbon steel. The internal environment of the applicable portions of the system is air. The external surfaces of these same portions of the Instrument Air System are exposed to the Auxiliary Building and Reactor Building environments.

2.5.4.7 Leak Rate Test System

The purpose of the Leak Rate Test System is to perform periodic Integrated Leak Rate Tests and local leak rate tests of the Reactor Building containment for pressure boundary integrity. The Leak Rate Test System performs no function during normal operation. Only the containment penetration portion of the system is within the scope of license renewal, which includes the containment isolation valves (bodies only) and associated piping.

The containment isolation portion of the Leak Rate Test System piping is designed and constructed in accordance with the requirements associated with Oconee System Piping Class F. This portion of the system is designed to withstand a design basis earthquake without a loss of function. The materials of construction for the containment isolation portion of this system are stainless steel and carbon steel. The internal environment of the applicable portions of the system is air. The external surfaces of these same portions of the system are exposed to the Auxiliary Building and Reactor Building environments.

2.5.4.8 Liquid Waste Disposal System

The Liquid Waste Disposal System is designed to collect, sample, hold-up for decay, evaporate, reclaim, reprocess or discharge all liquid wastes generated at Oconee Nuclear Station. The portions of Liquid Waste Disposal System that are applicable to license renewal are the containment isolation valves (bodies only) from the emergency and normal Reactor Building sumps and their associated piping

The portions of the Liquid Waste Disposal System within the scope of license renewal are Oconee System Piping Class C. The piping at each Reactor Building penetration is Class C piping for containment isolation purposes. The Class C portions of the Liquid Waste Disposal System are designed to withstand a design basis earthquake without a loss of function. The material of construction of the applicable components in this system is stainless steel. The internal environment of the containment isolation portion of the Liquid Waste Disposal System is borated water. The external surfaces of these same portions of the system are exposed to the Auxiliary Building and embedded environments.

2.5.4.9 Nitrogen Purge and Blanketing System

The Nitrogen Purge and Blanketing System is used during normal operation to provide a nitrogen overpressure on the core flood tanks and quench tanks. The system is used also for fill and make-up to the core flood tanks from the High Pressure Injection System and the Chemical Addition System. The only portions of the system within the scope of license renewal include the containment isolation valves (bodies only), associated piping, and the portions of the system with safety-related pipe classifications.

The containment isolation portion of the Nitrogen Purge and Blanketing System piping is designed and constructed in accordance with the requirements associated with Oconee System Piping Class F. The other portions of the system applicable to license renewal are Class B or Class F. These portions of the system are designed to withstand a design basis earthquake without a loss of function. The materials of construction in the applicable portions of this system are stainless steel and carbon steel. The internal environments of the applicable portions of the system are nitrogen and borated water. The external surfaces of these same portions of the system are exposed to the Auxiliary Building and Reactor Building environments.

2.5.4.10 Reactor Building Purge System

The Reactor Building Purge System purges the Reactor Building with fresh air. The system includes containment isolation valves (bodies only) on either side of the containment penetrations. The exhaust portion of the system includes a filter train, fans, and associated ductwork. The filter train consists of a prefilter, HEPA filter, and charcoal filter.

The materials of construction for the Reactor Building Purge System are carbon steel, stainless steel, aluminum, copper, brass, bronze, and galvanized steel. The internal environment of the system is air. The external surfaces of the system are exposed to the Auxiliary Building and Reactor Building environments.

2.5.5 EMERGENCY CORE COOLING SYSTEMS

Emergency core cooling systems are designed to cool the reactor core and provide shutdown capability following design basis accidents. These systems are described in Section 6.3 of the Oconee UFSAR. The following systems are included in this section:

- Core Flood System
- High Pressure Injection System
- Low Pressure Injection System

The license renewal flow diagrams listed in Table 2.5-6 show the evaluation boundaries for the portions of the emergency core cooling systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified within Table 2.5-7.

2.5.5.1 Core Flood System

The Core Flood System is designed to inject water directly into the reactor vessel when the Reactor Coolant System pressure drops below a certain level following an accident. The Core Flood System is self-contained, self-actuating, and passive in nature. During power operation, when the Reactor Coolant System pressure is higher than the Core Flood System pressure, check valves (bodies only) located between the reactor vessel core flood nozzles and the core flood tanks prevent high pressure reactor coolant from entering the core flood tanks. The driving force to inject the stored borated water into the reactor vessel is supplied by a pressurized nitrogen cover in the core flood tanks. After an accident, when the Reactor Coolant System pressure decreases below the nitrogen cover pressure, the contents of the core flood tanks will be injected directly into the reactor vessel.

The portions of the Core Flood System within the scope of license renewal have various piping classifications. The portions of the Core Flood System between the Reactor Coolant System and the second check valve from the Reactor Coolant System are Duke Inservice Inspection Class A. The identification of mechanical components for this portion of the Core Flood System is provided in Section 2.4 of OLRP-1001. The remaining portions of the system applicable to license renewal are Oconee System Piping Class B and F. The portions of the Core Flood System applicable to license renewal are designed to withstand a design basis earthquake without a loss of function. The materials of construction in this system are stainless steel, inconel, and carbon steel. Inconel is a nickel-base alloy. The core flood tanks are carbon steel with an internal stainless steel cladding. The carbon steel is not exposed to the internal borated water or nitrogen environment. Only the stainless steel cladding is exposed to this internal environment of the system. Therefore, carbon steel is not evaluated for the internal environments of the system. With the exception of the nitrogen cover in the core flood tanks, the internal environment of the portions of the Core Flood System applicable to license renewal is borated water. The Core Flood System external surfaces are exposed to the Reactor Building and Auxiliary Building environments.

2.5.5.2 High Pressure Injection System

The High Pressure Injection System operates during normal reactor operation to recirculate reactor coolant for purification and to supply seal water to the reactor coolant pumps (casings). Letdown flow is directed to the letdown storage tank, which provides suction flow to the operating high pressure injection pump. The letdown storage tank is normally supplied with a hydrogen overpressure. The high pressure injection pump supplies water directly to the Reactor Coolant System via the normal charging header and also supplies seal injection water to the reactor coolant pumps (casings).

During emergency operation, the High Pressure Injection System automatically provides borated water directly to the reactor vessel injection nozzles on low Reactor Coolant System pressure or high Reactor Building pressure. The High Pressure Injection System also supplies borated water to the reactor coolant pump seals. The water added directly to the system makes up for water lost due to a primary-side leak or from shrinkage of the Reactor Coolant System due to cooling caused by a secondary-side break.

The High Pressure Injection System has various piping classifications. Portions of the system that could be required to transport recirculated Reactor Building sump water following a loss-of-coolant accident are Oconee System Piping Class B. The portion of the system that transports letdown from the Reactor Coolant System is Class C. The emergency high pressure injection piping closest to the Reactor Coolant System is Duke Inservice Inspection Class A, as are the portions of the normal letdown flowpath connected directly to the Reactor Coolant System piping. The reactor coolant pump coolers on Units 2 and 3 provide a pressure boundary function only. Similarly, the reactor coolant pump seal return coolers provide a pressure boundary function. The identification of mechanical components for this portion of the High Pressure Injection System is provided in Section 2.4 of OLRP-1001.

The portions of the High Pressure Injection System within the scope of license renewal are designed to withstand a design basis earthquake without a loss of function. The material of construction in this system is stainless steel. With the exception of the hydrogen cover in the letdown storage tank, the internal environment of the portions of the High Pressure Injection System applicable to license renewal is borated water. The High Pressure

Injection System external surfaces are exposed to the Reactor Building and Auxiliary Building environments.

2.5.5.3 Low Pressure Injection System

The Low Pressure Injection System is used during cold shutdown and refueling operations to remove decay heat. During power operation, the system is idle. This system is also part of the emergency core cooling system and provides cooling water to the reactor after intermediate and large loss-of-coolant accidents.

During unit cooldown, the reactor coolant temperature and pressure are reduced via the steam generators. At approximately 250°F and 300 psig, the Low Pressure Injection System is placed in service. Reactor coolant is drawn from the Reactor Coolant System via the decay heat drop line and cooled by the decay heat removal coolers and returned to the Reactor Coolant System. The decay heat removal coolers provide pressure boundary and heat transfer functions.

Upon initiation of an accident, the Low Pressure Injection System takes suction from the borated water storage tank and injects the tank contents into the reactor vessel. When the borated water storage tank level becomes low, system suction is manually transferred to the Reactor Building emergency sump. Water from the sump is cooled by the decay heat removal coolers and reinjected into the reactor vessel.

The Low Pressure Injection System has various piping classifications. The portions of the system between the Reactor Coolant System and suitable isolation valves (bodies only) are classified as Duke Inservice Inspection Class A. The identification of mechanical components for this portion of the Reactor Coolant System is provided in Section 2.4 of OLRP-1001. Portions of the Low Pressure Injection System that perform an emergency core cooling function are Oconee System Piping Class C, except those portions that are designed to handle post-accident containment sump fluid, which are Class B. The portions of the Low Pressure Injection System applicable to license renewal are designed to withstand a design basis earthquake without a loss of function.

The materials of construction in the Low Pressure Injection System are stainless steel, with the exception of the borated water storage tank, which is carbon steel with a plasite lining. The internal environment of the portions of the Low Pressure Injection System applicable to license renewal is borated water, with the exception of the upper portions of the borated water storage tank, which is exposed to air. The Low Pressure Injection System external surfaces are exposed to the Reactor Building and Auxiliary Building environments, with the exception of some piping, valves (bodies only) and the borated water storage tank, which are exposed to the outside yard environment.

2.5.6 Auxiliary Systems

Auxiliary systems are generally located within the Auxiliary Building and are further described in Sections 9.1 and 9.2 of the Oconee UFSAR. The following systems are included in this section:

- Spent Fuel Cooling System
- Auxiliary Service Water System
- Condenser Circulating Water System
- High Pressure Service Water System
- Low Pressure Service Water System

The license renewal flow diagrams listed in Table 2.5-8 show the evaluation boundaries for the portions of the auxiliary systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified within Table 2.5-9.

2.5.6.1 Spent Fuel Cooling System

The Spent Fuel Cooling System cools and purifies the water in the spent fuel pool. The cooling loop takes suction from a high point in the pool, pumps the water through spent fuel coolers, and returns flow to high and low points in the pool. The Recirculating Cooling Water System provides cooling water flow to the spent fuel coolers. The spent fuel coolers provide a pressure boundary function. The purification loop removes particulate matter, dissolved fission products, and ionic impurities from the spent fuel pool and the borated water storage tanks. The purification loop is operated intermittently as required by pool water conditions.

The cooling and purification functions of the Spent Fuel Cooling System described above do not provide any mitigation function that warrants inclusion of the system within the scope of license renewal. However, there are other plant functions that interface with the Spent Fuel Cooling System (e.g., Standby Shutdown Facility functions) to perform design basis event mitigation, fire protection functions, and station blackout functions. These portions of the Spent Fuel Cooling System are included in scope for that reason.

Although the cooling and purification portions of the Spent Fuel Cooling System are not required to mitigate design bases events, the piping is seismically designed as Oconee System Piping Class B and C, so as to provide design margin for assurance against loss of inventory of the system and the spent fuel pool. Because the piping is classified as such, it is included in the scope of license renewal.

The material of construction in this system is stainless steel. The internal environment of the Spent Fuel Cooling System is borated water. The Spent Fuel Cooling System external surfaces are exposed to the Auxiliary Building, with the exception of the spent fuel transfer tube, which is exposed to the external environments of borated water and concrete.

2.5.6.2 Auxiliary Service Water System

The Auxiliary Service Water System is designed to remove decay heat from all three units simultaneously assuming the concurrent loss of each unit's Main Feedwater, Emergency Feedwater, and Decay Heat Removal (a.k.a., Low Pressure Injection) Systems. Loss of these systems can be postulated as a result of a tornado. The system also serves as a backup source of cooling water for the high pressure injection pump motor coolers. Lake water is provided to the Auxiliary Service Water System via the Unit 2 Condenser Circulating Water System's intake pipes. During normal plant operation, the Auxiliary Service Water System is not operating and manual isolation valves (bodies only) on the suction, discharge and minimum flow piping are closed. The discharge header supplies all three units and is isolated from the six steam generators by several closed check valves (bodies only) and closed, manually-operated gate valves (bodies only).

The Auxiliary Service Water System piping is designed and constructed to the requirements of Oconee System Piping Class F. The system is designed to withstand a design basis earthquake without a loss of function. The materials of construction in this system are carbon steel, stainless steel, and cast iron. The internal environment of the Auxiliary Service Water System is raw water and air. The Auxiliary Service Water System external surfaces are exposed to the Auxiliary Building and Turbine Building.

2.5.6.3 Condenser Circulating Water System

The Condenser Circulating Water System utilizes lake water that serves as the ultimate heat sink during normal operation and for decay heat removal during plant cooldown. This system also provides cooling water to various plant equipment and is the suction source for other service water systems. The Condenser Circulating Water System contains recirculating cooling water heat exchangers which provide a pressure boundary function.

The portions of the Condenser Circulating Water System within the scope of license renewal are Oconee System Piping Class D, F, and G. The condenser circulating water pumps (casings) and intake piping to the low pressure service water pumps (casings), through the condenser and emergency condenser circulating water discharge piping, are Class D or F. The Class F portions of the system are designed to withstand a design basis earthquake without loss of function. The Class D portions of the system are designed to maintain pressure boundary and structural integrity based on the potential for interaction with other systems during a design basis earthquake.

The materials of construction in this system are carbon steel, stainless steel, bronze, and cast iron. The internal environment of the Condenser Circulating Water System is raw water. The Condenser Circulating Water System external surfaces are exposed to the Auxiliary Building (pipe, valves), Turbine Building (pumps, piping, valves), Condenser Cooling Water Intake Structure (pumps and piping), and outside yard environments (piping and valves). Portions of the Condenser Circulating Water System are embedded (piping) or are underground (piping).

2.5.6.4 High Pressure Service Water

The High Pressure Service Water System supplies water to fire protection sprinkler systems, hose stations, fire hydrants, and deluge systems throughout the plant and plant site (excluding the Reactor Building and Keowee). The system also supplies sealing or cooling water to many plant components. Two motor-driven large-capacity pumps (casings) and one motor-driven small-capacity (jockey) pump, together with the elevated water storage tank, deliver a reliable supply of water for the system. The pumps (casings) and elevated water storage tank discharge into a common header that distributes the water supply throughout the plant.

The High Pressure Service Water System piping inside any structures or buildings and the piping at the Condenser Circulating Water Intake Structure are typically Oconee System Piping Class G. The only portions of the High Pressure Service Water System capable of withstanding a design basis earthquake are the portions with Class F piping. The materials of construction in this system are stainless steel, carbon steel, cast iron, copper, brass, and bronze. The internal environment of the High Pressure Service Water System is raw water, with the exception that an air environment exists in the upper portion of the elevated water storage tank. The High Pressure Service Water System external surfaces are exposed to the Auxiliary Building, Turbine Building, outside yard environments, and a portion of the piping is underground.

2.5.6.5 Low Pressure Service Water System

The Low Pressure Service Water System provides cooling water to a variety of safety-related components in the plant, including the Reactor Building cooling units, low pressure injection coolers, high pressure injection pump motor bearing coolers, turbine driven emergency feedwater pump bearing cooling jackets, and motor driven emergency feedwater pump motor air coolers. The Low Pressure Service Water System also provides a source of water to nonsafety-related systems and components in the plant for cooling, sealing, inventory makeup, fire protection (Reactor Building only), backwash and flush. The component coolers within the Low Pressure Service Water System provide a pressure boundary function.

The safety-related portions of the Low Pressure Service Water System are Oconee System Piping Class F. The remainder of the system is Class G. The Class F portions of the system are designed to withstand the effects of a design basis earthquake without a loss of function. The materials of construction in this system are stainless steel, carbon steel, copper, brass, and bronze. The internal environment of the Low Pressure Service Water System is raw water. The Low Pressure Service Water System external surfaces are exposed to the Reactor Building, Auxiliary Building, and Turbine Building. Portions of the carbon steel piping are embedded in concrete.

2.5.7 PROCESS AUXILIARIES

Process auxiliary systems are required to support the reactor during normal operation. These systems are generally located within the Auxiliary Building and are further described in Section 9.3 of the Oconee UFSAR. The following systems are included in this section:

- Chemical Addition System
- Coolant Storage System

The license renewal flow diagrams listed in Table 2.5-10 show the evaluation boundaries for the portions of the process auxiliary systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified within Table 2.5-11.

2.5.7.1 Chemical Addition System

The Chemical Addition System is designed to mix, store, and inject chemicals into the Reactor Coolant System and auxiliary systems. The system also functions as a central location for sampling various fluids throughout the plant to ensure chemical concentrations are maintained within the prescribed limits.

The portion of the Chemical Addition System used to draw samples from the secondary side of the steam generators is exposed to a treated water internal environment. The portion of the system used to draw samples from the primary side of the steam generators and the pressurizer steam and water spaces is exposed to a borated water internal environment. The Chemical Addition System external surfaces are exposed to the Reactor Building and Auxiliary Building environments.

The portions of the system piping within the scope of license renewal are Oconee System Piping Class B, C, E, F, and G. The Class C and F portions of the system are safety-related and designed to withstand the effects of a design basis earthquake without a loss of function. The material of construction of Chemical Addition System components is stainless steel.

2.5.7.2 Coolant Storage System

The Coolant Storage System is used for the collection and storage of reactor coolant liquid. The liquid is received from the High Pressure Injection System as a result of reactor coolant expansion during startup and for boric acid concentration reduction during startup and normal operation. Coolant is stored in coolant bleed holdup tanks or processed through deborating demineralizers for boric acid removal and returned to the High Pressure Injection System as unborated makeup. Liquid from the coolant bleed holdup tanks is pumped to the Coolant Treatment System for processing. The quench tank, located inside the Reactor Building, condenses and contains effluent from the pressurizer safety valves (bodies only), power operated relief valves (bodies only), and various vents and drains.

The portions of the Coolant Storage System within the scope of license renewal are designed and constructed in accordance with the requirements of Oconee System Piping Class C and F. The Class F piping exists at the containment penetrations. The Class C and F piping are designed to withstand the effects of a design basis earthquake without a loss of function. The Coolant Storage System is constructed with stainless steel components. The internal environment of the portions of the Coolant Storage System applicable to license renewal is borated water. The Coolant Storage System external surfaces are exposed to the Auxiliary Building and Reactor Building environments, with the exception of some stainless steel piping that is embedded in concrete.

2.5.8 Air Conditioning, Heating, Cooling and Ventilation Systems

Air conditioning, heating, cooling and ventilation systems maintain the ambient air conditions within the Auxiliary Building. These systems are further described within Section 9.4 of the Oconee UFSAR. The following systems are included in this section:

- Auxiliary Building Ventilation System
- Control Room Pressurization and Filtration System
- Penetration Room Ventilation System

The license renewal flow diagrams listed in Table 2.5-12, show the evaluation boundaries for the portions of the air conditioning, heating, cooling and ventilation systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified within Table 2.5-13.

2.5.8.1 Auxiliary Building Ventilation System

The Auxiliary Building Ventilation System maintains the Auxiliary Building at a negative pressure with respect to the Turbine Building and the outside atmosphere so that any potential contamination will be monitored and discharged through the unit vent. The Auxiliary Building Ventilation System is designed to maintain the Auxiliary Building temperature within certain limits. The Auxiliary Building Ventilation System is included within the scope of license renewal to provide ventilation in support of the Oconee response to fire events.

The materials of construction for the Auxiliary Building Ventilation System are carbon steel, stainless steel, aluminum, and galvanized steel. The internal environment of the applicable portions of the system is air. The external surfaces of these same portions of the system are exposed to the Auxiliary Building environment.

2.5.8.2 Control Room Pressurization and Filtration System

The Control Room Pressurization and Filtration System maintains the control room at a positive pressure using filtered outside air during emergency operation to prevent inleakage of radioactive effluents or toxic gases from the Turbine Building, Auxiliary Building, or outside atmosphere. Another purpose of the system is to remove smoke from the control room during and after a fire. Finally, the system operates to maintain a suitable environment in the control room and associated areas for equipment operability and personnel habitability.

The materials of construction for the Control Room Pressurization and Filtration System are carbon steel, stainless steel, aluminum, copper, brass, bronze, and galvanized steel. The internal environment of the applicable portions of the system is air. The external surfaces of these same portions of the system are exposed to the Auxiliary Building.

2.5.8.3 Penetration Room Ventilation System

The Penetration Room Ventilation System controls and minimizes the release of radioactive materials from the Reactor Building to the environment during post-accident conditions. The Penetration Room Ventilation System is designed to collect and process potential post-accident Reactor Building penetration leakage to minimize environmental radiation levels. During operation, the Penetration Room Ventilation System maintains a negative pressure in the penetration room with respect to the surrounding areas (outside atmosphere and Auxiliary Building) to prevent uncontrolled or unmonitored releases.

The materials of construction for the Penetration Room Ventilation System are carbon steel, stainless steel, aluminum, copper, brass, and galvanized steel. The internal environment of the system is air. The external surfaces of the system are exposed to the Auxiliary Building.

2.5.9 STEAM AND POWER CONVERSION SYSTEMS

Steam and power conversion systems are designed to remove heat from the Reactor Coolant System. These systems are described further within Chapter 10 of the Oconee UFSAR. The following systems are included in this section:

- Main Steam System
- Condensate System
- Emergency Feedwater System
- Feedwater System

The license renewal flow diagrams listed in Table 2.5-14 show the evaluation boundaries for the portions of the steam and power conversion systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified in Table 2.5-15.

2.5.9.1 Main Steam System

The Main Steam System transports dry, superheated steam from the steam generators to the main turbine and main feedwater pump turbines. In addition, the Main Steam System supplies steam to drive the emergency feedwater pump turbine during emergency operation and a variety of other components during normal operation. The Main Steam System is relied upon to dissipate heat from the Reactor Coolant System following a load rejection, turbine or reactor trip by dumping steam to the condenser and/or atmosphere. The Main Steam System is also used to achieve normal cooldown to Low Pressure Injection System initiation conditions.

The portions of the Main Steam System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class F and G. The Class F portions of the system are designed to withstand a design basis earthquake without loss of function. The material of construction in this system is carbon steel. The internal environment of the Main Steam System is treated water. The system external surfaces are exposed to the Auxiliary Building, Turbine Building and Reactor Building environments. Portions of the Main Steam System piping are exposed to the outside yard environment.

2.5.9.2 Condensate System

The Condensate System delivers condensate from the condenser hotwells to the suction of the main feedwater pumps (casings), purifies the condensate, removes non-condensable gases from the condensate, and heats the condensate to improve overall plant efficiency. The Condensate System supplies water to the emergency feedwater pumps (casings) during emergency operation. The Condensate System includes the main condenser, condensate coolers, and generator water coolers.

The portions of the Condensate System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class F and G. The Class F portions of the system are designed to withstand the effects of a design basis earthquake without loss of function. The materials of construction in this system are carbon steel, stainless steel, copper, brass, and cast iron. The internal environment of the Condensate System is treated water. In addition, a vacuum environment exists at the top of the upper surge tanks and upper region of the condenser hotwell. The system external surfaces are predominantly exposed to the Turbine Building environment; however, portions of the Condensate System piping are embedded in concrete.

2.5.9.3 Emergency Feedwater System

The Emergency Feedwater System is designed to provide a source of water to the steam generator in the event of a loss of both main feedwater pumps or a low steam generator level. The system ensures that a sufficient water level is provided in the steam generator, allowing time to restore the flow of main feedwater or to cool down the Reactor Coolant System to the point at which decay heat can be removed by the Low Pressure Injection System.

The portions of the Emergency Feedwater System piping within the scope of license renewal are Oconee System Piping Class B and F. These portions of the system are designed to withstand a design basis earthquake without loss of function. The materials of construction in this system are carbon steel, stainless steel, and low alloy steel. The internal environment of the Emergency Feedwater System is treated water. The Emergency Feedwater System external surfaces are exposed to the Turbine Building and Reactor Building environments.

2.5.9.4 Feedwater System

The Feedwater System receives water from the Condensate System, increases the water pressure and temperature, and delivers the water to the steam generators at a controlled rate of flow. The system operates during accidents to provide steam generator level indication, isolate feedwater flow to a faulted steam generator to prevent containment overpressurization, and provide the feedwater pump operating status to the Reactor

Protection System and the AMSAC/Diversified Scram System. The Feedwater System also provides containment isolation during accidents that require containment integrity to be maintained.

The portions of the Feedwater System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class F, with the exception of the once-through steam generator recirculation pump line, which is classified as Class D. The once-through steam generator drain and recirculation portion of the Feedwater System are included within the scope of license renewal based on the classification of the piping as D. The Class F portions of the system are designed to withstand a design basis earthquake without loss of function. The Class D portions of the system are designed to maintain pressure boundary and structural integrity based on the potential for interaction with other systems during a design basis earthquake. The materials of construction in this system are carbon steel and stainless steel. The internal environment of the Feedwater System is treated water. The system external surfaces are exposed to the Auxiliary Building, Reactor Building, and Turbine Building environments.

2.5.10 Post-Accident Hydrogen Control

Post-accident hydrogen control is provided at Oconee to preclude excessive hydrogen concentrations from occurring within the Reactor Building following certain design basis accidents. These accidents and the post-accident hydrogen control features are described further in Chapter 15 of the Oconee UFSAR. The following systems are included in this section:

- Containment Hydrogen Control System
- Post-Accident Monitoring System

The license renewal flow diagrams listed in Table 2.5-16 show the evaluation boundaries for the portions of the post-accident hydrogen control systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified within Table 2.5-17.

2.5.10.1 Containment Hydrogen Control System

The Containment Hydrogen Control System maintains the Reactor Building hydrogen concentration below flammable limits following a loss-of-coolant accident. During normal operation, the Containment Hydrogen Control System piping is used as a flowpath for radiation monitoring and atmosphere sampling of the Reactor Building. The Containment Hydrogen Control System also includes a portable hydrogen recombiner [Footnote 2] that is shared among all three units. Hydrogen concentration control is accomplished by circulating containment atmosphere through the hydrogen recombiner. The air is heated to a temperature above which hydrogen combines with oxygen to form water vapor and the hydrogen-free air is returned to containment. This system also provides valves (bodies only) and piping used for containment isolation.

2. The hydrogen recombiner is addressed on an Oconee-specific basis consistent with NEI 95-10, Revision 0, "Industry Guidelines For Implementing the Requirements of 10 CFR Part 54-The License Renewal Rule," and the letter from the NRC to the NEI on September 19, 1997, addressing Determination of Aging Management Review for Electrical Components.

The Containment Hydrogen Control System piping is designed and constructed to the requirements of Oconee System Piping Class B and C. The system is required to remain operable after a design basis earthquake. The material of construction of the system is stainless steel. The internal environment of the Containment Hydrogen Control System piping is air. The system external surfaces are exposed to the Auxiliary Building and Reactor Building. During normal plant operation, the portable hydrogen recombiner performs no function, is stored in a warehouse at the plant, and is heated internally to keep the unit warm and dry while in storage. The external environment is the moist air of the warehouse.

2.5.10.2 Post-Accident Monitoring System

The Post-Accident Monitoring System is designed to draw air samples from various locations inside the Reactor Building following an accident to determine the hydrogen concentrations.

The portions of the system piping within the scope of license renewal are Oconee System Piping Class C. These portions of the system are safety-related and designed to withstand the effects of a design basis earthquake without a loss of function. The material of construction of the Post-Accident Monitoring System components is stainless steel. The Post-Accident Monitoring System internal environment is air. The external surfaces of the system are exposed to the Reactor Building and Auxiliary Building environments.

2.5.11 Reactor Coolant Pump Motor Oil Collection System

Each reactor coolant pump has several components that utilize or process lubricating oil, including the oil lift system, oil coolers, and the upper and lower pots. Leakage from, or a failure of, these components could result in uncontrolled leakage. This situation could result in oil flashing that leads to fires or equipment inoperability. To prevent uncontrolled oil leakage from these components, the Reactor Coolant Pump Motor Oil Collection System provides shields on the oil lift system, oil coolers, and the upper and lower pots to catch oil and carry it into a collection tank.

The portions of the system piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class D. These portions of the system are designed to remain intact following a design basis earthquake. The materials of construction of the license renewal portions of this system are carbon steel and stainless steel. The system is primarily an air environment, with any oil leakage being collected and routed to the tank. The system external surfaces are exposed to the Reactor Building environment.

The license renewal flow diagrams listed in Table 2.5-18 show the evaluation boundaries for the portion of the Reactor Coolant Pump Motor Oil Collection System that is within the scope of license renewal (i.e., §54.4). The title on each of these flow diagrams is "Reactor Coolant System RC Pump Motor Drain System." These diagrams are contained in OLRP-1002 [Reference 2.5-2]. Table 2.5-19 identifies Reactor Coolant Pump Motor Oil Collection System mechanical components and their intended functions.

2.5.12 Reactor Coolant System Vents, Drains, and Instrument Lines

The Reactor Coolant System includes vents, drains, and instrument lines as well as the Duke Inservice Inspection Class A piping that is discussed in Section 2.4. With the exception of the pressurizer relief valve piping, all piping that is not Duke Inservice Inspection Class A in the Reactor Coolant System is two inch nominal pipe diameter or smaller.

The portions of the Reactor Coolant System, other than the Duke Inservice Inspection Class A piping, within the scope of license renewal are Oconee System Piping Class B or C. These piping classes are seismically designed to withstand a design basis earthquake without a loss of function. The material of construction in this system is stainless steel. The internal environment of the portions of the Reactor Coolant System applicable to license renewal is borated water. The Reactor Coolant System external surfaces are exposed to the Reactor Building and Auxiliary Building environments.

The license renewal flow diagrams listed in Table 2.5-20 show the evaluation boundaries for the portions of the Reactor Coolant System that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. Table 2.5-21 identifies the Reactor Coolant System vents, drains, and instrument lines and their intended functions.

2.5.13 Keowee Hydroelectric Station

The Keowee Hydroelectric Station (Keowee) is described in Section 1.2 of ORLP-1001. The following systems are included in this section:

- Carbon Dioxide System
- Depressing Air System
- Generator High Pressure Oil System
- Governor Air System
- Governor Oil System
- Service Water System
- Turbine Generator Cooling Water System
- Turbine Guide Bearing Oil System
- Turbine Sump Pump System

The license renewal flow diagrams listed in Table 2.5-22 show the evaluation boundaries for the portions of the Keowee systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified in Table 2.5-23.

2.5.13.1 Carbon Dioxide System

The Carbon Dioxide System provides fire protection to the Keowee generators. In the event of a fire in the Keowee generators, four banks of carbon dioxide filled bottles automatically dump to the generators. The carbon dioxide dump extinguishes the fire by reducing oxygen concentration that prevents the fire from continuing. The system provides interlocks to prevent the Keowee generator from being placed on-line in case of a fire.

The Carbon Dioxide System piping is designed and constructed to the requirements of Oconee System Piping Class H. The system is not required to remain operable after a design basis earthquake. The materials of construction of the system are carbon steel and stainless steel. The internal environment of the Carbon Dioxide System is gas in the storage bottles, while in the remaining piping and components it is air. The system external surfaces are exposed to the Keowee ambient environment.

2.5.13.2 Depressing Air System

Depressing Air System forces water from the turbine space to reduce turbine rolling resistance. The aging management review for this system only considers the need for the components in the system to maintain pressure boundary and structural integrity. No system intended functions are performed by the Depressing Air System.

Depressing Air System piping is designed and constructed to the requirements of Oconee System Piping Class D. The Class D piping is required to maintain pressure boundary and structural integrity based on the potential for interaction with other systems during a design basis earthquake. The material of construction of the license renewal portion of this system is carbon steel. The internal environment of the system is air. The system external surfaces are exposed to the Keowee ambient environment.

2.5.13.3 Generator High Pressure Oil System

The Generator High Pressure Oil System provides two functions during unit operation. During unit startup, system pumps (casings) start to provide a film of oil between the thrust bearing shoes to keep them apart to reduce wear. When the generator reaches a certain speed, grooves in the thrust bearing shoes will create the necessary hydraulic lift to keep the shoes apart. At this point, the system pumps stop and the system provides pressure boundary only for lubrication and cooling of the generator thrust and guide bearings. The motion of the bearing and shaft provides the motive force to the oil to circulate around the coolers immersed in the oil. As generator speed slows and reaches a certain speed during shutdown, the system pumps restart to provide the film of oil needed to keep the thrust bearing shoes apart to reduce wear.

The portions of the Generator High Pressure System piping within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class D. The Class D piping is required to maintain pressure boundary and structural integrity based on the potential for interaction with other systems during a design basis earthquake. The materials of construction of the license renewal portions of this system are carbon steel, stainless steel, copper, and brass alloys. The internal environment of this system is lubricating oil. The Generator High Pressure System external surfaces are exposed to the Keowee ambient environment.

2.5.13.4 Governor Air System

The Governor Air System maintains a cover pressure in the Governor Oil Pressure Tank. Following a loss-of-offsite power in conjunction with a design basis event requiring Keowee to supply emergency power, the Governor Oil System supplies hydraulic oil to operate the turbine wicket gates. The hydraulic oil provides the motive force required to move the gates. Oil pressure to the wicket gates is provided by cover pressure provided by the Governor Air System and by the governor oil pumps.

The portion of the Governor Air System within the scope of license renewal is designed and constructed in accordance with the requirements associated with Oconee System Piping Class F. This portion of the Governor Air System is designed to withstand a design basis earthquake without a loss of function. The material of construction for the license renewal portion of this system is carbon steel. The internal environment of the applicable portions of the system is air. The external surfaces of these same portions of the system are exposed to the Keowee ambient environment.

2.5.13.5 Governor Oil System

In the event that Keowee is supplying emergency power following a loss-of-offsite power, the Governor Oil System supplies hydraulic oil to operate the turbine wicket gates. The hydraulic oil provides the motive force required to move the gates. Oil pressure to the wicket gates is provided by the governor oil pumps (casings) and the Governor Air System.

The Governor Oil System operates intermittently to maintain oil pressure. System pumps (casings) start on low oil pressure and maintain the oil level in the governor oil pressure tank. Pumps take suction from the governor oil sump and deliver the oil to the governor oil pressure tank. The governor oil pressure tank is provided with a pressurized air blanket by the Governor Air System.

The Governor Oil System piping is designed and constructed to the requirements of Oconee System Piping Class F, with the exception of the Class G piping downstream of the manual isolation valve in the sump drain piping. The Class F portion of the Governor Oil System is designed to withstand the design basis earthquake without a loss of function. The materials of construction Governor Oil System are carbon steel and stainless steel. The internal environment of the system is oil, with the exception of the upper portions of the carbon steel tanks which have an air environment. The Governor Oil System external surfaces are exposed to the Keowee ambient environment.

2.5.13.6 Service Water System

The Service Water System provides cooling water from Lake Keowee to various plant equipment. In addition, this system supplies water for fire protection services at Keowee.

The portions of the Service Water System piping which are within the scope of license renewal are Oconee System Piping Class H. The system is within the scope of license renewal for fire protection. The system is not required to remain operable after a design basis earthquake. The materials of construction of the license renewal portions of this system are stainless steel, carbon steel, cast iron, ductile cast iron, copper, brass, and bronze. The internal environment of the Service Water System is raw water. The external surfaces of the system are exposed to the Keowee ambient environment. Portions of the system (hydrant supply piping) are underground.

2.5.13.7 Turbine Generator Cooling Water System

The Turbine Generator Cooling Water System provides cooling water to the turbine packing box, generator thrust bearing coolers, generator air coolers, and turbine guide bearing oil coolers as well as backup cooling to other unit loads. The turbine guide bearing oil coolers and turbine packing boxes are supplied continuously. The remaining loads are supplied when Keowee is in operation.

The portions of the Turbine Generator Cooling Water System which are within the scope of license renewal are Oconee System Piping Class F. The Class F piping is designed to withstand the effects of a design basis earthquake without a loss of function. The materials of construction of the license renewal portions of this system are stainless steel, carbon steel, bronze, copper, and brass. The internal environment of the Turbine Generator Cooling Water System is raw water. The system external surfaces are exposed to the Keowee ambient environment. Portions of the system piping are buried underground or located in an outdoor environment.

2.5.13.8 Turbine Guide Bearing Oil System

The Turbine Guide Bearing Oil System provides lubrication and cooling for the turbine guide bearings. The Turbine Guide Bearing Oil System has an AC motor-driven pump and a DC motor-driven pump, which draw oil from the lower oil reservoir and pump it into the upper oil reservoir through a filter and an oil cooler. Gravity flow returns the oil from the upper oil reservoir through the turbine guide bearings to the lower oil reservoir providing bearing lubrication and cooling. The oil in this system is recirculated continuously during both unit operation and shutdown conditions. The turbine guide bearing oil coolers provide a heat transfer function as well as a pressure boundary function.

The Turbine Guide Bearing Oil System piping is designed and constructed to the requirements of Oconee System Piping Class F. The system is designed to withstand a design basis earthquake without a loss of function. The materials of construction of the system are carbon steel, stainless steel, brass, and copper. The internal environment of system is oil, with the exception that an air environment exists in the upper region of the upper oil reservoir and the lines connecting to the upper reservoir. The Turbine Guide Bearing Oil System external surfaces are exposed to the Keowee ambient environment.

2.5.13.9 Turbine Sump Pump System

The Turbine Sump Pump System is provided with two AC-motor-driven pumps and a DC-motor-driven pump to move water from the turbine wheel pit to the Keowee tailrace. This function is safety-related because flooding in the turbine wheel pit would jeopardize the ability of a Keowee unit to provide emergency power.

The portions of the Turbine Sump Pump System piping which are within the scope of license renewal are Oconee System Piping Class F. The Class F piping is designed to withstand the effects of a design basis earthquake without a loss of function. The materials of construction for the license renewal portions of this system are stainless steel, carbon steel, bronze, and brass. The internal environment of the Turbine Sump Pump System is raw water. The system external surfaces are exposed to the Keowee ambient environment. Portions of the system piping are embedded in concrete.

2.5.14 STANDBY SHUTDOWN FACILITY

The Standby Shutdown Facility is described in Section 1.2 of ORLP-1001. The following systems are included in this section:

- Air Intake and Exhaust System
- Diesel Generator Fuel Oil System
- Drinking Water System
- Heating, Ventilation, and Air Conditioning System
- Reactor Coolant Makeup System
- Sanitary Lift System
- Standby Shutdown Facility Auxiliary Service Water System
- Starting Air System

The license renewal flow diagrams listed in Table 2.5-24 show the evaluation boundaries for the portions of the Standby Shutdown Facility systems that are within the scope of license renewal (i.e., §54.4). These diagrams are contained in OLRP-1002 [Reference 2.5-2]. The mechanical components and their intended functions for the systems in this section are identified in Table 2.5-25.

2.5.14.1 Air Intake and Exhaust System

The Air Intake and Exhaust System provides combustion air for the Standby Shutdown Facility diesel engines, and removes exhaust gases from the engines. The air intake portion of the system includes a filter and silencer assembly and a turbocharger assembly. The filter and silencer assembly removes particulates from the air supply and reduces noise. The turbocharger assembly increases the engine horsepower and provides better fuel economy through the utilization of exhaust gases to pressurize the intake air. The exhaust portion of the system includes an exhaust silencer to reduce exhaust gas noise.

The piping in this system is designed and constructed in accordance with the requirements for Oconee System Piping Class C. In addition, Code Case N-19-2 (1481-2) was used to design the Standby Shutdown Facility Diesel Engine exhaust piping, since the exhaust air temperature was predicted to be 800°F. The Class C piping is designed to withstand a design basis earthquake without a loss of function. The materials of construction in this system are carbon steel and chrome-molybdenum. The internal environment of the Air Intake and Exhaust System is air, with the exception that the exhaust piping is a mixture of air and exhaust gases during periodic engine operation. The external surfaces of the system are exposed to the Standby Shutdown Facility ambient environment, with the exception of some piping which is exposed to the outside yard environment.

2.5.14.2 Diesel Generator Fuel Oil System

The Standby Shutdown Facility Diesel Generator Fuel Oil System supplies fuel oil to each diesel engine injector for combustion and fuel injector cooling. The system operates when the diesel engine is operating. The Standby Shutdown Facility Diesel Generator Fuel Oil System is normally stagnant and at ambient conditions in the Standby Shutdown Facility.

The Standby Shutdown Facility Diesel Generator Fuel Oil System piping is Oconee System Piping Class C. The system is designed to remain operable after a design basis earthquake. The materials of construction in this system are carbon steel, copper, brass and stainless steel. The internal environment of the system is fuel oil; however, the tops of the carbon steel tanks and lines connecting to the top of the tanks are open to the atmosphere. The external surfaces of the system are exposed to the Standby Shutdown Facility ambient environment, with the exception of some piping and the main storage tank that are underground.

2.5.14.3 Drinking Water System

The Standby Shutdown Facility Drinking Water System distributes potable water throughout the Standby Shutdown Facility. The aging management review for this system only considers the need for the components in the system to maintain pressure boundary and structural integrity. No system intended functions are performed by the Standby Shutdown Facility Drinking Water System.

The Standby Shutdown Facility Drinking Water System piping is designed and constructed to the requirements of Oconee System Piping Class D. The Class D piping is required to maintain pressure boundary and structural integrity based on the potential for interaction with other systems during a design basis earthquake. The material of construction of the license renewal portion of this system is stainless steel. The internal environment of the system is treated water. The system external surfaces are exposed to the Standby Shutdown Facility ambient environment.

2.5.14.4 Heating, Ventilation, and Air Conditioning System

The Standby Shutdown Facility Heating, Ventilation, and Air Conditioning System maintains the Standby Shutdown Facility environment within a predetermined temperature range to support equipment operability. The Standby Shutdown Facility Heating, Ventilation, and Air Conditioning System contains a cooling coil which provides both a heat transfer and pressure boundary function. The Standby Shutdown Facility Heating Ventilation and Air Conditioning water-cooled Condensers are considered to be part of the Standby Shutdown Facility Auxiliary Service Water System discussed in Section 2.5.14.7.

The Standby Shutdown Facility Heating, Ventilation, and Air Conditioning System is designed to withstand the effects of the design basis earthquake without a loss of function. The materials of construction of this system include stainless steel, aluminum, and galvanized steel. The internal environment of the system is air. The external surfaces of the system are exposed to the Standby Shutdown Facility ambient environment.

2.5.14.5 Reactor Coolant Makeup System

The Reactor Coolant Makeup System is designed to supply reactor coolant pump seal injection flow to any of the three Oconee units in the event that the normal makeup system becomes inoperable while Reactor Coolant System temperature is greater than or equal to 250ºF.

The Reactor Coolant Makeup System piping is Oconee Class B. The Reactor Coolant Makeup System is designed to withstand a design basis earthquake without loss of function. The material of construction in this system is stainless steel. The internal environment of the portions of the Reactor Coolant Makeup System applicable to license renewal is borated water. The Reactor Coolant Makeup System external surfaces are exposed to the Reactor Building environment.

2.5.14.6 Sanitary Lift System

The Standby Shutdown Facility Sanitary Lift System is the network of piping collecting sanitary wastewater from drains within the Standby Shutdown Facility. The aging management review for this system considers the need for the components in the system to maintain pressure boundary and structural integrity. No system intended functions are performed by the Standby Shutdown Facility Sanitary Lift System.

The portions of the system piping which are within the scope of license renewal are designed and constructed to the requirements of Oconee System Piping Class D. The Class D piping is required to maintain pressure boundary and structural integrity based on the potential for interaction with other systems during a design basis earthquake. The material of construction of the license renewal portions of this system is stainless steel. The Standby Shutdown Facility Sanitary Lift System is rarely used and would normally be dry for long periods, due to the pitch required in sanitary lines with infrequent wetting. Therefore, this system has an internal environment of air. The system external surfaces are exposed to the Standby Shutdown Facility ambient environment.

2.5.14.7 Standby Shutdown Facility Auxiliary Service Water System

The Standby Shutdown Facility Auxiliary Service Water System includes the Standby Shutdown Facility Heating Ventilation and Air Conditioning Service Water subsystem and the Standby Shutdown Facility Diesel Engine Service Water subsystem. The Standby Shutdown Facility Auxiliary Service Water System is designed as a high-head, high-volume system which provides sufficient steam generator inventory to ensure adequate decay heat removal for all three units during a station blackout (loss of all off-site AC power including both Keowee units), in conjunction with the loss of normal and emergency feedwater system flow. The Standby Shutdown Facility Auxiliary Service Water System includes Standby Shutdown Facility Heating Ventilation and Air Conditioning water-cooled Condensers which provide both a heat transfer and pressure boundary function.

The Standby Shutdown Facility Auxiliary Service Water System crossover between emergency feedwater lines in each Reactor Building is Oconee System Piping Class B. The remainder of the Standby Shutdown Facility Auxiliary Service Water System is Class C. The Standby Shutdown Facility Auxiliary Service Water System is designed to withstand a design basis earthquake without a loss of function. The materials of construction in this system are stainless steel and carbon steel. The internal environment of the Standby Shutdown Facility Auxiliary Service Water System is raw water. The external surfaces of the system are exposed to the Auxiliary Building and Standby Shutdown Facility ambient environments. The Standby Shutdown Facility Auxiliary Service Water System also has stainless and carbon steel piping in the outside yard environment.

The Standby Shutdown Facility Auxiliary Service Water System includes a submersible pump which is a low-head, high-volume pump capable of providing adequate makeup flow from Lake Keowee to the Unit 2 section of the Condenser Circulating Water System piping that serves as a supply reservoir for several plant systems. The submersible pump is used only if both the forced Condenser Circulating Water flow and the siphon flow are lost during an accident, which requires operation of the Standby Shutdown Facility.

2.5.14.8 Starting Air System

The Standby Shutdown Facility Starting Air System provides compressed air to start the diesel engines in the Standby Shutdown Facility. The Standby Shutdown Facility Starting Air System piping is designed and constructed in accordance with the requirements associated with Oconee System Piping Class C. These portions of the system are designed to withstand a design basis earthquake without a loss of function. The material of construction of this system is carbon steel. The internal environment of the applicable portions of the system is air. The external surfaces of these same portions of the system are exposed to the Standby Shutdown Facility ambient environment.

2.5.15 REFERENCES FOR SECTION 2.5

2.5-1. *NEI 95-10, Revision 0, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule*, Nuclear Energy Institute, March 1996.

2.5-2. OLRP-1002, *Oconee Nuclear Station License Renewal Flow Diagrams*, Duke Energy, transmitted by W. R. McCollum (Duke) letter dated July 1, 1998 to Document Control Desk (NRC), Docket Nos. 50-269, 50-270, 50-287.

2.5-3. *Oconee Nuclear Station, Updated Final Safety Analysis Report*, as revised.

Table 2.5-1 Oconee System Piping Classifications

Original Oconee and Keowee Piping System Classifications:

Piping Class	Design Criteria	Designed for Seismic Loading
A	Class I, USAS B31.7(1)	Yes
B	Class II, USAS B31.7(1)	Yes
C	Class III, USAS B31.7(1)	Yes
D	USAS B31.1.0(2)	Yes
E	USAS B31.1.0(2)(3)	No
F	USAS B31.1.0(2)	Yes
G	USAS B31.1.0(2)	No
H	Good Industry Practice	No

Notes: (1) USAS B31.7 (1968); (2) USAS B31.1.0 (1967); (3) Portions of Piping Class E are considered a Class III system in accordance with UFSAR Section 3.2.2.1

Standby Shutdown Facility Piping Classifications:

Piping Class	Design Criteria	Designed for Seismic Loading
A	ASME III(1)	Yes
B	ASME III(1)	Yes
C	ASME III(1)	Yes
D	ANSI B31.1(2)	Yes
E	ANSI B31.1(2)	No
F	ANSI B31.1(2)	Yes
G	ANSI B31.1(2)	No
H	As specified on the Oconee Flow Diagram or Piping Drawing	No

Notes: (1) ASME Section III, 1974 Edition, Summer 1975 Addendum; (2) ANSI B31.1, 1973 Edition, Summer 1975 Addendum

Table 2.5-2 Flow Diagrams Indicating Evaluation Boundaries of Containment Heat Removal Systems

Reactor Building Cooling System		
Flow Diagram	**Revision**	**Unit**
OLRFD-116E-1.1	0	1
OLRFD-116E-2.1	0	2
OLRFD-116E-3.1	0	3

Reactor Building Spray System		
Flow Diagram	**Revision**	**Unit**
OLRFD-102A-1.1	0	1
OLRFD-102A-2.1	0	2
OLRFD-102A-3.1	0	3
OLRFD-103A-1.1	0	1
OLRFD-103A-2.1	0	2
OLRFD-103A-3.1	0	3

Table 2.5-3 Components of Containment Heat Removal Systems and their Intended Functions

Mechanical Component	Intended Function(s)	Material
Reactor Building Cooling System		
Ductwork	Pressure Boundary	Aluminum
Ductwork	Pressure Boundary	Stainless Steel
Ductwork	Pressure Boundary	Galvanized Steel
Reactor Building Cooling Units	Presure Boundary Heat Transfer	90-10 Copper-Nickel Copper Stainless Steel
Reactor Building Spray System		
Mechanical Expansion Joint	Pressure Boundary	Stainless Steel
Orifice	Pressure Boundary, Throttle	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Stainless Steel
Spray Nozzle	Pressure Boundary, Spray	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-4 Flow Diagrams Indicating Evaluation Boundaries of the Containment Isolation System

Breathing Air System		
Flow Diagram	**Revision**	**Unit**
OLRFD-137A-1.3	0	1
OLRFD-137A-2.3	0	2
OLRFD-137A-3.3	0	3

Component Cooling System		
Flow Diagram	**Revision**	**Unit**
OLRFD-100A-1.3	0	1
OLRFD-100A-2.3	0	2
OLRFD-100A-3.3	0	3
OLRFD-144A-1.2	0	1
OLRFD-144A-1.3	0	1
OLRFD-144A-2.2	0	2
OLRFD-144A-2.3	0	2
OLRFD-144A-3.2	0	3
OLRFD-144A-3.3	0	3

Demineralized Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-106E-1.1	0	1
OLRFD-106E-2.1	0	2
OLRFD-106E-3.1	0	3

Table 2.5-4 Flow Diagrams Indicating Evaluation Boundaries of the Containment Isolation System (continued)

Filtered Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-106E-1.1	0	1
OLRFD-106E-2.1	0	2
OLRFD-106E-3.1	0	3

Gaseous Waste Disposal System		
Flow Diagram	**Revision**	**Unit**
OLRFD-107A-1.1	0	1
OLRFD-107A-2.1	0	2
OLRFD-107A-3.1	0	3

Instrument Air System		
Flow Diagram	**Revision**	**Unit**
OLRFD-137B-1.2	0	1,2,3

Table 2.5-4 Flow Diagrams Indicating Evaluation Boundaries of the Containment Isolation System (continued)

Leak Rate Test System		
Flow Diagram	**Revision**	**Unit**
OLRFD-137E-1.1	0	1,2,3

Liquid Waste Disposal System		
Flow Diagram	**Revision**	**Unit**
OLRFD-107B-1.1	0	1
OLRFD-107B-2.1	0	2
OLRFD-107B-3.1	0	3
OLRFD-107D-1.2	0	1
OLRFD-107D-2.2	0	2
OLRFD-107D-3.2	0	3

Nitrogen Purge and Blanketing System		
Flow Diagram	**Revision**	**Unit**
OLRFD-102A-1.3	0	1
OLRFD-102A-2.3	0	2
OLRFD-102A-3.3	0	3
OLRFD-127B-1.2	0	1
OLRFD-127B-2.2	0	2
OLRFD-127B-3.2	0	3

Table 2.5-4 Flow Diagrams Indicating Evaluation Boundaries of the Containment Isolation System (continued)

Reactor Building Purge System		
Flow Diagram	**Revision**	**Unit**
OLRFD-116A-1.1	0	1
OLRFD-116A-2.1	0	2
OLRFD-116A-3.1	0	2

Table 2.5-5 Components of Containment Isolation Systems and their Intended Functions

Mechanical Component	Intended Function(s)	Material
Breathing Air System		
Pipe	Pressure Boundary	Stainless Steel
ValveBodies	Pressure Boundary	Stainless Steel
Component Cooling System		
Orifice	Pressure Boundary, Throttles	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Demineralized Water System		
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Filtered Water System		
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Gaseous Waste Disposal System		
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-5 Components of Containment Isolation Systems and their Intended Functions (Continued)

Instrument Air System		
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Leak Rate Test System		
Hose Connection	Pressure Boundary	Carbon Steel
Hose Connection	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-5 Components of Containment Isolation Systems and their Intended Functions (continued)

Mechanical Component	Intended Function(s)	Material
Liquid Waste Disposal System		
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Nitrogen Purge and Blanketing System		
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Reactor Building Purge System		
Air Flow Monitor	Pressure Boundary	Aluminum
Air Flow Monitor	Pressure Boundary	Galvanized Steel
Air Flow Monitor	Pressure Boundary	Stainless Steel
Annubar	Pressure Boundary	Stainless Steel
Ductwork	Pressure Boundary	Aluminum
Ductwork	Pressure Boundary	Galvanized Steel
Ductwork	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary Filtration	Aluminum
Filter	Pressure Boundary Filtration	Galvanized Steel

Table 2.5-5 Components of Containment Isolation Systems and their Intended Functions (continued)

Reactor Building Purge System (Continued)		
Filter	Pressure Boundary Filtration	Stainless Steel
Grill	Pressure Boundary	Aluminum
Grill	Pressure Boundary	Galvanized Steel
Grill	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon steel
Tubing	Pressure Boundary	Copper
Valve Bodies	Pressure Boundary	Carbon Steel

Table 2.5-6 Flow Diagrams Indicating Evaluation Boundaries of Emergency Core Cooling Systems

Core Flood System		
Flow Diagram	**Revision**	**Unit**
OLRFD-102A-1.2	0	1
OLRFD-102A-1.3	0	1
OLRFD-102A-2.2	0	2
OLRFD-102A-2.3	0	2
OLRFD-102A-3.2	0	3
OLRFD-102A-3.3	0	3
OLRFD-127B-1.2	0	1
OLRFD-127B-2.2	0	2
OLRFD-127B-3.2	0	3

Table 2.5-6 Flow Diagrams Indicating Evaluation Boundaries of Emergency Core Cooling Systems (continued)

High Pressure Injection System		
Flow Diagram	**Revision**	**Unit**
OLRFD-100A-1.3	0	1
OLRFD-100A-2.3	0	2
OLRFD-100A-3.3	0	3
OLRFD-101A-1.1	0	1
OLRFD-101A-1.2	0	1
OLRFD-101A-1.3	0	1
OLRFD-101A-1.4	0	1
OLRFD-101A-1.5	0	1
OLRFD-101A-2.1	0	2
OLRFD-101A-2.2	0	2
OLRFD-101A-2.3	0	2
OLRFD-101A-2.4	0	2
OLRFD-101A-2.5	0	2
OLRFD-101A-3.1	0	3
OLRFD-101A-3.2	0	3
OLRFD-101A-3.3	0	3
OLRFD-101A-3.4	0	3
OLRFD-101A-3.5	0	3
OLRFD-104A-1.1	0	1&2
OLRFD-104A-3.1	0	3
OLRFD-109A-1.1	0	1&2
OLRFD-109A-3.1	0	3
OLRFD-110A-1.1	0	1
OLRFD-110A-2.1	0	2
OLRFD-110A-3.1	0	3
OLRFD-127B-1.2	0	1
OLRFD-127B-2.2	0	2
OLRFD-127B-3.2	0	3

Table 2.5-6 Flow Diagrams Indicating Evaluation Boundaries of Emergency Core Cooling Systems (continued)

Low Pressure Injection System		
Flow Diagram	**Revision**	**Unit**
OLRFD-100A-1.2	0	1
OLRFD-100A-2.2	0	2
OLRFD-100A-3.2	0	3
OLRFD-101A-1.3	0	1
OLRFD-101A-2.3	0	2
OLRFD-101A3.3	0	3
OLRFD-102A-1.1	0	1
OLRFD-102A-1.2	0	1
OLRFD-102A-2.1	0	2
OLRFD-102A-2.2	0	2
OLRFD-102A-3.1	0	3
OLRFD-102A-3.2	0	3
OLRFD-103A-1.1	0	1
OLRFD-103A-2.1	0	2
OLRFD-103A-3.1	0	3
OLRFD-104A-1.1	0	1&2
OLRFD-104A-1.2	0	1&2
OLRFD-104A-3.1	0	3
OLRFD-104A-3.2	0	3
OLRFD-106A-1.2	0	1
OLRFD-106A-2.2	0	2
OLRFD-106A-3.2	0	3
OLRFD-110A-1.4	0	1
OLRFD-110A-2.4	0	2
OLRFD-110A-3.4	0	3

Table 2.5-7 Components of Emergency Core Cooling Systems and their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Core Flood System		
Tank	Pressure Boundary	Carbon Steel w/Stainless Steel Clad internally
Pipe	Pressure Boundary	Stainless Steel
Tank Nozzle	Pressure Boundary	Inconel
Tubing	Pressure Boundary	Satinless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
High Pressure Injection System		
Demineralizer	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary	Stainless Steel
Flexable Hose	Pressure Boundary	Stainless Steel
Flow Meter	Pressure Boundary	Stainless Steel
Flow Nozzle	Pressure Boundary, Throttle	Stainless Steel
Mechanical Expansion Joint	Pressure Boundary	Stainless Steel
Orifice	Pressure Boundary, Throttle	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Stainless Steel
Tank	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel

Table 2.5-7 Components of Emergency Core Cooling Systems and their Intended Functions (Continued)

High Pressure Injection System (Continued)		
Valve Bodies	Pressure Boundary	Stainless Steel
RCP Coolers (Units 2 & 3)	Pressure Boundary	Stainless Steel
RCP Seal Return Coolers	Pressure Boundary	Carbon Steel Stainless Steel
Low Pressure Injection System		
Annubar	Pressure Boundary, Throttle	Stainless Steel
Decay Heat Removal Coolers	Presure Boundary Heat Transfer	Carbon Steel Stainless Steel
Orifice	Pressure Boundary, Throttle	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Stainless Steel
Tank (Borated Water Storage)	Pressure Boundary	Carbon Steel(Lined)
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-8 Flow Diagrams Indicating Evaluation Boundaries of Auxiliary Systems

Spent Fuel Cooling System		
Flow Diagram	**Revision**	**Unit**
OLRFD-102A-1.1	0	1
OLRFD-102A-2.1	0	2
OLRFD-102A-3.1	0	3
OLRFD-104A-1.1	0	1&2
OLRFD-104A-1.2	0	1&2
OLRFD-104A-3.1	0	3
OLRFD-104A-3.2	0	3

Auxiliary Service Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-121D-1.2	0	1,2,3

Table 2.5-8 Flow Diagrams Indicating Evaluation Boundaries of Auxiliary Systems (continued)

Condenser Circulating Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-124B-1.1	0	1
OLRFD-124B-2.1	0	2
OLRFD-124B-3.1	0	3
OLRFD-133A-1.1	0	1
OLRFD-133A-1.2	0	1
OLRFD-133A-1.3	0	1
OLRFD-133A-1.4	0	1
OLRFD-133A-1.5	0	1
OLRFD-133A-2.1	0	2
OLRFD-133A-2.2	0	2
OLRFD-133A-2.3	0	2
OLRFD-133A-3.1	0	3
OLRFD-133A-3.2	0	3
OLRFD-133A-3.3	0	3
OLRFD-133A-3.4	0	3

Table 2.5-8 Flow Diagrams Indicating Evaluation Boundaries of Auxiliary Systems (continued)

High Pressure Service Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-124C-1.1	0	1,2,3
OLRFD-124C-1.2	0	1
OLRFD-124C-1.3	0	1
OLRFD-124C-1.4	0	1,2,3
OLRFD-124C-1.6	0	1
OLRFD-124C-2.2	0	2
OLRFD-124C-2.3	0	2
OLRFD-124C-2.6	0	2
OLRFD-124C-3.2	0	3
OLRFD-124C-3.3	0	3
OLRFD-124C-3.6	0	3
OLRFD-133A-1.1	0	1
OLRFD-133A-2.1	0	2
OLRFD-133A-3.1	0	3

Table 2.5-8 Flow Diagrams Indicating Evaluation Boundaries of Auxiliary Systems (continued)

Low Pressure Service Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-100A-1.3	0	1
OLRFD-100A-2.3	0	2
OLRFD-100A-3.3	0	3
OLRFD-121C-1.1	0	1
OLRFD-124A-1.1	0	1,2
OLRFD-124A-1.2	0	1
OLRFD-124A-1.3	0	1
OLRFD-124A-2.3	0	2
OLRFD-124A-3.1	0	3
OLRFD-124A-3.3	0	3
OLRFD-124B-1.1	0	1
OLRFD-124B-1.2	0	1
OLRFD-124B-1.4	0	1
OLRFD-124B-1.5	0	1,2
OLRFD-124B-1.6	0	1,2
OLRFD-124B-2.1	0	2
OLRFD-124B-2.2	0	2
OLRFD-124B-2.4	0	2
OLRFD-124B-3.1	0	3
OLRFD-124B-3.2	0	3
OLRFD-124B-3.4	0	3
OLRFD-124B-3.6	0	3
OLRFD-133A-1.1	0	1
OLRFD-133A-2.1	0	2
OLRFD-133A-3.1	0	3

Table 2.5-9 Components of Auxiliary Systems and their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Spent Fuel Cooling System		
Demineralizer	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary	Stainless Steel
Flexible Hose	Pressure Boundary	Stainless Steel
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Stainless Steel
Spent Fuel Transfer Tube	Pressure Boundary	Stainless Steel
Tank	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Spent Fuel Coolers	Pressure Boundary	Stainless Steel
Auxiliary Service Water System		
Annubar Tube	Pressure Boundary, Throttle	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Cast Iron
Tubing	Pressure Boundary	Stainless Steel

Table 2.5-9 Components of Auxiliary Systems and their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Auxiliary Service Water System (Continued)		
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Condenser Circulating Water System		
Mechanical Expansion Joint	Pressure Boundary	Carbon Steel
Mechanical Expansion Joint	Pressure Boundary	Stainless Steel
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Cast Iron
Pump Casing	Pressure Boundary	Carbon Steel
Screen	Pressure Boundary Filter	Carbon Steel
Screen	Pressure Boundary Filter	Stainless Steel
Valve Bodies	Pressure Boundary	Bronze

Table 2.5-9 Components of Auxiliary Systems and their Intended Functions (continued)

Mechanical Component	Intended Function(s)	Materials
Condenser Circulating Water System (continued)		
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Recirculated Cooling Water Heat Exchanger	Pressure Boundary	Admiralty Brass Carbon Steel
High Pressure Service Water System		
Filter	Pressure Boundary	Carbon Steel
Fire Hydrant	Pressure Boundary	Cast Iron
Hose Rack	Pressure Boundary	Bronze
Hose Rack	Pressure Boundary	Carbon Steel
Mechanical Expansion Joint	Pressure Boundary	Carbon Steel
Mechanical Expansion Joint	Pressure Boundary	Stainless Steel
Mulsifyer	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Cast Iron
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Cast Iron

Table 2.5-9 Components of Auxiliary Systems and their Intended Functions (continued)

Mechanical Component	Intended Function(s)	Materials
High Pressure Service Water System (Continued)		
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Sprinkler	Pressure Boundary, Spray	Bronze
Strainer	Pressure Boundary	Cast Iron
Valve Bodies	Pressure Boundary	Bronze
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Cast Iron
Valve Bodies	Pressure Boundary	Stainless Steel
Low Pressure Service Water System		
Annubar Tube	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary, Filter	Carbon Steel
Filter	Pressure Boundary, Filter	Stainless Steel
Flex Hose	Pressure Boundary	Stainless Steel
Hose Rack	Pressure Boundary	Bronze
Hose Rack	Pressure Boundary	Carbon Steel
Mechanical Expansion Joint	Pressure Boundary	Stainless Steel

Table 2.5-9 Components of Auxiliary Systems and their Intended Functions (continued)

Mechanical Component	Intended Function(s)	Materials
Low Pressure Service Water System (Continued)		
Mechanical Expansion Joint	Pressure Boundary	Carbon Steel
Orifice	Pressure Boundary, Throttle	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Carbon Steel
Site Glass	Pressure Boundary	Carbon Steel
Site Glass	Pressure Boundary	Stainless Steel
Strainer	Pressure Boundary	Carbon Steel
Strainer	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Bronze
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Component Coolers	Presure Boundary	Admiralty Brass Carbon Steel

Table 2.5-10 Flow Diagrams Indicating Evaluation Boundaries of Process Auxiliaries

Chemical Addition System		
Flow Diagram	**Revision**	**Unit**
OLRFD-102A-1.3	0	1
OLRFD-102A-2.3	0	2
OLRFD-102A-3.3	0	3
OLRFD-110A1.1	0	1
OLRFD-110A-1.4	0	1
OLRFD-110A2.1	0	2
OLRFD-110A-2.4	0	2
OLRFD-110A3.1	0	3
OLRFD-110A-3.4	0	3
OLRFD-127B-1.2	0	1
OLRFD-127B-2.2	0	2
OLRFD-127B-3.2	0	3

Table 2.5-10 Flow Diagrams Indicating Evaluation Boundaries of Process Auxiliaries (continued)

Coolant Storage System		
Flow Diagram	**Revision**	**Unit**
OLRFD-102A-1.3	0	1
OLRFD-102A-2.3	0	2
OLRFD-102A-3.3	0	3
OLRFD-107A-1.1	0	1
OLRFD-107A-1.2	0	1
OLRFD-107A-2.1	0	2
OLRFD-107A-2.2	0	2
OLRFD-107A-3.1	0	3
OLRFD-107A-3.2	0	3
OLRFD-127B-1.2	0	1
OLRFD-127B-2.2	0	2
OLRFD-127B-3.2	0	3

Table 2.5-11 Components of Process Auxiliaries and their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Chemical Addition System		
Accumulator	Pressure Boundary	Stainless Steel
Expansion Coil	Pressure Boundary	Stainless Steel
Flexable Hose	Pressure Boundary	Stainless Steel
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Coolant Storage System		
Pipe	Pressure Boundary	Stainless Steel
Spray Nozzles	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-12 Flow Diagrams Indicating Evaluation Boundaries of Air Conditioning, Heating, Cooling and Ventilation Systems

Auxiliary Building Ventilation System		
Flow Diagram	**Revision**	**Unit**
OLRFD-116G-1.1	0	1
OLRFD-116G-1.2	0	1
OLRFD-116G-1.3	0	1
OLRFD-116G-1.4	0	1
OLRFD-116G-2.1	0	2
OLRFD-116G-3.1	0	3
OLRFD-116G-3.2	0	3
OLRFD-116G-3.3	0	3

Control Room Pressurization and Filtration System		
Flow Diagram	**Revision**	**Unit**
OLRFD-116J-1.1	0	1,2
OLRFD-116J-1.2	0	1,2
OLRFD-116-J3.2	0	3

Penetration Room Ventilation System		
Flow Diagram	**Revision**	**Unit**
OLRFD-116B-1.1	0	1
OLRFD-116B-2.1	0	2
OLRFD-116B-3.1	0	3

Table 2.5-13 Components of Air Conditioning, Heating, Cooling and Ventilation Systems and Their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Auxiliary Building Ventilation System		
Air Flow Monitor	Pressure Boundary	Aluminum
Air Flow Monitor	Pressure Boundary	Carbon Steel
Air Flow Monitor	Pressure Boundary	Galvanized Steel
Air Flow Monitor	Pressure Boundary	Stainless Steel
Air Handling Unit	Pressure Boundary	Aluminum
Air Handling Unit	Pressure Boundary	Galvanized Steel
Air Handling Unit	Pressure Boundary	Stainless Steel
Ductwork	Pressure Boundary	Aluminum
Ductwork	Pressure Boundary	Galvanized Steel
Ductwork	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary	Aluminum
Filter	Pressure Boundary	Galvanized Steel
Filter	Pressure Boundary	Stainless Steel
Grill	Pressure Boundary	Aluminum
Grill	Pressure Boundary	Galvanized Steel
Grill	Pressure Boundary	Stainless Steel

Table 2.5-13 Components of Air Conditioning, Heating, Cooling and Ventilation Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Control Room Pressurization and Filtration System		
Air Flow Monitor	Pressure Boundary	Aluminum
Air Flow Monitor	Pressure Boundary	Galvanized Steel
Air Flow Monitor	Pressure Boundary	Stainless Steel
Air Handling Unit	Pressure Boundary	Aluminum
Air Handling Unit	Pressure Boundary	Galvanized Steel
Air Handling Unit	Pressure Boundary	Stainless Steel
Ductwork	Pressure Boundary	Aluminum
Ductwork	Pressure Boundary	Galvanized Steel
Ductwork	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary, Filtration	Aluminum
Filter	Pressure Boundary, Filtration	Galvanized Steel
Filter	Pressure Boundary, Filtration	Stainless Steel
Grill	Pressure Boundary	Aluminum
Grill	Pressure Boundary	Galvanized Steel
Grill	Pressure Boundary	Stainless Steel

Table 2.5-13 Components of Air Conditioning, Heating, Cooling and Ventilation Systems and Their Intended Functions

(continued)

Mechanical Component	Intended Function(s)	Materials
Control Room Pressurization and Filtration System (continued)		
Heater (PB Only)	Pressure Boundary	Aluminum
Heater (PB Only)	Pressure Boundary	Galvanized Steel
Heater (PB Only)	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Penetration Room Ventilation System		
Filter	Pressure Boundary Filter	Carbon Steel
Grill	Pressure Boundary	Aluminum
Grill	Pressure Boundary	Galvanized Steel
Grill	Pressure Boundary	Stainless Steel
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel

Table 2.5-13 Components of Air Conditioning, Heating, Cooling and Ventilation Systems and Their Intended Functions

(continued)

Mechanical Component	Intended Function(s)	Materials
Penetration Room Ventilation System (Continued)		
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Valves Bodies	Pressure Boundary	Carbon Steel

Table 2.5-14 Flow Diagrams Indicating Evaluation Boundaries of Steam and Power Conversion Systems

Main Steam System		
Flow Diagram	**Revision**	**Unit**
OLRFD-122A-1.1	0	1
OLRFD-122A-1.2	0	1
OLRFD-122A-1.3	0	1
OLRFD-122A-1.4	0	1
OLRFD-122A-1.5	0	1
OLRFD-122A-2.1	0	2
OLRFD-122A-2.2	0	2
OLRFD-122A-2.3	0	2
OLRFD-122A-2.4	0	2
OLRFD-122A-2.5	0	2
OLRFD-122A-3.1	0	3
OLRFD-122A-3.2	0	3
OLRFD-122A-3.3	0	3
OLRFD-122A-3.4	0	3
OLRFD-122A-3.5	0	3
OLRFD-122B-1.1	0	1
OLRFD-122B-2.1	0	2
OLRFD-122B-3.1	0	3

Table 2.5-14 Flow Diagrams Indicating Evaluation Boundaries of Steam and Power Conversion Systems (continued)

Condensate System		
Flow Diagram	**Revision**	**Unit**
OLRFD-121A-1.1	0	1
OLRFD-121A-1.2	0	1
OLRFD-121A-1.3	0	1
OLRFD-121A-1.4	0	1
OLRFD-121A-1.5	0	1
OLRFD-121A-1.6	0	1
OLRFD-121A-1.7	0	1
OLRFD-121A-1.8	0	1
OLRFD-121A-2.1	0	2
OLRFD-121A-2.2	0	2
OLRFD-121A-2.3	0	2
OLRFD-121A-2.4	0	2
OLRFD-121A-2.5	0	2
OLRFD-121A-2.6	0	2
OLRFD-121A-2.7	0	2
OLRFD-121A-2.8	0	2
OLRFD-121A-3.1	0	3
OLRFD-121A-3.2	0	3
OLRFD-121A-3.3	0	3
OLRFD-121A-3.4	0	3
OLRFD-121A-3.5	0	3
OLRFD-121A-3.6	0	3
OLRFD-121A-3.7	0	3
OLRFD-121A-3.8	0	3

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Table 2.5-14 Flow Diagrams Indicating Evaluation Boundaries of Steam and Power Conversion Systems (continued)

Emergency Feedwater System		
Flow Diagram	**Revision**	**Unit**
OLRFD-121D-1.1	0	1
OLRFD-121D-1.2	0	1,2,3
OLRFD-121D-2.1	0	2
OLRFD-121D-3.1	0	3

Feedwater System		
Flow Diagram	**Revision**	**Unit**
OLRFD-121B-1.3	0	1
OLRFD-121B-1.5	0	1
OLRFD-121B-2.3	0	2
OLRFD-121B-2.5	0	2
OLRFD-121B-3.3	0	3
OLRFD-121B-3.5	0	3

Table 2.5-15 Components of Steam and Power Conversion Systems and Their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Main Steam System		
EFWP Turbine Casing	Pressure Boundary	Carbon Steel
Filter	Pressure Boundary	Carbon Steel
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Condensate System		
Demineralizer	Pressure Boundary	Carbon Steel
Filter	Pressure Boundary	Carbon Steel
Mechanical Expansion Joint	Pressure Boundary	Carbon Steel
Orifice	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Carbon Steel
Pump Casing	Pressure Boundary	Cast Iron
Strainer	Pressure Boundary	Carbon Steel

Table 2.5-15 Components of Steam and Power Conversion Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Condensate System (Continued)		
Tank (Powdex, Upper Surge Tank)	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Main Condenser	Pressure Boundary	Carbon Steel Stainless Steel
Condensate Coolers	Pressure Boundary	Carbon Steel Stainless Steel
Generator Water Coolers	Pressure Boundary	Stainless Steel
Emergency Feedwater System		
Flow Nozzle	Pressure Boundary	Stainless Steel
Flow Sensor	Pressure Boundary, Throttle	Stainless Steel
Orifice	Pressure Boundary, Throttle	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pump Casing	Pressure Boundary	Carbon Steel

Table 2.5-15 Components of Steam and Power Conversion Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Emergency Feedwater System (Continued)		
Pump Casing	Pressure Boundary	Low Alloy Steel
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Feedwater System		
Emergency Feedwater Header	Pressure Boundary	Carbon Steel
Flow Nozzle	Pressure Boundary	Stainless Steel
Main Feedwater Header	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-16 Flow Diagrams Indicating Evaluation Boundaries of Post-Accident Hydrogen Control Systems

Containment Hydrogen Control System		
Flow Diagram	**Revision**	**Unit**
OLRFD-107B-2.1	0	2
OLRFD-107B-3.1	0	3
OLRFD-116C-1.1	0	1
OLRFD-116C-2.1	0	2
OLRFD-116C-3.1	0	3

Post-Accident Monitoring System		
Flow Diagram	**Revision**	**Unit**
OLRFD-110A-1.3	0	1
OLRFD-110A-2.3	0	2
OLRFD-110A-3.3	0	3

Table 2.5-17 Components of Post-Accident Hydrogen Control Systems and Their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Containment Hydrogen Control System		
Flex Hose	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Hydrogen Recombiner	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Post-Accident Monitoring System		
Pipe	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-18 Flow Diagrams Indicating Evaluation Boundaries of the Reactor Coolant Pump Motor Oil Collection System

Reactor Coolant Pump Motor Oil Collection System		
Flow Diagram	**Revision**	**Unit**
OLRFD-100A-1.4	0	1
OLRFD-100A-2.4	0	2
OLRFD-100A-3.4	0	3

Table 2.5-19 Components of the Reactor Coolant Pump Motor Oil Collection System and Their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Reactor Coolant Pump Motor Oil Collection System		
Enclosures	Pressure Boundary	Carbon Steel
Flex Hose	Pressure Boundary	Carbon Steel
Flex Hose	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Tank	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel

Table 2.5-19 Components of the Reactor Coolant Pump Motor Oil Collection System and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Reactor Coolant Pump Motor Oil Collection System (Continued)		
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-20 Flow Diagrams Indicating Evaluation Boundaries of the Reactor Coolant System Vents, Drains, and Instrument Lines

Flow Diagram	Revision	Unit
OLRFD-100A-1.1	0	1
OLRFD-100A-1.2	0	1
OLRFD-100A-1.3	0	1
OLRFD-100A-2.1	0	2
OLRFD-100A-2.2	0	2
OLRFD-100A-2.3	0	2
OLRFD-100A-3.1	0	3
OLRFD-100A-3.2	0	3
OLRFD-100A-3.3	0	3
OLRFD-101A-1.1	0	1
OLRFD-101A-1.4	0	1
OLRFD-101A-2.1	0	2
OLRFD-101A-2.4	0	2
OLRFD-101A-3.1	0	3
OLRFD-101A-3.4	0	3
OLRFD-102A-1.1	0	1
OLRFD-102A-1.2	0	1
OLRFD-102A-1.3	0	1
OLRFD-102A-2.1	0	2
OLRFD-102A-2.2	0	2
OLRFD-102A-2.3	0	2
OLRFD-102A-3.1	0	3
OLRFD-102A-3.2	0	3
OLRFD-102A-3.3	0	3
OLRFD-110A-1.1	0	1
OLRFD-110A-2.1	0	2
OLRFD-110A-3.1	0	3

Table 2.5-21 Components of the Reactor Coolant System Vents, Drains, and Instrument Lines and Their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Reactor Coolant System Vents, Drains, and Instrument Lines		
Mechanical Expansion Joint	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pressure Breakdown Coil	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-22 Flow Diagrams Indicating Evaluation Boundaries of Keowee Hydroelectric Station Systems

Carbon Dioxide System		
Flow Diagram	**Revision**	**Unit**
KLRFD-108A-1.1	0	1,2

Depressing Air System		
Flow Diagram	**Revision**	**Unit**
KLRFD-111A-1.1	0	1,2

Generator High Pressure Oil System		
Flow Diagram	**Revision**	**Unit**
KLRFD-103A-1.1	0	1
KLRFD-103A-2.1	0	2

Governor Air System		
Flow Diagram	**Revision**	**Unit**
KLRFD-104A-1.1	0	1
KLRFD-104A-2.1	0	2
KLRFD-105A-1.1	0	1
KLRFD-105A-2.1	0	2

Table 2.5-22 Flow Diagrams Indicating Evaluation Boundaries of Keowee Hydroelectric Station Systems (continued)

Governor Oil System		
Flow Diagram	**Revision**	**Unit**
KLRFD-105A-1.1	0	1
KLRFD-105A-2.1	0	2

Service Water System		
Flow Diagram	**Revision**	**Unit**
KLRFD-109A-1.1	0	1,2
OLRFD-117B-1.5	0	1,2

Turbine Generator Cooling Water System		
Flow Diagram	**Revision**	**Unit**
KLRFD-100A-1.1	0	1
KLRFD-100A-2.1	0	2

Table 2.5-22 Flow Diagrams Indicating Evaluation Boundaries of Keowee Hydroelectric Station Systems (continued)

Turbine Guide Bearing Oil System		
Flow Diagram	**Revision**	**Unit**
KLRFD-101A-1.1	0	1
KLRFD-101A-2.1	0	2

Turbine Sump Pump System		
Flow Diagram	**Revision**	**Unit**
KLRFD-102A-1.1	0	1
KLRFD-102A-2.1	0	2

Table 2.5-23 Components of Keowee Hydroelectric Station Systems and Their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Carbon Dioxide System		
Flexable Hose	Pressure Boundary	Carbon Steel
Nozzle	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Depressing Air System		
Pipe	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Generator High Pressure Oil System		
Filter	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Copper
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Carbon Steel
Tank	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper

Table 2.5-23 Components of Keowee Hydroelectric Station Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Generator High Pressure Oil System (Continued)		
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Bronze
Valve Bodies	Pressure Boundary	Copper
Valve Bodies	Pressure Boundary	Stainless Steel
Governor Air System		
Pipe	Pressure Boundary	Carbon Steel
Tank	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Governor Oil System		
Pipe	Pressure Boundary	Carbon Steel
Pump Casing	Pressure Boundary	Carbon Steel
Tank	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Service Water System		
Annubar	Pressure Boundary, Throttle	Stainless Steel

Table 2.5-23 Components of Keowee Hydroelectric Station Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Service Water System (Continued)		
Filter	Pressure Boundary	Carbon Steel
Fire Hydrant	Pressure Boundary	Cast Iron
Hose Rack	Pressure Boundary	Bronze
Hose Rack	Pressure Boundary	Carbon Steel
Mulsifyer	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Ductile Iron
Pump Casing	Pressure Boundary	Cast Iron
Strainer	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Bronze
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Cast Iron

Table 2.5-23 Components of Keowee Hydroelectric Station Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Turbine Generator Cooling Water System		
Filter	Pressure Boundary,Filter	Stainless Steel
Filter	Pressure Boundary,Filter	Carbon Steel
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Brass
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Bronze
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-23 Components of Keowee Hydroelectric Station Systems and Their Intended Functions (continued)

Mechanical Component	Intended Function(s)	Materials
Turbine Guide Bearing Oil System		
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Carbon Steel
Strainer	Pressure Boundary	Stainless Steel
Tank	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Turbine Guide Bearing Oil Coolers	Presure Boundary Heat Transfer	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Turbine Sump Pump System		
Filter	Pressure Boundary	Bronze
Filter	Pressure Boundary	Stainless Steel

Table 2.5-23 Components of Keowee Hydroelectric Station Systems and Their Intended Functions (continued)

Mechanical Component	Intended Function(s)	Materials
Turbine Sump Pump System (Continued)		
Pipe	Pressure Boundary	Brass
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Bronze
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-24 Flow Diagrams Indicating Evaluation Boundaries of Standby Shutdown Facility Systems

Air Intake and Exhaust System		
Flow Diagram	**Revision**	**Unit**
OLRFD-137D-1.3	0	1,2,3

Diesel Generator Fuel Oil System		
Flow Diagram	**Revision**	**Unit**
OLRFD-135A-1.2	0	0

Drinking Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-126B-1.1	0	1,2,3

Heating, Ventilation, and Air Conditioning System		
Flow Diagram	**Revision**	**Unit**
OLRFD-116N-1.1	0	1,2,3

Table 2.5-24 Flow Diagrams Indicating Evaluation Boundaries of Standby Shutdown Facility Systems (continued)

Reactor Coolant Makeup System		
Flow Diagram	**Revision**	**Unit**
OLRFD-101A-1.5	0	1
OLRFD-101A-2.5	0	2
OLRFD-101A-3.5	0	3

Sanitary Lift System		
Flow Diagram	**Revision**	**Unit**
OLRFD-126B-1.1	0	1,2,3

Standby Shutdown Facility Auxiliary Service Water System		
Flow Diagram	**Revision**	**Unit**
OLRFD-133A-2.5	0	1,2,3

Starting Air System		
Flow Diagram	**Revision**	**Unit**
OLRFD-137D-1.1	0	1,2,3
OLRFD-137D-1.2	0	1,2,3

Table 2.5-25 Components of the Standby Shutdown Facility Systems and Their Intended Functions

Mechanical Component	Intended Function(s)	Materials
Air Intake and Exhaust System		
Mechanical Expansion Joint	Pressure Boundary	Chrome-Molybdenum
Muffler/Silencer	Pressure Boundary Noise Reduction	Carbon Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Chrome-Molybdenum
Screen	Pressure Boundary, Filtration	Carbon Steel Chrome-Molybdenum
Screen	Pressure Boundary, Filtration	
Tubing	Pressure Boundary	Carbon Steel
Diesel Generator Fuel Oil System		
Orifice	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Carbon Steel
Strainer	Pressure Boundary, Filter	Stainless Steel
Tank	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Brass
Tubing	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Copper
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-25 Components of the Standby Shutdown Facility Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Drinking Water		
Hose Connection	Pressure Boundary	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Heating, Ventilation and Air Conditoning		
Air Flow Monitor	Pressure Boundary	Aluminum
Air Flow Monitor	Pressure Boundary	Galvanized Steel
Air Flow Monitor	Pressure Boundary	Stainless Steel
Air Handling Unit	Pressure Boundary	Aluminum
Air Handling Unit	Pressure Boundary	Galvanized Steel
Cooling Coil (except the Standby Shutdown Facility HVAC Condensers)	Pressure Boundary	Aluminum Copper
Ductwork	Pressure Boundary	Aluminum
Ductwork	Pressure Boundary	Galvanized Steel
Ductwork	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary	Aluminum
Filter	Pressure Boundary	Galvanized Steel
Filter	Pressure Boundary	Stainless Steel

Table 2.5-25 Components of the Standby Shutdown Facility Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Heating, Ventilation and Air Conditoning (Continued)		
Grill	Pressure Boundary	Aluminum
Grill	Pressure Boundary	Galvanized Steel
Grill	Pressure Boundary	Stainless Steel
Heater (PB Only)	Pressure Boundary	Aluminum
Heater (PB Only)	Pressure Boundary	Galvanized Steel
Heater (PB Only)	Pressure Boundary	Stainless Steel
Reactor Coolant Makeup System		
Accumulator	Pressure Boundary	Stainless Steel
Filter	Pressure Boundary, Filter	Stainless Steel
Orifice	Pressure Boundary, Throttling	Stainless Steel
Pipe	Pressure Boundary	Stainless Steel
Pulsation Damper	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Stainless Steel
Sanitary Lift System		
Pipe	Pressure Boundary	Stainless Steel

Table 2.5-25 Components of the Standby Shutdown Facility Systems and Their Intended Functions (Continued)

Mechanical Component	Intended Function(s)	Materials
Standby Shutdown Facility Auxiliary Service Water System		
Air Ejector	Pressure Boundary, Gas Removal	Stainless Steel
Annubar Tube	Pressure Boundary, Throttling	Stainless Steel
Orifice	Pressure Boundary, Throttling	Stainless Steel
Pipe	Pressure Boundary	Carbon Steel
Pipe	Pressure Boundary	Stainless Steel
Pump Casing	Pressure Boundary	Carbon Steel
Pump Casing	Pressure Boundary	Cast Iron
Standby Shutdown Facility HVAC water-cooled Condensers	Pressure Boundary	90-10 Copper/Nickel Carbon steel
Strainer	Pressure Boundary, Filtration	Carbon Steel
Strainer	Pressure Boundary, Filtration	Stainless Steel
Tubing	Pressure Boundary	Stainless Steel
Valve Bodies	Pressure Boundary	Carbon Steel
Valve Bodies	Pressure Boundary	Stainless Steel

Table 2.5-25 Components of the Standby Shutdown Facility Systems and Their Intended Functions (continued)

Mechanical Component	Intended Function(s)	Materials
Starting Air System		
Pipe	Pressure Boundary	Carbon Steel
Tank	Pressure Boundary	Carbon Steel
Valve	Pressure Boundary	Carbon Steel
Tubing	Pressure Boundary	Carbon Steel

2.6 Electrical Components

2.6.1 Description of the Process to Identify Electrical Components Subject to Aging Management Review

The initial step to identify electrical components to be included in the aging management review is to determine those electrical components that perform their function without moving parts or without a change in configuration or properties. NEI 95-10, Revision 0, Appendix B [Reference 2.6-1, Table B-1], §54.21(a)(1)(i) [Reference 2.6-2]. Various Oconee electrical drawings were reviewed to identify electrical components. Subsequent stages of the identification process consider (1) whether or not the electrical component is within the scope of license renewal and (2) whether or not the electrical component is subject to replacement based on a qualified life or specified time period. Based on this review, Duke has determined that the Oconee electrical component types that perform their function without moving parts or without a change in configuration or properties, and are included in the aging management review, are as follows:

- Bus
- Insulated Cables & Connections
- Insulators
- Transmission Conductors

These electrical components along with their intended functions are listed in Table 2.6-1.

Electrical components interface with other types of components at Oconee and the assessments of these interfacing components are provided in other sections of OLRP-1001. For example, the assessment of electrical racks, panels, frames, cabinets, cable tray, conduit and their supports is provided as part of the Structures and Structural Components review in Sections 2.7 and 3.7 of OLRP-1001.

Sections 2.6.2 through 2.6.5 provide descriptions of the electrical components that are included in the aging management review. Section 2.6.6 provides a basis for the determination that several electrical components are not subject to aging management review. Section 2.6.7 identifies the structures and areas of Oconee that contain electrical components that are subject to aging management review.

2.6.2 BUS

2.6.2.1 Phase Bus

2.6.2.1.1 ISOLATED-PHASE BUS

An isolated-phase bus is an electrical bus in which each phase conductor is enclosed by an individual metal housing separated from adjacent conductor housings by an air space. Isolated-phase bus structural supports are reviewed in Sections 2.7 and 3.7 of OLRP-1001.

The 13.8 kV isolated-phase bus for each Keowee unit is used to connect the main switchgear to Transformer 1 (main step-up transformer). Transformer 1 is connected to the Oconee 230 kV Switchyard through the Keowee Transmission Line. The bus-transformer-transmission line-switchyard path is used to supply normal power to the Duke transmission system and is used to supply emergency power to the Oconee units (as part of the emergency overhead power path). As such, each Keowee 13.8 kV isolated-phase bus is designated as QA Condition 1 and is considered safety-related. Therefore, each Keowee 13.8 kV isolated-phase bus is in scope and subject to aging management review.

The list of isolated-phase bus that are subject to aging management review is provided in Table 2.6-2. A typical cross-section of the isolated-phase bus is shown in Figure 2.6-1.

2.6.2.1.2 NONSEGREGATED-PHASE BUS

A nonsegregated-phase bus is an electrical bus constructed with all phase conductors in a common metal enclosure without barriers between the phases. Nonsegregated-phase bus structural supports are reviewed in Sections 2.7 and 3.7 of OLRP-1001.

A nonsegregated-phase bus is used in the Oconee 4160V power system to connect normal and emergency power to, and make connections between, bus sections for safety-related switchgear B1T, B2T, 3B1T, 3B2T, 1TC, 1TD, 1TE, 2TC, 2TD, 2TE, 3TC, 3TD, and 3TE. These switchgear supply power to all Oconee safety-related loads and many nonsafety-related loads. Therefore, all 4160V nonsegregated-phase bus is within scope and is subject to aging management review.

The list of nonsegregated-phase buses subject to aging management review is provided in Table 2.6-3. A typical cross-section of a nonsegregated-phase bus is shown in Figure 2.6-2.

2.6.2.1.3 SEGREGATED-PHASE BUS

A segregated-phase bus is an electrical bus in which all phase conductors are in a common metal enclosure, but are segregated by metal barriers between phases. Segregated-phase bus structural supports are reviewed in Sections 2.7 and 3.7 of OLRP-1001.

The Keowee segregated-phase bus is used to connect the unit generation to the main switchgear and the main switchgear to the emergency underground feeder switchgear in the Keowee Breaker Vault. Both sections of the Keowee segregated-phase bus are designated as QA Condition 1 and are considered safety-related. Therefore, all Keowee segregated-phase bus is subject to aging management review.

The list of segregated-phase bus subject to aging management review is provided in Table 2.6-4. A typical cross-section of the segregated-phase bus is shown in Figure 2.6-3.

2.6.2.2 Switchyard Bus

A switchyard bus is an uninsulated, unenclosed, rigid electrical conductor used in switchyards and switching stations to provide an electrically common connection point for several electrical components. Transmission conductors are reviewed in Section 2.6.5 of OLRP-1001 and insulators are reviewed in Section 2.6.4 of OLRP-1001. This review of the switchyard bus includes the hardware used in connections to insulators and transmission conductors.

The 230 kV Switchyard structures are the only structures within scope that support the switchyard bus. Rather than scoping the switchyard bus in the 230 kV Switchyard, a bounding set of switchyard bus is chosen which contains all switchyard bus in the 230 kV Switchyard. Therefore, all switchyard bus in the 230 kV Switchyard is included in the aging management review.

The list of switchyard bus subject to aging management review is provided in Table 2.6-5. Figure 2.6-4 is a one-line diagram showing the 230 kV Switchyard layout.

2.6.3 Insulated Cables And Connections

An insulated cable is an assembly of a single electrical conductor (wire) with an insulation covering or a combination of conductors insulated from one another having overall coverings. Cable connections are used to connect the cable conductors to other cables or electrical devices and include compression connectors, fusion connectors, plug-in connectors, splice insulation systems (heat-shrink or tape), and terminal blocks.

Insulated cables and connections are grouped into two applications: power and instrumentation and control (I&C), as defined below.

- **Power Applications:** Insulated cables and connections used to supply power to devices or components where the cables carry a large amount of current, relative to their rating, for significant periods of time and, therefore, may be subject to self-heating temperature rise from the current they carry.

- **I&C Applications:** Insulated cables and connections used to supply power to devices or components where the cables carry a small amount of current, relative to their rating, or carry current for insignificant periods of time and, therefore, are subject to insignificant self-heating temperature rise from the current they carry.

Insulated cables and connections evaluated in this section are those that are separate components and not part of some larger complex assembly (e.g., motor, switchgear, relay, transformer, power supply, charger, penetration assembly). Insulated cable and connection structural supports (e.g., cable tray, conduit, trenches) are reviewed in Sections 2.7 and 3.7 of OLRP-1001.

Insulated cables and connections installed at Oconee that have been determined not to be subject to aging management review are described in Section 2.6.6.1.

The list identifying insulated cables and connections included in the aging management review is grouped based on insulation material. Reasonable assurance exists that all cable and connection insulation materials have been identified or that the identified insulation materials bound the physical properties of all cable and connection materials. Cable insulation materials are not linked directly with specific manufacturers and, therefore, the aging management review takes the bounding approach that any insulated cable type could have been supplied by any manufacturer.

The insulated cables and connections included within the aging management review are listed in Table 2.6-6. A cross section of a typical insulated cable is shown in Figure 2.6-5.

2.6.4 INSULATORS

An insulator is an insulating material in a form designed to (a) support a conductor physically and (b) separate the conductor electrically from another conductor and object. The insulators evaluated in the electrical Integrated Plant Assessment are station post, strain, and suspension insulators used to support uninsulated, high voltage electrical components (e.g., transmission conductors, switchyard bus).

Insulators evaluated in this section are those that are separate components and not part of a larger complex assembly. Insulators interface with structural steel supports and connecting hardware which are reviewed in Sections 2.7 and 3.7, transmission conductors and connecting hardware which are reviewed in Section 2.6.5, and switchyard bus and connecting hardware which are reviewed in Section 2.6.5 of OLRP-1001.

Insulators are identified by their supporting structures. The 230 kV Keowee Transmission Line structures, 230 kV Switchyard structures, Keowee Transformer Yard structures associated with Keowee Transformer 1, and Oconee Transformer Yard structures associated with Transformers CT1, CT2 and CT3 are the only structures within scope that support insulators. Rather than scoping the insulators supported by these structures, a bounding set of insulators is chosen which contains all insulators supported by these structures. These insulators support disconnect switches, switchyard bus and transmission conductors. Therefore, all insulators supported by 230 kV Keowee Transmission Line structures, 230 kV Switchyard structures, Keowee Transformer Yard structures associated with Keowee Transformer 1, and Oconee Transformer Yard structures associated with Transformers CT1, CT2 and CT3 are included in the aging management review.

A list of the insulators subject to aging management review is provided in Table 2.6-7. Figure 2.6-6 is a cross-section drawing of a typical strain or suspension insulator and a cross-section of a typical post insulator is shown in Figure 2.6-7.

2.6.5 TRANSMISSION CONDUCTORS

Transmission conductors are uninsulated, stranded wire conductors and are used outside buildings in high voltage applications. Transmission conductors interface with insulators which are reviewed in Section 2.6.4 and switchyard bus and connecting hardware which are reviewed in Section 2.6.2.2 of OLRP-1001. This review of transmission conductors includes the hardware used in connections to insulators.

Transmission conductors are identified by the insulators that support them. Rather than scoping the transmission conductors, a bounding set of transmission conductors is chosen that contain all transmission conductors supported by the insulators identified in Table 2.6-7. Therefore, all transmission conductors supported by insulators identified in Table 2.6-7 are included in the aging management review.

A list of transmission conductors included in the aging management review is provided in Table 2.6-8.

2.6.6 ELECTRICAL COMPONENTS NOT SUBJECT TO AGING MANAGEMENT REVIEW

The process to determine the types of Oconee electrical components subject to aging management review initially relied on determinations made in §54.21(a)(1)(i), and NEI 95-10, Revision 0, Appendix B and in a written communication from the NRC to the industry [Reference 2.6-3]. Items 122, 139, 140, 143, and 144 of NEI 95-10, Revision 0, Appendix B require plant-specific review to determine whether or not they are subject to aging management review. [Footnote 1] The sections below provide the basis for the determination that these and other specific electrical component types are not subject to aging management review at Oconee.

2.6.6.1 Insulated Cables and Connections Not Subject to Aging Management Review

2.6.6.1.1 INSULATED CABLES AND CONNECTIONS INCLUDED IN THE OCONEE EQ PROGRAM

Numerous insulated cables and connections are relied on in safety analyses and plant evaluations to perform a function that demonstrates compliance with 10 CFR, §50.49. As such, these insulated cables and connections are included in the Oconee Environmental Qualification (EQ) Program. The Oconee EQ Program is described in the UFSAR [Reference 2.6-4, Chapter 3.11]. Insulated cables and connections, as included in the Oconee EQ Program, have a documented, administratively controlled qualified life. With a documented qualified life, insulated cables and connections included in the Oconee EQ Program are a replacement item as described in §54.21(a)(1)(ii). Therefore, insulated cables and connections included in the Oconee EQ Program are not subject to aging management review.

2.6.6.1.2 INSULATED CABLES AND CONNECTIONS USED FOR FIRE DETECTORS AS PART OF THE FIRE DETECTION SYSTEM

Insulated cables and connections are used to connect fire detectors to the other parts of the Fire Detection System. The Fire Detection System is not required to mitigate the consequences of a design basis accident and has no seismic design classification as defined in Section L-6 of 10 CFR Part 50, Appendix R. In addition, no potential seismic interaction exists between the Fire Detection System equipment and QA Condition 1 equipment, and the wiring of this system is supervised to provide a trouble alarm for any open circuit, short circuit, or ground condition.

In addition to the continuous circuit monitoring, each fire detector is tested for operability monthly by performance of a Channel Functional Test using the Fire Detection Instrumentation Control Board Panel Test Switch as directed by the UFSAR [Reference 2.6-4 , Chapter 16, *Selected Licensee Commitments,* Section 16.9.6, *Fire Detection Instrumentation*]. This test is a

1. Item 68, Recombiners, which are also required to be reviewed on a plant specific basis are being addressed by Duke in Section 2.5.10, “Post-Accident Hydrogen Control,” of OLRP-1001.

communication check between each fire detector and the control board. Since the test is conducted using the insulated cables and connections for communication, it is a performance test of the insulated cables and connections. Any failure of this test or trouble alarm indication is identified and the problem is remedied with the insulated cable or connection being replaced as appropriate. Therefore, the fire detector insulated cables and connections are excluded from an aging management review based on the criteria of §54.21(a)(1)(ii).

Excluding components under the criteria of §54.21(a)(1)(ii) on the grounds that they are replaced based on a performance or condition program, is addressed in the Statement of Consideration (SOC) of the Final Rule [Reference 2.6-2, Section III.f.(i)(b)]. The SOC does not explicitly preclude site-specific justification that a replacement program based on component performance provides reasonable assurance that the intended function of the component will be maintained in the period of extended operation. The expected attributes of a program to address this are also given in the SOC [Reference 2.6-2, Section III.f.(i)(b)].

SOC to 10 CFR Part 54, Section III.f.(i)(b)

¼ the Commission would generally expect that such a replacement program would have defined performance or condition measuring methods (e.g., wall thickness of heat exchanger tubes), an established monitoring frequency that supports timely discovery of degraded conditions (e.g., every refueling outage), and an appropriate replacement criterion (e.g., upon reaching a specified number of tubes plugged).

The fire detector insulated cables and connections meet the attributes described in the SOC. The condition and performance capability of the fire detector insulated cables and connections is monitored via continuity, short circuit, and functional circuit checks. The insulated cables and connections are continuously monitored for continuity and short circuits. They also are performance tested monthly; frequent enough for timely discovery of a degraded condition. If an insulated cable or connection malfunction is found that is due to age degradation, it will be replaced (or repaired if appropriate). The Fire Detection System and the regulated administrative controls provide reasonable assurance that the intended function of the fire detector insulated cables and connections will be maintained during the period of extended operation. Therefore, the fire detector insulated cables and connections are excluded from aging management review based on the criteria of §54.21(a)(1)(ii).

2.6.6.2 Electrical Penetration Assemblies

Penetration assemblies are used to pass electrical circuits through the Reactor Building outer wall while maintaining containment integrity.

Electrical penetration assemblies are designated as safety-related and installed electrical penetration assemblies are relied on in safety analyses and plant evaluations to perform a function that demonstrates compliance with §50.49. As such, electrical penetration assemblies are included in the Oconee Environmental Qualification (EQ) Program. The Oconee EQ Program is described in the UFSAR [Reference 2.6-4, Chapter 3.11]. Electrical penetration assemblies, as included in the Oconee EQ Program, have a documented, administratively controlled qualified life. With a documented qualified life, electrical penetration assemblies are replacement items as described in §54.21(a)(1)(ii). Therefore, electrical penetration assemblies are not subject to aging management review.

The integrated plant assessment of the metallic portion of the electrical penetration assemblies is provided as part of the Reactor Building (Containment) review in Sections 2.3 and 3.3 of OLRP-1001.

2.6.6.3 Heat Tracing & Electric Heaters

Heat tracing and electric heaters are identified as Items 139 and 140, respectively, in NEI 95-10, Revision 0 [Reference 2.6-1, Table B-1], but no determination was made as to whether or not they are subject to aging management review. This determination is required to be performed on a plant-specific basis. However, in a NRC written communication to the industry [Reference 2.6-3], the NRC determined that heat tracing and electric heaters are not subject to aging management review.

2.6.6.4 Transformers

Transformers are identified as Items 122, 143, and 144 in NEI 95-10, Revision 0 [Reference 2.6-1, Table B-1], but no determination was made of whether or not they are passive. This determination is required to be performed on a plant-specific basis. Transformers are not identified in §54.21(a)(1)(i). However, in a NRC written communication to the industry [Reference 2.6-3], the NRC determined that transformers are not subject to aging management review.

2.6.6.5 Resistance Temperature Detectors (RTDs)

RTDs are identified in NEI 95-10, Revision 0, Appendix B as performing their function without moving parts or without a change in configuration or properties. Duke does not agree with this determination for the following reason. The function of an RTD is to convert a measured physical parameter into a proportional electrical parameter. The electrical parameter is the resistance between the RTD terminals. This resistance is an electrical property of the RTD and it changes in proportion to the physical parameter being measured. The proportional variations in the RTD terminal resistance are integral to the function of an RTD and only exist when it is performing its function; i.e., an RTD performs its function by changing its electrical properties. This indicates that RTDs do not perform their function without moving parts or without a change in configuration or properties. Therefore, RTDs are not subject to aging management review based on the criteria of §54.21(a)(1)(i).

2.6.6.6 Thermocouples

Thermocouples are identified in NEI 95-10, Revision 0, Appendix B as performing their function without moving parts or without a change in configuration or properties. Duke does not agree with this determination for the following reason. The function of a thermocouple is to convert a measured physical parameter (thermal energy) into a proportional electrical parameter. The electrical parameter is the voltage between the thermocouple terminals. A thermocouple consists of a junction of two dissimilar metallic conductors (e.g., copper and iron) in which an electromotive force (voltage) is induced when the conductors are maintained at different temperatures; the force being related to the temperature difference.

The thermocouple is used to determine the temperature of a third substance by connecting it to the junction of the metals and measuring the electromotive force (voltage) produced. The voltage produced by this process is an electrical property of the thermocouple and it changes in proportion to the thermal energy being measured. The proportional variations in the thermocouple terminal voltage are integral to the function of a thermocouple and only exist when it is performing its function (i.e.a thermocouple performs its function by changing its electrical properties). This indicates that thermocouples do not perform their function without moving parts or without a change in configuration or properties. Therefore, thermocouples are not subject to aging management review based on the criteria of §54.21(a)(1)(i).

2.6.6.7 Fuses

Fuses have two functions:

- Disconnect an electrical circuit at a predetermined current and duration
- Maintain electrical circuit continuity during normal circuit operation

Each of these functions are discussed separately below.

2.6.6.7.1 DISCONNECT AN ELECTRICAL CIRCUIT AT A PREDETERMINED CURRENT AND DURATION — FUSES

One function of a fuse is to disconnect an electrical circuit at a predetermined current and duration. This fuse function is identified in the September 19, 1997, NRC letter to NEI as being excluded from an aging management review. This identification indicates, and Duke agrees, that the function of a fuse is to disconnect an electrical circuit at a predetermined current and duration *is not* performed without moving parts or without a change in configuration or properties. Therefore, the function of a fuse to disconnect an electrical circuit at a predetermined current and duration is not subject to aging management review.

2.6.6.7.2 MAINTAIN ELECTRICAL CIRCUIT CONTINUITY DURING NORMAL CIRCUIT OPERATION — FUSES

The second function of a fuse is to maintain electrical circuit continuity during normal circuit operation. Electrical continuity, as a component function, is common to all electrical components since no electrical component would function without it. Several electrical components listed in §54.21(a)(1)(i) have been excluded from aging management review:

> **§54.21 Contents of Application - Technical Information**
>
> *Each application must contain the following information:*
>
> *(a) An integrated plant assessment (IPA). The IPA must --*
>
> *(1) For those systems, structures, and components within the scope of this part, as delineated in §54.4, identify and list those structures and components subject to an aging management review. Structures and components subject to an aging management review shall encompass those structures and components --*
>
> *(i) That perform an intended function, as described in §54.4, without moving parts or without a change in configuration or properties. These structures and components include, but are not limited to, …, excluding, but not limited to, …, motors, diesel generators, …, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies; ….*

The electrical continuity function for each component listed in §54.21(a)(1)(i) has been excluded from aging management review. The electrical continuity function is normally tested by performance testing—when energized, the component either works or it does not work. This work or not-work performance test is the most common way of testing electrical components listed above in §54.21(a) as well as all other electrical components, including fuses, that are not listed above.

The following statement was also made in the September 19, 1997, NRC letter to NEI [Reference 2.6-3]:

> *Unlike other electrical components which have similar continuity functions such as breakers, switches, and relays which have been excluded in §54.21(a)(1)(i) from an aging management review, degradation of the fuse's ability to perform this intended function due to aging is not readily monitorable. Degradation of the fuse's intended continuity function may not result in detectable losses in associated system safety function until degradation becomes unacceptable.*

This statement assumes that aging degradation of a component must be monitorable or the component cannot be excluded under §54.21(a)(1)(i). Component examples listed in §54.21(a)(1)(i) contradict this assumption. Transistors and circuit boards are two examples of components whose aging degradation cannot be monitored, yet the components are excluded from aging management review. Section 54.21(a)(1)(i) sets the precedent for such determinations and for the characteristics of components that can be excluded.

The continuity function of fuses is no different than the continuity function of electrical components excluded from aging management review in §54.21(a)(1)(i). The continuity function of fuses is performance tested the same way as it is performance tested in electrical components excluded from aging management review in §54.21(a)(1)(i). Degradation of the continuity function is not (or not easily) monitorable for fuses, just as it is not monitorable for electrical components excluded from an aging management review in §54.21(a)(1)(i). Therefore, based on the express exclusion of the identical function in electrical components listed in §54.21(a)(1)(i), the continuity function of fuses is not subject to aging management review.

2.6.6.7.3 CONCLUSION — FUSES

Both functions of a fuse (disconnect an electrical circuit at a predetermined current and duration, and maintain electrical circuit continuity during normal circuit operation) are excluded from aging management review based on the criteria in §54.21(a)(1)(i).

2.6.7 Structures and Areas Containing Electrical Components Subject to Aging Management Review

The Oconee electrical component integrated plant assessment is a component-based review where component characteristics are compared to their service conditions. Identifying plant structures and areas that contain electrical components subject to aging management review (or stated conversely, eliminating those structures and areas that do not contain electrical components subject to aging management review) reduces the number of areas for which component service conditions need to be determined.

Electrical components are installed in, attached to, or otherwise supported by a structure (e.g., building, cable trench, structural steel, conduit). The only exception is direct buried cables.

Section 2.7 of OLRP-1001 identifies the Oconee structures which have been determined to be subject to aging management review. By eliminating structures and areas that do not contain any electrical components that are within the scope of license renewal and by adding direct buried cables as part of Yard Structures, the structures and areas that contain electrical components within the scope of license renewal are identified. This list is provided in Table 2.6-9.

2.6.8 References for Section 2.6

2.6-1. *NEI 95-10, Revision 0, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule,* Nuclear Energy Institute, March 1996.

2.6-2. Final License Renewal Rule, 10 CFR Part 54, 60 FR 22461, May 8, 1995.

2.6-3. C. I. Grimes (NRC) letter dated September 19, 1997 to D. Walters (NEI), Project 690, *Determination of Aging Management Review for Electrical Components.*

2.6-4. *Oconee Nuclear Station, Updated Final Safety Analysis Report,* as revised.

Table 2.6-1 Electrical Component Types Subject to Aging Management Review and Their Intended Functions

Component	Intended Function(s)
Bus • Isolated Phase Bus • Nonsegregated-Phase Bus • Segregated-Phase Bus • Switchyard Bus	Provide electrical connection between two sections of an electrical circuit.
Insulated Cables & Connections	Provide electrical connection between two sections of an electrical circuit.
Insulators [separate, high voltage equipment]	Insulate and support an electrical conductor.
Transmission Conductors	Provide electrical connection between two sections of an electrical circuit.

Table 2.6-2 Isolated-Phase Bus Subject to Aging Management Review

Bus Section	Connecting Terminal	Terminal Location
Keowee 13.8 kV Bus No. 1	Unit 1 Main Switchgear	Keowee Power House
	Transformer 1	Keowee Transformer Yard
Keowee 13.8 kV Bus No. 2	Unit 2 Main Switchgear	Keowee Power House (and through Keowee Breaker Vault)
	Transformer 1	Keowee Transformer Yard

Table 2.6-3 Nonsegregated-Phase Bus Subject to Aging Management Review

Bus Section	Connecting Terminals	Terminal Location
4160V Main Feeder Bus #1 Unit 1	4160V Switchgear B1T-2	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B1T-6	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear 1TC-14	Turbine Building
	4160V Switchgear 1TD-14	Turbine Building
	4160V Switchgear 1TE-14	Turbine Building
4160V Main Feeder Bus #2 Unit 1	4160V Switchgear B2T-8	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B2T-12	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear 1TC-1	Turbine Building
	4160V Switchgear 1TD-1	Turbine Building
	4160V Switchgear 1TE-1	Turbine Building
Transformer 1T 4160V Bus	4160V Switchgear B1T-3	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B2T-11	Unit 1&2 Switchgear Blockhouse
	Transformer 1T-4160V	Oconee Transformer Yard
4160V Emergency Start-up Bus	4160V Switchgear B1T-1	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B2T-13	Unit 1&2 Switchgear Blockhouse
	Transformer CT1-4160V	Oconee Transformer Yard
	4160V Switchgear B1T-13	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B2T-1	Unit 1&2 Switchgear Blockhouse
	Transformer CT2-4160V	Oconee Transformer Yard
	4160V Switchgear 3B1T-1	Unit 3 Switchgear Blockhouse
	4160V Switchgear 3B2T-5	Unit 3 Switchgear Blockhouse
	Transformer CT3-4160V	Oconee Transformer Yard
Transformer CT4 4160V Bus	4160V Switchgear B1T-5	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B2T-9	Unit 1&2 Switchgear Blockhouse
	Transformer CT4	Unit 1&2 Switchgear Blockhouse
4160V Main Feeder Bus #1 Unit 2	4160V Switchgear B1T-8	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B1T-12	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear 2TC-1	Turbine Building
	4160V Switchgear 2TD-1	Turbine Building
	4160V Switchgear 2TE-1	Turbine Building
4160V Main Feeder Bus #2 Unit 2	4160V Switchgear B2T-2	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B2T-6	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear 2TC-14	Turbine Building
	4160V Switchgear 2TD-14	Turbine Building
	4160V Switchgear 2TE-14	Turbine Building

Table 2.6-3 is continued on the next page.

Table 2.6-3 Nonsegregated-Phase Bus Subject to Aging Management Review (continued)

Bus Section	Connecting Terminals	Terminal Location
Transformer 2T 4160V Bus	4160V Switchgear B1T-11	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear B2T-3	Unit 1&2 Switchgear Blockhouse
	Transformer 2T/4160V Terminals	Oconee Transformer Yard
4160V Main Feeder Bus #1 Unit 3	4160V Switchgear B1T-7	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear 3B1T-3	Unit 3 Switchgear Blockhouse
	4160V Switchgear 3TC-1	Turbine Building
	4160V Switchgear 3TD-1	Turbine Building
	4160V Switchgear 3TE-1	Turbine Building
4160V Main Feeder Bus #2 Unit 3	4160V Switchgear B2T-7	Unit 1&2 Switchgear Blockhouse
	4160V Switchgear 3B2T-2	Unit 3 Switchgear Blockhouse
	4160V Switchgear 3TC-14	Turbine Building
	4160V Switchgear 3TD-14	Turbine Building
	4160V Switchgear 3TE-14	Turbine Building
Transformer 3T 4160V Bus	4160V Switchgear 3B1T-5	Unit 3 Switchgear Blockhouse
	4160V Switchgear 3B2T-1	Unit 3 Switchgear Blockhouse
	Transformer 3T/4160V Terminals	Oconee Transformer Yard

Table 2.6-4 Segregated-Phase Bus Subject to Aging Management Review

Bus Section	Connecting Terminals	Terminal Location
Keowee Unit 1 Generator Bus	Unit 1 Generator	Keowee Powerhouse
	Unit 1 Main Switchgear	Keowee Powerhouse
Keowee Unit 1 Underground Feeder Bus	Unit 1 Main Switchgear	Keowee Powerhouse
	Underground Feeder Switchgear	Keowee Breaker Vault
Keowee Unit 2 Generator Bus	Unit 2 Generator	Keowee Powerhouse
	Unit 2 Main Switchgear	Keowee Powerhouse
Keowee Unit 2 Underground Feeder Bus	Unit 2 Main Switchgear	Keowee Powerhouse
	Underground Feeder Switchgear	Keowee Breaker Vault

Table 2.6-5 Switchyard Bus Included in the Aging Management Review

Bus Name	Connecting Terminals
230 kV Switchyard Red Bus	Disconnect switch for PCB 4 Disconnect switch for PCB 7 Disconnect switch for PCB 10 Disconnect switch for PCB 13 Disconnect switch for PCB 16 Disconnect switch for PCB 19 Disconnect switch for PCB 22 Disconnect switch for PCB 25 Disconnect switch for PCB 28 Disconnect switch for PCB 31
230 kV Switchyard Yellow Bus	Disconnect switch for PCB 9 Disconnect switch for PCB 12 Disconnect switch for PCB 15 Disconnect switch for PCB 18 Disconnect switch for PCB 21 Disconnect switch for PCB 24 Disconnect switch for PCB 27 Disconnect switch for PCB 30 Disconnect switch for PCB 33
Transformer 4T Bus	Disconnect switch for PCB 4 Disconnect switch for Transformer 4T
Bus for Switchgear B3T Feeder	Transformer 4T Cable for Switchgear B3T
Dacus Black Transmission Line Bus	Disconnect switch for PCB 7 Disconnect switch for PCB 8
Keowee Transmission Line Bus	Disconnect switch for PCB 8 Disconnect switch for PCB 9
Dacus White Transmission Line Bus	Disconnect switch for PCB 10 Disconnect switch for PCB 11
Jocassee White Transmission Line Bus	Disconnect switch for PCB 11 Disconnect switch for PCB 12
Oconee Black Transmission Line Bus	Disconnect switch for PCB 13 Disconnect switch for PCB 14
Jocassee Black Transmission Line Bus	Disconnect switch for PCB 14 Disconnect switch for PCB 15
Oconee White Transmission Line Bus	Disconnect switch for PCB 16 Disconnect switch for PCB 17
Transformer CT1 Busline	Disconnect switch for PCB 17 Disconnect switch for PCB 18

Table 2.6-5 Switchyard Bus Included in the Aging Management Review (Continued)

Bus Name	Connecting Terminals
Calhoun Black Transmission Line Bus	Disconnect switch for PCB 19 Disconnect switch for PCB 20
Oconee Unit 1 Busline	Disconnect switch for PCB 20 Disconnect switch for PCB 21
Calhoun White Transmission Line Bus	Disconnect switch for PCB 22 Disconnect switch for PCB 23
Oconee Unit 2 Busline	Disconnect switch for PCB 23 Disconnect switch for PCB 24
PCB 25 to PCB 26 Bus	Disconnect switch for PCB 25 Disconnect switch for PCB 26
Transformer CT2 Busline	Disconnect switch for PCB 26 Disconnect switch for PCB 27
Transformer CT3 Busline	Disconnect switch for PCB 28 Disconnect switch for PCB 30
525 kV Autotransformer	Disconnect switch for PCB 31 Disconnect switch for PCB 33
Transformer 5T Bus	525 kV Autotransformer Transformer 5T
525 kV Spare Autotransformer Bus	Spare 525 kV Autotransformer 525 kV Busline

PCB - power circuit breaker

Table 2.6-6 Insulated Cables And Connections Subject to Aging Management Review

Materials		Applications & Power Cable Sizes
Insulation	**Cable Jacket**	
AVA		**I&C:** Special Cable Shield Grounding System
Butyl	PVC	**POWER:** 600V Power; 350 MCM
EP, EPR, EPDM, FR-EPR	CPE, FR-XLPE, Neoprene, PVC	**I&C:** 600V Control, Bailey System Interconnection Cable, Control, Festooned Cable for Radiation Monitoring on the Bridge, Festooned Computer Cable to Fuel Handling Bridge, Instrument Cable, Oconee to Keowee Control, Thermocouple Extension Cable; **POWER:** 600V Power, 4kV Power, Oconee-Keowee 5kV Power, 7kV Power, Oconee-Keowee 15kV Power, Discharge to Keowee-Tailrace Valve #1/13/77, Lighting; #12, #10, #6, #5, #4, #2, #1, #2/0, #3/0, #4/0 AWG, 250, 350, 500, 600 MCM; **CONNECTIONS:** Plug-in Connectors (I&C, Power), Splice Insulation Systems (tape)
Fiberglass	PVC	**I&C:** Thermocouple (Incore Instrumentation)
Hypalon	Hypalon, Neoprene	**I&C:** Festooned Cable for Control Interlocking on the Bridge, Instrumentation Cable (RB), Rod Control, Thermocouple Cable (RB); **POWER:** Festooned Cable for Power to Bridge, Rod Control; #8, #6, #4 AWG
Kapton		**POWER:** Pressurizer Heater Cable; #6 AWG; **CONNECTIONS:** Plug-in Connectors (I&C, Power)
Kerite-HTK	PVC	**POWER:** 600V Power; #10, #6, #2, #2/0 AWG, 250, 500 MCM; **CONNECTIONS:** Plug-in Connectors (I&C, Power)
Nylon		**CONNECTIONS:** Terminal Blocks (I&C)
PE	PE, PVC	**I&C:** 52 ohm Carrier & Transfer Trip, Communication Cable, Incore Instrumentation, Nuclear Instrumentation, RC Pump Vibration Monitor, Source Range Pre-Amp Low Voltage Cable, Telephone Cable, Trash Rack Vibration Monitor, TV Camera Cable Belden, Video Pair for Carrier Relays; **POWER:** 120 & 208V Lighting & Transformer Secondaries, Lighting; #12, #10, #2, #2/0 AWG, 250 MCM
Phenolic		**CONNECTIONS:** Terminal Blocks (I&C, Power)
Polyalkene	PVF	**I&C:** General Purpose Hook-up

Table 2.6-6 Insulated Cables And Connections Subject to Aging Management Review (continued)

Materials		Applications & Power Cable Sizes
Insulation	**Cable Jacket**	
PVC	Hypalon, PVC	**I&C:** Annunciator Prefab. Cable, Bailey System Interconnecting Cable, Computer (Special), Computer Cable (Switchyard to Control Room), Control Rod Drive Cabinet to Unit Control Board, GE Supplied EHC Cable 60 ft. Long, ICS Simulator Cable, Instrumentation Cable, Incore Instrumentation, Intrasite Telephone System, Keowee to Oconee Interface, P. A. System, Process Radiation Monitoring Cable, Staging Voice Paging System, Thermocouple Cable, TV Camera Cable Belden; **CONNECTIONS:** Splice Insulation Systems/Tape (tape)
SR		**I&C:** Control Rod Drive; **POWER:** 600 V Power, Control Rod Drive Rod Control; #8, #4, #3/0 AWG, 300, 500 MCM; **CONNECTIONS:** Plug-in Connectors (I&C, Power), Splice Insulation Systems (tape)
XLP, XLPE, Vulkene, FR-XLPE	CPE, FR-XLPE, Neoprene, PVC	**I&C:** 600V Control, Alarms and Signals, Bailey System Interconnection Cable, Containment Instrumentation, Control (Switchyard to Control Room), Instrument Cable, Instrumentation Cable (RB), Misc. Instrumentation Not To Be Used in RB, Radiation Monitor Cable, Switchboard Hook-Up Wire, Thermocouple Cable (RB); **POWER:** 120 & 208V Lighting, Lighting and Power Panelboard, Transformer Secondaries & Associated Equipment, Lighting; #12, #10, #6, #2, #2/0 AWG, 500 MCM; **CONNECTIONS:** Plug-in Connectors (I&C, Power), Splice Insulation Systems/Heat Shrink Tubing (I&C, Power)

Table 2.6-7 Insulators Included in the Aging Management Review

Description
Insulators supporting disconnect switches in the 230 kV Switchyard
Insulators supporting disconnect switches in the Keowee Transformer Yard
Insulators supporting switchyard bus in the 230 kV Switchyard
Insulators supporting Transformer CT1 Bus Lines
Insulators supporting Transformer CT2 Bus Lines
Insulators supporting Transformer CT3 Bus Lines
Insulators supporting transmission conductors in the 230 kV Switchyard
Insulators supporting the Keowee Transmission Line

Table 2.6-8 Transmission Conductors Included in the Aging Management Review

Description
Transmission conductors used in the Transformer CT1 Bus Lines
Transmission conductors used in the Transformer CT2 Bus Lines
Transmission conductors used in the Transformer CT3 Bus Lines
Transmission conductors used in the 230 kV Switchyard
Transmission conductors used in the 230 kV Keowee Transmission Line

Table 2.6-9 Structures and Areas Included in The Electrical Component Integrated Plant Assessment

Structure or Area	Description
Auxiliary Buildings	Includes all levels of all 3 unit Auxiliary Buildings including the Hot Machine Shop and Spent Fuel Pools for Units 1&2 (shared) and Unit 3, and Penetration Rooms
Intake Structure	Includes the CCW pump Intake Structure
Keowee Structures	Includes the Breaker Vault, Intake Structure, Penstock, Powerhouse, Service Bay Structure, and Spillway
Reactor Buildings	Includes all levels of all three Reactor Buildings and the Unit Vents
Standby Shutdown Facility	Includes all levels and rooms in the Standby Shutdown Facility
Turbine Buildings	Includes all levels of all 3 unit Turbine Buildings and the Switchgear Blockhouses for Units 1&2 (shared) and Unit 3
Yard Structures	Includes all areas and components outside the other buildings. Specifically, this includes the following: • **230kV Keowee Transmission Line Towers** **230kV Switchyard Structures and Relay House** (includes the area within the switchyard boundary fence) • **Appendix R Warehouse** [Appendix R cable only] • **Cable Conduit** • **Cable Trenches** • **Direct Buried Cables** • **Elevated Water Storage Tank** • **Keowee Transformer Yard** [for components associated with Keowee Transformer 1] (includes the gravel covered area outside, on the South side of the Keowee Powerhouse structure where Keowee Transformer 1 and Keowee transmission line support structures are located) • **Oconee Transformer Yard** [for components associated with Transformers CT1, CT2 and CT3] (includes the gravel covered area outside, on the East side of the Turbine Buildings where the unit main step-up transformers and the unit start-up transformers are located)

Figure 2.6-1 Cross Section — Isolated-Phase Bus

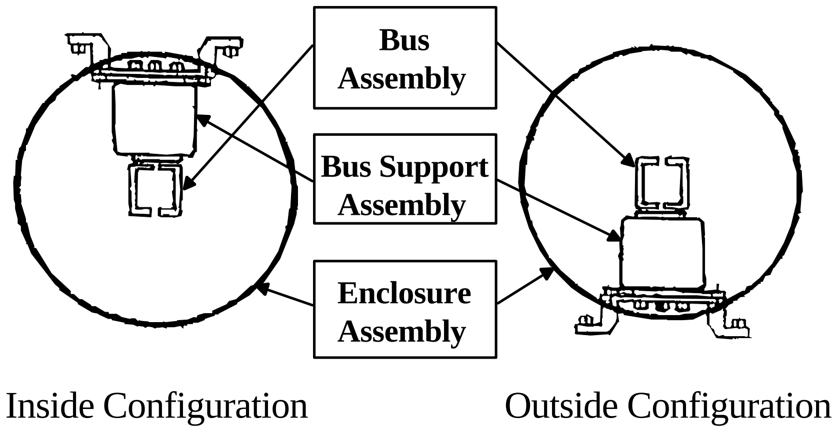


Figure 2.6-2 Cross Section — Nonsegregated-Phase Bus

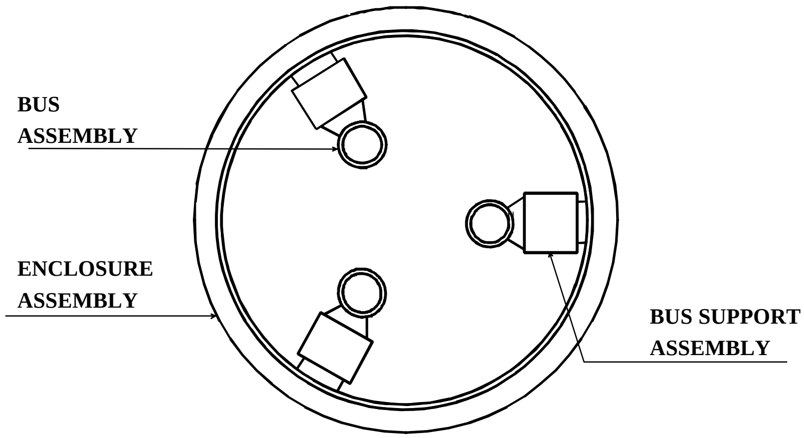


Figure 2.6-3 Cross Section — Segregated-Phase Bus

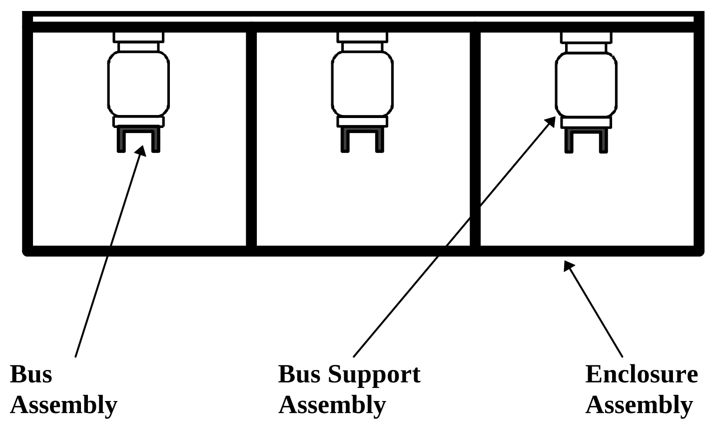


Figure 2.6-4 Oconee 230 kV Switchyard One-Line Diagram

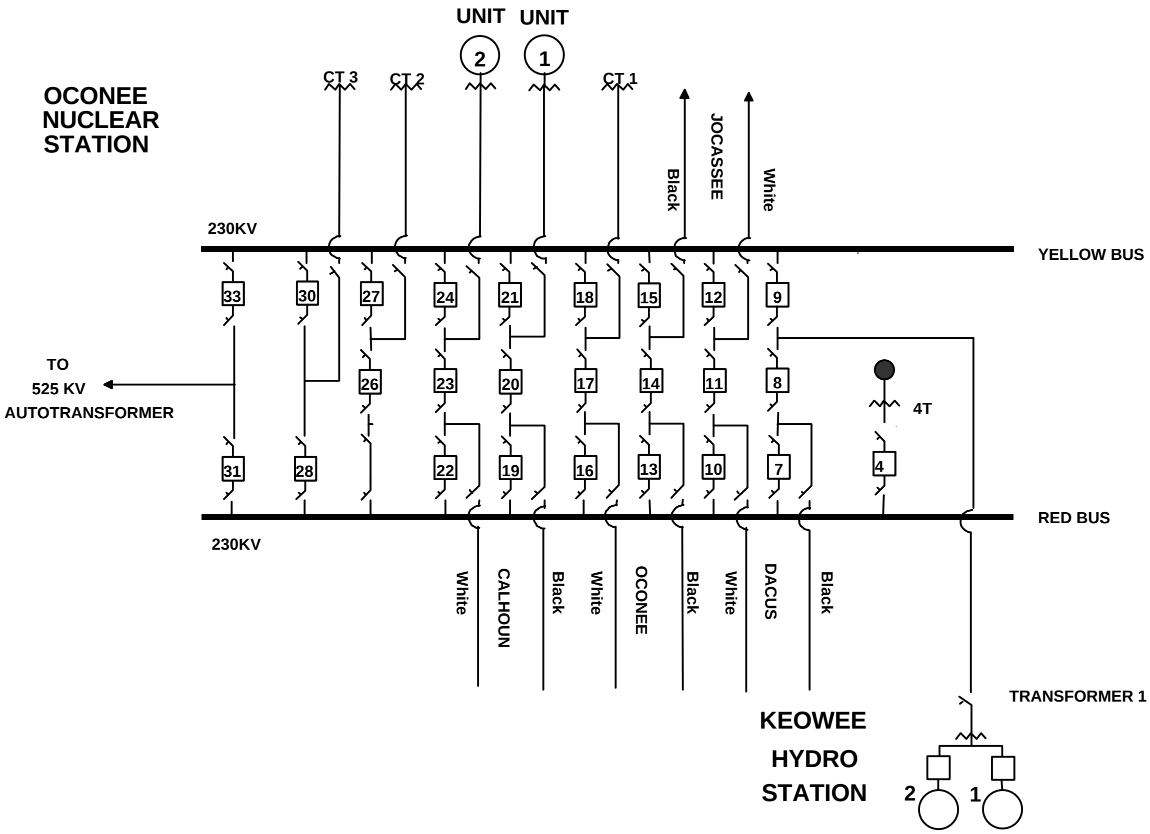


Figure 2.6-5 Cross-Section of a Typical Oconee Power Cable

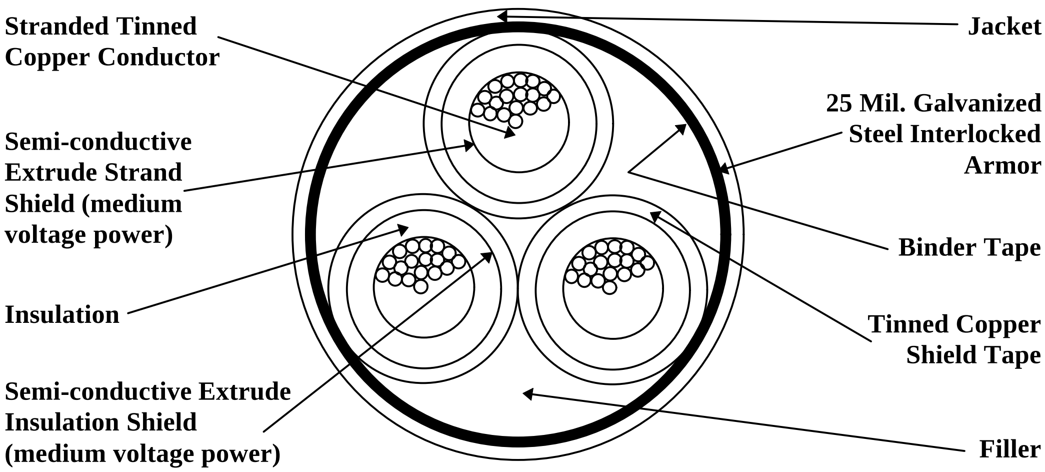


Figure 2.6-6 Cross Section of a Typical Strain/Suspension Insulator

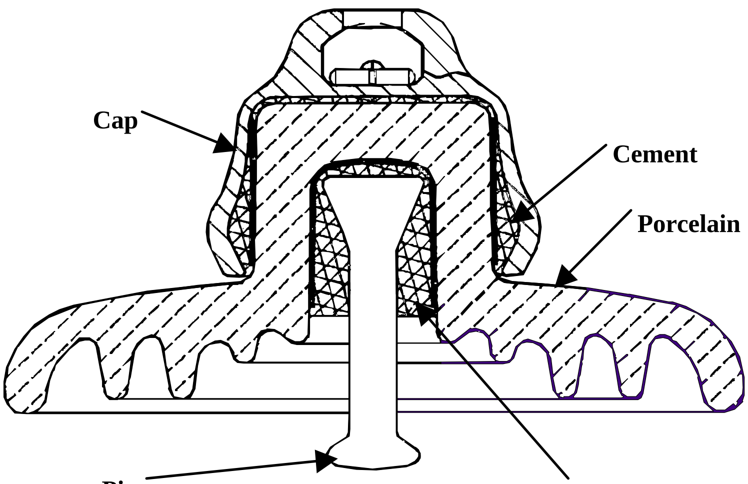
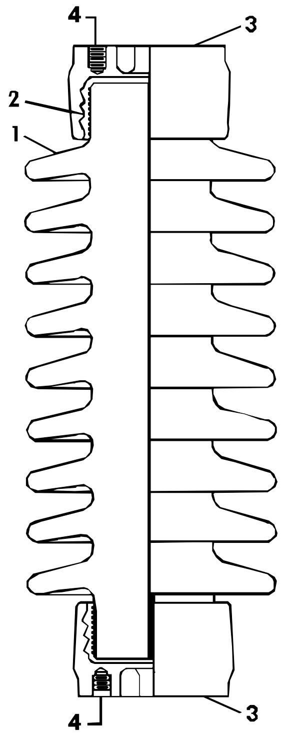


Figure 2.6-7 Cross Section of a Typical Post Insulator



1. **Porcelain**
2. **Cement**
3. **Cap**
4. **Bolt Holes**

2.7 STRUCTURES & STRUCTURAL COMPONENTS

2.7.1 DESCRIPTION OF THE PROCESS TO IDENTIFY STRUCTURAL COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

The determination of Oconee structures within the scope of license renewal is made by initially identifying all Oconee structures and then reviewing each structure to determine which ones satisfy one or more of the criteria contained in §54.4. This process is described in Section 2.2 of OLRP-1001. Section 2.7 contains the information required by §§54.21(a)(1) and (a)(2) for Oconee structural components that are subject to aging management review for license renewal.

In order to optimize the aging management review, structures which are attached to or contained within larger structures have been reviewed with the larger structure. In addition, earthen embankments have been reviewed collectively because of their similar material of construction and aging management programs. The following is a consolidated list of Oconee structures that have been determined to be subject to aging management review for license renewal:

- Auxiliary Buildings, which include Hot Machine Shop, Spent Fuel Pools for Units 1 & 2 (shared), and Unit 3
- Earthen Embankments, which include Intake Canal Dike, Keowee River Dam, and Little River Dam and Dikes
- Intake Structure
- Keowee Structures, which include Breaker Vault, Intake Structure, Penstock, Powerhouse, Service Bay Structure, and Spillway
- Reactor Buildings Internal Structure and the Unit Vent Stacks
- Standby Shutdown Facility
- Turbine Buildings, which include Switchgear Enclosures for Units 1 & 2 (shared) and Unit 3
- Yard Structures, which include all areas and components outside the other buildings. Specifically, the 230 kV Keowee Transmission Line towers, 230 kV Switchyard Structures and Relay House, trenches, Elevated Water Storage Tank, Keowee Transformer Yard, and Oconee Transformer Yard

Following the establishment of the evaluation boundaries of the Oconee structures, the structural components within each of these structures are identified. A generic list of structural components was developed by using the lists of components provided in NUMARC Containment and Class I Structures Industry Reports and Appendix B of

NEI 95-10, Revision 0 [References 2.7-1, 2.7-2 , and 2.7-3 respectively]. Additional components were added following the review of commitments made for compliance with the following regulated events: fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram and station blackout. Finally, several Oconee-specific documents were reviewed to determine if any other structural components should be added to the list.

The functions of the structures were determined from a review of information contained in the Oconee UFSAR [Reference 2.7-4], Oconee engineering specifications, and regulated events documentation. The functions of structural components were determined from a review of the commitments made in response to design basis events and regulated events. The structural component function(s) may support the intended function(s) of the structure or may have a unique function that does not support the intended function of the structure. A case in point is the spent fuel storage racks. The racks are contained in the Auxiliary Building. The intended functions of the Auxiliary Building are identified in Table 2.7-1. A unique function of the spent fuel racks is to maintain separation of the fuel assemblies to prevent criticality. Table 2.7-1 through Table 2.7-8 identify, for each structure identified above, the structural components that are within the scope of license renewal as well as the intended functions of each of these structural components.

Structures and structural components interface with other types of components at Oconee and the assessment of these interfacing components is provided in other sections of OLRP-1001. For example, the assessment of Containment is provided in Sections 2.3 and 3.3; the assessment of reactor coolant system component supports is provided in Sections 2.4 and 3.4; and, for non-Class 1 mechanical components, the assessment is provided in Sections 2.5 and 3.5.

To facilitate the structures and structural component aging management reviews, structural components have been grouped into four categories, as follows:

- Concrete Structural Components
- Steel Structural Components in an Air Environment
- Steel Structural Components in a Fluid Environment
- Fire Barriers

Section 2.7.2 identifies the generic list of structural components that have been determined to require aging management review. Sections 2.7.3 through 2.7.10 provide descriptions on a structure-by-structure basis. Tables at the end of Section 2.7 identify the components within each structure subject to aging management review and their intended functions.

2.7.2 Structural Components

2.7.2.1 Concrete Structural Components

The following concrete structural components are within the scope of license renewal and subject to aging management review:

- Anchorage
- Embedments
- Equipment Pads
- Flood Curbs
- Foundation Dowels
- Foundations
- Hatches [Footnote 1]
- Masonry Block & Brick Walls
- Missile Shields
- Pipe Piles
- Reinforced Concrete Beams, Columns, Floor Slabs, and Walls
- Roof Slabs
- Sumps
- Trenches

2.7.2.2 Steel Components in an Air Environment

The following steel components in an air environment are within the scope of license renewal and subject to aging management review:

- Anchorage/Embedments (exposed surfaces)
- Battery Racks
- Cable Tray
- Conduit
- Cable Tray & Conduit Supports
- Checkered Plate
- Control Boards
- Control Room Ceiling
- Crane Rails & Girders
- Electrical & Instrument Panels & Enclosures

1. Hatches, which are part of the Reactor Building Containment boundary, are addressed in Section 2.3 of OLRP-1001.

- Equipment Component Supports
- Expansion Anchors
- Flood, Pressure and Specialty Doors
- HVAC Duct Supports
- Instrument Line Supports
- Instrument Racks & Frames
- Lead Shielding Supports
- Metal Siding
- Piles
- Pipe Supports (see discussion below)
- Stairs, Platform, Grating Supports
- Structural Steel Beams, Columns, Plates & Trusses
- Sump Screens
- Transmission Towers
- Unit Vent Stack

The exposed surfaces of many of these components are covered with a protective coating.

2.7.2.2.1 PIPE SUPPORTS

Oconee piping is supported by different types of hangers and supports to satisfy the United States of America Standard (USAS) B31.1.0 and B31.7 code requirements. Pipe supports cover the entire range of structural elements which perform the function of carrying the weight of a piping system and providing them with structural stability. The various types of pipe supports include:

- Rigid type supports (single acting)
- Rigid type supports (double acting)
- Constant support spring hangers
- Variable support spring hangers
- Anchors
- Guides and stops
- Restraints
- Snubbers

Although snubbers are excluded from an aging management review by §54.21(a)(1)(i), the components that mount the snubber to the pipe and to the structure are subject to aging management review.

Pipe supports are classified based upon the piping system which they support. The relationship between Oconee system piping class, design criteria, and Quality Assurance Condition is contained in the Oconee UFSAR [Reference 2.7-4, Table 3-1]. Further information about the Oconee system piping classification is contained in Table 2.5-1 of OLRP-1001.

Oconee Class A, B, C, and F piping supports are categorized as QA Condition 1 supports and are within the scope of license renewal. The QA Condition 1 supports can be identified using Oconee flow diagrams. Piping within the scope of license renewal is identified on the flow diagrams. The flow diagrams can be used to identify the associated math model that contains the pipe supports. All pipe supports within the license renewal evaluation boundary defined by the Oconee flow diagrams, including any required analysis math model overlap supports, are within the scope of license renewal.

Oconee Class D piping requires pressure boundary protection and structural integrity and is within the scope of license renewal. The pressure boundary function of the piping is addressed in Section 2.5 of OLRP-1001. The structural support of the piping is addressed within Section 2.7. The Oconee flow diagrams have been marked to identify the Class D piping. Supports for this piping can be identified by reviewing the associated math models.

Oconee Class E piping supports are not within the scope of license renewal. Although the piping is designed to carry radioactive fluid, a component failure would result in a calculated potential exposure that is less than the limits established by 10 CFR Part 20.

Oconee Class G and H piping supports may be assigned QA Condition 4 to denote requirements for seismic structural integrity to prevent adverse interactions with safety related systems, structures, and components. Oconee Class G and H pipe supports that are QA Condition 4 are within license renewal scope.

Supports that maintain piping required to meet any of the regulatory events defined in §54.4(a)(3) are also within the scope of license renewal. Oconee flow diagrams indicate piping that is required to meet this requirement. Supports for this piping can be identified by reviewing the associated analysis math models.

Pipe supports are constructed of a standard support, a structural frame or some combination of the two. A standard support is an assembly consisting of one or more units, is usually referred to as a catalogue item, and generally is mass produced. Pipe support frames are constructed of structural steel or tube shapes. Pipe supports are coated to prevent corrosion and loss of material.

2.7.2.3 Steel Components in a Fluid Environment

The following steel components in a fluid environment are within the scope of license renewal and subject to aging management review:

- Elevated Water Storage Tank (interior portion)
- Equipment Component Supports
- Fuel Transfer Canal Liner Plate
- Spent Fuel Pool Liner Plate
- Spent Fuel Storage Racks
- Structural Steel and Plates
- Trash Racks and Screens

2.7.2.4 Fires Barriers

The following fire barriers are within the scope of license renewal and subject to aging management review:

- Fire Doors
- Fire Walls
- Fire Barrier Penetration Seals

Fire doors and fire walls may perform other functions in addition to confining or retarding a fire from spreading to or from adjacent areas of the plant. Other functions of fire doors are addressed with flood, pressure, and specialty doors. Other functions of fire walls are addressed with reinforced concrete and masonry walls.

2.7.3 Auxiliary Buildings

Oconee has two Auxiliary Buildings: one structure is shared by both the Unit 1 and 2 reactors; the other structure contains systems which support the Unit 3 reactor. The Auxiliary Buildings are essentially free-standing reinforced concrete structures with no structural tie-ins to either the Turbine Buildings or the Reactor Buildings. The codes and standards used for the Auxiliary Building design and fabrication, including applicable edition are specified in the Oconee UFSAR [Reference 2.7-4, Section 3.8.1].

The Auxiliary Buildings are constructed on reinforced concrete mat foundations. Below grade, the Auxiliary Buildings consist of reinforced concrete walls and slabs. Above grade, the Auxiliary Buildings consist principally of reinforced concrete columns, beams, and slabs. All below grade construction joints in exterior walls are protected by cast in place water stops. Common below grade water stops are shared by the Auxiliary Buildings and the Reactor and Turbine Buildings. The Auxiliary Buildings are designed to accommodate differential movements with respect to the Reactor Buildings.

The portions of the Auxiliary Buildings that house engineered safe-guards systems, control room, fuel storage facilities, and radioactive materials are Class 1 structures. Class 1 structures are those which prevent uncontrolled release of radioactivity and are designed to withstand all loadings without loss of function [Reference 2.7-4, Section 3.2.1.1.1]. Class 1 structures have been determined to meet the intent of §54.4(a)(1). Other portions of the Auxiliary Buildings are Class 2 structures. Class 2 structures are those whose limited damage would not result in a release of radioactivity and would permit a controlled plant shutdown but could interrupt power generation. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

The Auxiliary Buildings also include the Hot Machine Shop. The Hot Machine Shop and its extension are located between the Unit 1 & 2 Reactor Buildings and are adjacent to the west side of the Units 1 & 2 Spent Fuel Pool. The Hot Machine Shop structure is constructed of reinforced concrete floor and roof slabs supported on concrete beams. The Hot Machine Shop shares reinforced concrete walls on the east and north sides with the Spent Fuel Pool and Fuel Loading Area, respectively. The south and west sides consist of reinforced concrete columns with infilled concrete block walls. The Hot Machine Shop extension is a steel frame structure with a metal deck, built up roof, and exterior block walls. The Hot Machine Shop extension is a QA 4 structure.

A reinforced concrete tunnel extends from the Auxiliary Building to the Hot Machine Shop by passing under the Units 1 & 2 Spent Fuel Pool. This tunnel provides a sheltered and shielded passage for equipment between the Auxiliary Building areas to the machine shop work area. Access to the tunnel from the Hot Machine Shop is by spiral stairs and an adjacent floor hatch.

The Auxiliary Buildings serve as enclosures to protect the plant auxiliary systems, the control room, and other systems necessary for the safe operation of the unit. The Auxiliary Buildings are subdivided into numerous compartments and components. The Auxiliary Buildings were designed to withstand the various combinations of dead and live loads, design basis event loads, design event loads, and other generic design criteria loads, as identified in Table 3-23 of the Oconee UFSAR [Reference 2.7-4].

The Auxiliary Buildings are comprised of structural components whose materials of construction are either reinforced concrete or steel. Fire barriers and lead shielding are structural components that are also within the evaluation boundary of the Oconee Auxiliary Buildings.

2.7.3.1 Concrete

The Auxiliary Building concrete design complies with the American Concrete Institute (ACI) 318-63 [Reference 2.7-5]. The concrete used in the structure is made from Type II cement with fine and coarse aggregate. Coarse aggregate consisted of crushed Gaffney marble obtained from Blacksburg, South Carolina.

The concrete components within the Oconee Auxiliary Building and their intended functions are listed in Table 2.7-1.

2.7.3.2 Steel in Air Environment

The Auxiliary Building steel design complies with AISC *Manual of Steel Construction* [Reference 2.7-6]. The steel components within the Oconee Auxiliary Building and their intended functions are listed in Table 2.7-1.

2.7.3.3 Steel in Fluid Environment

The Auxiliary Building steel components in fluid environments and their intended functions are listed in Table 2.7-1.

2.7.3.4 Fire Barriers

The fire barriers within the Oconee Auxiliary Buildings and their intended functions are listed in Table 2.7-1.

2.7.4 Earthen Embankments

The structures included within this group for aging management review are earthen embankments submerged partially or totally in Lake Keowee. The structures which are evaluated within this group are:

- Intake Canal Dike
- Keowee River Dam
- Little River Dam and Dikes A, B, C, and D

The Oconee Earthen Embankments and their intended functions are listed in Table 2.7-2.

2.7.4.1 Intake Canal Dike

The Intake Canal Dike is a homogeneous embankment constructed of rolled earthfill and is designed to have an adequate factor of safety under the same conditions of seismic loadings as used for the design of Oconee. The Intake Canal Dike is an Oconee Class 2 structure. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

The dike has zoned filter drainage blankets under the downstream slope to collect and control seepage. The upstream face is riprapped with dumped riprap and quarry run stone. The riprap layer is a minimum of two feet thick and a twelve inch layer of graded gravel is provided under the riprap for the filter. The riprap is provided on the upstream slope to accommodate all reservoir water levels. Ground cover is provided to minimize erosion.

2.7.4.2 Keowee River Dam

The Keowee River Dam is a homogenous embankment constructed of rolled earthfill and the design was reviewed by an independent board of consultants and approved by the Federal Power Commission (now the Federal Energy Regulatory Commission or FERC) in accordance with the license issued by that agency. The foundation exploration, foundation and abutment treatment, slope stability and seismic analysis of the Keowee River Dam are described in the Oconee UFSAR, Section 2.5.6 [Reference 2.7-4]. The Keowee River Dam is an Oconee Class 2 structure. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

Seepage monitoring weirs and pipes, observation wells and piezometers are installed in the embankment to monitor the performance of the dam. A three-layer graded filter is provided under the downstream third of the dam to intercept safely any seepage through the embankment and foundation. Slope protection from wind-generated waves is provided on the upstream slope of the dam. Stone riprap is provided to accommodate all reservoir levels, including maximum drawdown and maximum flood. Ground cover is provided to minimize erosion.

2.7.4.3 Little River Dam and Dikes A, B, C, and D

The Little River Dam and Dikes A, B, C, and D are homogeneous embankments, constructed of rolled earthfill, that impound the Little River Watershed of the Keowee Reservoir. The design of the dam and dikes was reviewed by an independent board of consultants and approved by the Federal Power Commission (now FERC) in accordance with the license issued by that agency. The foundation exploration, foundation and abutment treatment, slope stability and seismic analysis are described in the Oconee UFSAR, Section 2.5.6 [Reference 2.7-4]. The Little River Dam and Dikes are Oconee Class 2 structures. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

Seepage monitoring weirs and pipes, observation wells and piezometers are installed in the embankments to monitor performance. The dam and dikes A and D have zoned filter drainage blankets under the downstream slope to collect and control seepage. Slope protection from wind-generated waves is provided on the upstream slope for the Little River Dam and Dikes. Stone riprap is provided to accommodate all reservoir water levels including maximum drawdown and maximum flood. Ground cover is provided to minimize erosion.

2.7.5 INTAKE STRUCTURE

The Intake Structure is a reinforced concrete structure located at the north end of the Intake Canal. The structure houses the pumps (casings), supports the pump motors and the beginning sections of the condenser cooling water pipe. All steel surfaces not in contact with the concrete and subject to immersion are coated with metal primer. At the back of the structure is a utility trench rigidly attached to the Intake Structure and constructed of reinforced concrete. The Intake Structure is designed to withstand the maximum hypothetical earthquake [Reference 2.7-4, Section 3.8.5.2]. The Intake Structure is identified as a Class 2 structure in the Oconee UFSAR, Section 3.2 [Reference 2.7-4]. Class 2 structures have been determined to meet the intent of §54.4(a)(2). The Intake Structure was designed to withstand the loadings as identified in the Oconee UFSAR, Section 3.8 [Reference 2.7-4]. Intake Structure structural components along with their intended functions are listed in Table 2.7-3.

2.7.5.1 Concrete

The Intake Structure concrete design complies with ACI 318-63 [Reference 2.7-5]. Initial construction of the Intake Structure was in accordance with the information provided in ACI 301 [Reference 2.7-7]. The concrete used in the structure is made from Type II cement with fine and coarse aggregate. Coarse aggregate consisted of crushed Gaffney marble obtained from Blacksburg, South Carolina. The Oconee Intake Structure concrete components and their intended functions are listed in Table 2.7-3.

2.7.5.2 Steel in Air Environment

The Intake Structure steel design complies with AISC *Manual of Steel Construction* [Reference 2.7-6]. The Oconee Intake Structure steel components in an air environment and their intended functions are listed in Table 2.7-3.

2.7.5.3 Steel in Fluid Environment

The Intake Structure steel components in fluid environments and their intended functions are listed in Table 2.7-3.

2.7.6 Keowee Structures

The Keowee Structures include the Breaker Vault, Intake Structure, Penstock, Powerhouse, Service Bay Structure and the Spillway. Keowee Structures are identified as Class 2 structures in the Oconee UFSAR, Section 3.2 [Reference 2.7-4]. Class 2 structures have been determined to meet the intent of §54.4(a)(1). The Keowee Structures were designed to withstand the loadings as identified in the Oconee UFSAR, Section 3.8 [Reference 2.7-4].

Keowee structural components and their intended functions are listed in Table 2.7-4. Descriptions of these structures are provided below.

2.7.6.1 Breaker Vault

The Breaker Vault provides tornado wind and tornado missile protection for the electrical equipment used to route power to meet the emergency power needs of Oconee Nuclear Station. The Breaker Vault is located in the electrical equipment bay of the Keowee powerhouse. The breaker vault is supported by the powerhouse operating floor. The walls and roof provide missile protection for the electrical breakers. Two openings provide access for inspection and maintenance of the breakers. Each opening is protected from missile penetration by a rolling steel door. The breaker vault is designed in accordance with AISC *Manual of Steel Construction* and ACI 318-63 [References 2.7-6 and 2.7-5, respectively].

2.7.6.2 Keowee Intake Structure

The Keowee Intake Structure controls flow from Lake Keowee to the Keowee Hydro station turbines via the power and penstock tunnels. The Keowee Intake Structure is a reinforced concrete structure with eight sides. Eight piers connected to a reinforced concrete compression ring girder at the base support a concrete silo type structure at the top. The concrete silo section supports a structural steel frame, which in turn provides support for gate hoisting machinery. Closure of the water intake section between each pier is by either of two methods. One method is by a large cylindrical gate which is raised and lowered inside the structure to close off the eight intake openings. The second closure method is by eight individual steel bulkhead gates made up of three sections each, which close off each of the eight openings individually.

The structure is designed in accordance with AISC *Manual of Steel Construction* and ACI 318-63 [References 2.7-6 and 2.7-5, respectively].

The intake structure cylindrical gate is designed for hydrostatic pressures resulting from normal pond and flood. The cylindrical gate was designed in accordance with AISC *Manual of Steel Construction*. The Oconee UFSAR [Reference 2.7-4, Section 8.3.1.2] requires that the cylindrical gate be rigidly fastened during all times when Keowee units are available for emergency power. This action assures that a failure of the hoist system does not cause the gate to fall to the closed position. In the normal stored position, the cylindrical gate is inside the concrete structure within its guides and rigidly fastened to the Intake steel superstructure by means of three wire cables. The wire cables and the guides are designed for earthquake loading. The Keowee Intake Structure contains a structural steel frame which provides support for gate hoisting machinery. All steel material is coated.

2.7.6.3 Keowee Penstock

The Keowee power and penstock tunnels convey water from the Intake Structure in Lake Keowee to the Keowee Hydro Station turbines in the Keowee Powerhouse. The power tunnel extends from the cylindrical concrete intake structure to two penstocks that branch from the power tunnel to each unit. The power tunnel and approximately one-half of the penstocks downstream of the power tunnel are concrete lined. The downstream part of the penstocks is steel lined with a concrete envelope around the steel lining. An “elbow” section that provides a transition between the vertical intake cylinder and the horizontal power tunnel is also steel-lined and encased in concrete. The power and penstock tunnels are in excavated rock. The concrete lining for these tunnels is unreinforced.

2.7.6.4 Keowee Powerhouse

The Keowee Powerhouse consists of a monolithic mass concrete substructure and structural steel superstructure. The concrete substructure is supported on rock. The concrete substructure supports two vertical Francis-type turbines and contains a draft tube gallery, a scroll case access gallery, and a mechanical equipment gallery.

The structural steel superstructure is supported at the operating floor level. The steel frame is covered with insulated steel exterior panels and provides protection for the generators, a 270 ton bridge crane and associated electrical and mechanical equipment. Adjacent to the erection bay is the electrical switchgear bay, which provides protection for electrical switchgear and bus.

Masonry walls in the Keowee Powerhouse which could affect safety related equipment during a seismic event were qualified in accordance with NRC requirements outlined in IE Bulletin 80-11.

The Keowee Powerhouse provides support and protection for equipment and components used to generate emergency electrical power for Oconee Nuclear Station.

The Keowee Powerhouse is designed in accordance with AISC *Manual of Steel Construction* and ACI 318-63 [References 2.7-6 and 2.7-5, respectively].

2.7.6.5 Keowee Service Bay Structure

The service bay structure is located adjacent to the powerhouse structure whose west wall is common with the service bay structure. The service bay structure is located on rock. The service bay structure contains two floor levels--one supports the station batteries and the other supports the control room equipment. Foundation dowels anchor the service bay structure to bedrock.

The service bay structure is designed in accordance with AISC *Manual of Steel Construction* and ACI 318-63 [References 2.7-6 and 2.7-5, respectively].

2.7.6.6 Keowee Spillway

The Keowee spillway consists of a mass concrete ogee structure with four taintor gates. Below the ogee section is a tapered concrete chute section with mass concrete side walls and concrete flip bucket. The spillway is located on rock. Mass concrete wingwalls form an approach channel to the spillway. The taintor gates are constructed of steel plate over a system of structural shapes. The gate is supported and restrained by a grid of structural steel which is anchored to concrete piers between the gates. The piers provide support for the gates and for a bridge across the top of the structure which is used for maintenance and inspection of the structure and hoisting equipment.

The spillway taintor gates were designed per AISC *Manual of Steel Construction*. The skin plate and structural shapes in the taintor gates were qualified for seismic loadings. The Keowee spillway permits controlled discharge of storm inflow from rainfall on Lake Keowee drainage basin. The spillway prevents overtopping of the Keowee River Dam, the Little River Dam and Dikes, and the Oconee Intake Canal Dike during periods of high rainfall on the drainage basin. The spillway is designed in accordance with AISC *Manual of Steel Construction* and ACI 318-63 [References 2.7-6 and 2.7-5, respectively].

2.7.6.7 Concrete

The Keowee concrete design complies with ACI 318-63 [Reference 2.7-5]. The Keowee concrete components and their intended functions are listed in Table 2.7-4.

2.7.6.8 Steel in Air Environment

The Keowee Structure steel design complies with AISC *Manual of Steel Construction* [Reference 2.7-6]. The Keowee steel in air components and their intended functions are listed in Table 2.7-4.

2.7.6.9 Steel in a Fluid Environment

The Keowee structural steel and plates in a fluid environment and their intended functions are listed in Table 2.7-4.

2.7.7 Reactor Buildings Internal Structure and the Unit Vent Stacks

The Reactor Building Internal Structures consist of the reactor cavity, two steam generator compartments, and a refueling canal which is located between the steam generator compartments and above the reactor cavity for each Reactor Building.

The reactor cavity or primary shield houses the reactor vessel and serves as a biological shield wall. The reactor cavity is also designed to contain core flooding water up to the level of the reactor nozzle [Reference 2.7-4, Section 3.8.3.1].

The steam generator cavities or secondary shield houses the steam generators, reactor coolant pumps (casings), and associated reactor coolant system piping. The pressurizer and quench tank are located in one cavity. Also in the cavities are structural steel, platforms, ladders and grating for access to the various components for inspection and maintenance.

Six openings are provided in the lower shield walls to provide vent area. To ensure that no missile will impact on the Reactor Building Containment liner plate, concrete shielding is provided for the liner plate area opposite the openings. The shielding extends beyond the openings so that any missile will impact on the shields.

The secondary shield walls are designed so that sections can be removed. The structural adequacy of the removable sections is assured by the associated post-tensioned tendon assemblies. The primary strength of the removable sections of the wall is provided by horizontal tendons as well as conventional reinforcing bars in each panel. Vertical tendons provide continuity through the horizontal joints. The remaining portions of the secondary shield walls are of conventional concrete design. The steam generator lateral supports attach to the inner face of the secondary shield wall.

Structural steel is provided in the Reactor Building to allow access to the various elevations and areas inside containment for inspection and maintenance. The steel also provides support for several nuclear safety related components, including core flood tanks, reactor building cooling units, emergency core cooling system piping, and electrical instrumentation, control and power. All structural and miscellaneous steel is carbon steel. Crane rails are carbon steel. The Unit Vent Stack is a vertical cylinder constructed of carbon steel plates.

The floor surfaces of the structure consist of either reinforced concrete or galvanized steel grating. The floor beams are supported by columns or by attachments to the exterior surface of the Secondary Shield Wall. Structural steel angle welded to the liner plate also provides grating support. Attachment welds to the liner plate are within the evaluation boundary of Section 2.7.7 of OLRP-1001. [Footnote 2]

The Reactor Buildings are identified as Class 1 structures in the Oconee UFSAR, Section 3.2 [Reference 2.7-4]. Class 1 structures have been determined to meet the intent of §54.4(a)(1). The Reactor Building internal structures are designed to withstand the loadings as identified in the Oconee UFSAR, Section 3.8 [Reference 2.7-4].

Reactor Building internal structural components and the unit vent stack and their intended functions are listed in Table 2.7-5.

2.7.7.1 Concrete

The Reactor Building Internal Structure concrete design complies with ACI 318-63 [Reference 2.7-5]. Initial construction of the Reactor Building was in accordance with ACI 301 [Reference 2.7-7]. The concrete used in the structure is made from Type II cement with fine and coarse aggregate. Coarse aggregate consisted of crushed Gaffney marble obtained from Blacksburg, South Carolina. The concrete Containment structure is addressed in Section 2.3 of OLRP-1001.

The Reactor Building Internal concrete components and their intended functions are listed in Table 2.7-5.

2.7.7.2 Steel in Air Environment

The Reactor Building Internal Structure steel design complies with AISC *Manual of Steel Construction* [Reference 2.7-6]. The Reactor Building internal steel in air components and their intended functions are listed in Table 2.7-5. The liner plate, penetrations, and hatches of the Reactor Building (Containment) are addressed in Section 2.3 of OLRP-1001. The Reactor Coolant System component supports and Class 1 piping supports are addressed in Section 2.4 of OLRP-1001.

2.7.7.3 Steel in a Fluid Environment

The fuel transfer canal liner plate and its intended functions are listed in Table 2.7-5.

2. This section has been revised to supplement the initial Duke response to RAI 2.3-4 which was provided by Duke letter dated January 14, 1998. The initial Duke response to RAI 2.3-4 was discussed during a meeting with the NRC staff on April 29, 1998.

2.7.7.4 Post-Tensioning System

Structural adequacy of the removable Secondary Shield Walls is assured by a post-tensioning system. Horizontal tendons and conventional reinforcing steel in each removable section provide the primary strength of the removable sections, while vertical tendons provide continuity in the vertical direction through horizontal joints between the panels insuring the wall acts as a structural unit in a two-way direction. Each tendon consists of ninety carbon steel wires. The minimum specified ultimate strength of this material is 240 kips per square inch. The post-tensioning components subject to aging management review for license renewal include the tendon wire and the tendon anchorage. The post-tensioning system and its intended functions are listed in Table 2.7-5.

2.7.8 STANDBY SHUTDOWN FACILITY

The Standby Shutdown Facility is a reinforced concrete structure which is designed as standby system for use under extreme emergency conditions. The Standby Shutdown Facility is provided as an alternate means to achieve and maintain shutdown conditions following postulated fire, sabotage, and flooding events, and is designed in accordance with criteria associated with these events. The Standby Shutdown Facility is classified as a Class 1 structure. Class 1 structures have been determined to meet the intent of §54.4(a)(1).

Standby Shutdown Facility structural components and their intended functions are listed in Table 2.7-6.

2.7.8.1 Concrete

The Standby Shutdown Facility concrete design complies with ACI 318-71 [Reference 2.7-8]. The construction of the Standby Shutdown Facility was in accordance with ACI 301 [Reference 2.7-7]. The Standby Shutdown Facility concrete components and their intended functions are listed in Table 2.7-6.

2.7.8.2 Steel in Air Environment

The Standby Shutdown Facility steel design complies with AISC *Manual of Steel Construction* [Reference 2.7-6]. The Standby Shutdown Facility steel in air components and their intended functions are listed in Table 2.7-6.

2.7.9 Turbine Building

The Turbine Building includes the Turbine Buildings, the Units 1 and 2 Switchgear Enclosure, and the Unit 3 Switchgear Enclosure. The Turbine Building foundation and mat are constructed of reinforced concrete. The Turbine Building substructure is founded on bedrock. Foundation dowels connect the mat foundation to the underlying bedrock. Above grade, the building consists of structural steel with metal siding. The design bases event for the Turbine Building is the maximum hypothetical earthquake [Reference 2.7-4, Section 3.8.5.2].

The Turbine Building is a Class 2 structure. Class 2 structures are those whose limited damage would not result in a release of radioactivity and would permit a controlled plant shutdown but could interrupt power generation [Reference 2.7-4, Section 3.2.1.1.2]. Class 2 structures have been determined to meet the intent of §54.4(a)(2). The Turbine Buildings are designed to withstand the loadings as identified in the Oconee UFSAR, Section 3.8 [Reference 2.7-4].

The foundation and mat were designed in accordance with ACI 318-63 - "Building Code Requirements for Reinforced Concrete" [Reference 2.7-4, Section 3.8.5.2].

Design, material and workmanship for the Turbine building steel was in accordance with the AISC *Manual of Steel Construction* [Reference 2.7-6]. Field connections are made with high strength bolts of either ASTM A325 or A490 designation.

Turbine Building structural components, along with their intended functions, are provided in Table 2.7-7.

2.7.9.1 Switchgear Enclosures

The Unit 1 & 2 Transformer and Switchgear Enclosure is a reinforced concrete structure. The walls contain penetrations for electrical bus, ventilation and personnel access. Ventilation for the structure and transformer CT4 is provided by fans on the east and 12 inch diameter penetrations through the north and south walls. Ventilation penetrations are angled to provide missile protection. Interior walls provide missile protection at each personnel access door.

The structure is divided into two separate rooms by a hollow concrete block firewall. Wide flange sections divide the firewall into three sections. The wide flanges and channels attached to plates embedded in the walls of the structure provide restraint for horizontal loads applied during a postulated seismic event. Seismic bracing of structural steel is provided for the transformer and the electrical bus.

A concrete door on the south end of the structure is mounted on a rail and can be slid parallel to the wall to provide access for maintenance of the CT4 transformer. A plate embedded on the inside of the door helps provide missile protection for the doorway opening in the wall. A curb at the base of the door opening prevents oil or fire from penetrating the building during a postulated fire in the CT4 transformer. The Transformer and Switchgear enclosure is supported by battered pipe piles. The pipe piles were filled with concrete during construction of the structure.

The Unit 3 Switchgear Enclosure is a reinforced concrete structure. Interior walls provide missile protection at personnel access doors. Ventilation for the structure is provided by fans on the west wall of the structure and by the door openings through the walls. The Switchgear Enclosure is supported by battered pipe piles filled with concrete. Angle bracing provides seismic restraint to the electrical bus.

The Unit 1 & 2 Transformer and Switchgear Enclosures and the Unit 3 Switchgear Enclosure are Oconee Class 1 structures. Class 1 structures are those which prevent uncontrolled release of radioactivity and are designed to withstand all loadings without loss of function [Reference 2.7-4, Section 3.2]. Class 1 structures have been determined to meet the intent of §54.4(a)(1).

2.7.9.2 Concrete

The Turbine Building concrete design complies with ACI 318-63 [Reference 2.7-5]. The initial construction of the Turbine Building was in accordance with ACI 301 [Reference 2.7-7]. The Turbine Building concrete components and their intended functions are listed in Table 2.7-7.

2.7.9.3 Steel in Air Environment

The Turbine Building steel design complies with AISC *Manual of Steel Construction* [Reference 2.7-6]. The Turbine Building steel in air components and their intended functions are listed in Table 2.7-7.

2.7.9.4 Fire Barriers

The Turbine Building fire barriers and their intended functions are listed in Table 2.7-7.

2.7.10 Yard Structures

Yard Structures include the following: 230 kV Relay House, 230 kV Switchyard Structures, Trenches, 230 kV Towers from Keowee to Oconee, Elevated Water Storage Tank, Transformer Pads for Transformers CT1, CT2, CT3, Keowee Transformer 1 and foundations and pipe supports located in the Yard. Yard Structure structural components and their intended functions are listed in Table 2.7-8.

The Yard Structure concrete design complies with ACI 318-63 [Reference 2.7-5]. The initial construction of the Yard Structures was in accordance with the information provided in ACI 301[Reference 2.7-7]. The Yard Structure concrete components and their intended functions are listed in Table 2.7-8. Descriptions of Transformer Pads and Trenches are provided below.

The Yard Structure steel design complies with AISC *Manual of Steel Construction* [Reference 2.7-6]. Yard Structures steel in air components and their intended functions are listed in Table 2.7-8. Descriptions of the 230 kV Relay House, 230 kV Switchyard Structures, Elevated Water Storage Tank, and Transmission Towers are provided below.

2.7.10.1 230 kV Relay House

The structural steel superstructure for the 230 kV Relay House is a rectangular structure consisting of a roof system supported by columns forming a rigid frame in the direction of its least dimension and is braced with diagonal bracing in the other direction. The steel structure is erected on a slab on grade. The original design addressed normal live and dead loads and a wind loading based on a 95 mph wind. The design of the structure has been evaluated and determined to be capable of withstanding design basis seismic loadings. The 230 kV Relay House is a Class 2 structure. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

2.7.10.2 230 kV Switchyard Structures

The primary purpose of these structures is to support or protect the electrical equipment and transmission lines in the 230 kV Switchyard and the overhead power path. The 230 kV Switchyard Structures are Class 2 structures. Class 2 structures have been determined to meet the intent of §54.4(a)(2). All of these structures have been qualified for the maximum hypothetical earthquake. 230 kV Switchyard Structures include the following structures:

- Bus Support Bases
- Coupling Capacitor Potential Device Support Bases
- Disconnect Switch Supports
- Lightning Arrestor Supports
- Power Circuit Breaker Bases
- Strain Structures and Bases
- Wave Trap Support Structures

Bus support bases are cylindrical concrete structures embedded in the earth. These bases support electrical buswork support steel.

Coupling capacitor potential device support bases, disconnect switch supports, lightning arrestor supports, and wave trap supports are steel support posts supported by a reinforced concrete base.

Power circuit breaker bases are reinforced concrete footings embedded in the ground. These bases support certain power circuit breakers which are a part of the Keowee overhead power path.

The strain structures and bases in the 230 kV switchyard and at Keowee are an integral part of the Keowee overhead power path. The structural steel for these towers is seismically designed. The foundations are rectangular, combined footings made of reinforced concrete.

2.7.10.3 Elevated Water Storage Tank

The elevated water storage tank is a 100,000 gallon circular atmospheric tank. The tank is designed to American Water Works Association (AWWA) Standard D-100 [Reference 2.7-9]. The circular shaft and conical bell are constructed of structural steel. The bell is attached to the foundation by anchors which pass through an anchor chair and plate. Both the interior and exterior of the tank are coated to protect the steel from corrosion and loss of material.

The interior portion of the tank is exposed to a raw water environment. The elevated water storage tank ensures an inventory of water for the High Pressure Service Water system, which is addressed in Section 2.5.6.4 of OLRP-1001.

2.7.10.4 Equipment Pads

The Keowee main step-up transformer base is located southwest of the Keowee Powerhouse. The reinforced concrete base is supported on soil. The transformer is supported on piers which are located on the top of the base. Seismic restraint of the transformer is provided by a structural steel frame attached to each pier. The Keowee main step-up transformer base provides support and seismic restraint for the Keowee main step-up transformer. The base is considered an Oconee Class 2 structure. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

The Oconee CT1, CT2, and CT3 startup transformer bases are located in the Oconee transformer yard, east of the Turbine Buildings. The reinforced concrete bases are supported by soil. The transformer is supported on piers which are located on top of the base. The Oconee startup transformer bases provide support and seismic restraint for each unit's startup transformer. The bases are considered Oconee Class 2 structures. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

2.7.10.5 Trenches

Trenches are provided throughout the Oconee Yard to allow underground routing of cables and piping. The intended function of external concrete trenches is to provide shelter and protection for safety-related equipment. Trenches within the scope of license renewal are the Standby Shutdown Facility cable trench, emergency power path cable trench, the Intake Structure cable trench and the borated water storage tank pipe trench. Descriptions of these trenches are provided below.

2.7.10.5.1 STANDBY SHUTDOWN FACILITY CABLE TRENCH

The Standby Shutdown Facility cable trench, which carries electrical cables from the Standby Shutdown Facility to each unit's Auxiliary Building, is a reinforced concrete structure. These cables are QA Condition 1 and require the seismic design and analysis of the cable trench so that the trench will safely survive the effects of earthquakes, missile loads, and truck loads. The cable trench is designed in accordance with the criteria presented in the Oconee UFSAR [Reference 2.7-4, Section 3.8.4]. The cable trench is provided with missile-proof vents so that the trench covers are not lifted by the 3 psi pressure differential. Vents are designed to protect the trench from flooding. Reinforced concrete covers are provided over the trench. The Standby Shutdown Facility cable trench is a Class 2 structure. Class 2 structures have been determined to meet the intent of §54.4(a)(1).

2.7.10.5.2 EMERGENCY POWER PATH CABLE TRENCH

The cable trench for the emergency power path is laid out on a grid pattern which covers the entire 230 kV switchyard. It is a precast, reinforced concrete structure. The trench is drained by concrete drain tiles which run beneath it parallel to its centerline, and it is covered by reinforced concrete panels. The trench is bedded in clean washed stone. The cable trench for the emergency power path is a Class 2 structure. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

2.7.10.5.3 INTAKE STRUCTURE CABLE TRENCH

The cable trench to the Intake Structure is reinforced concrete. Checkered plate covers are provided for the reinforced concrete cable trenches to the Intake Structure. These checkered plate covers are seismically designed. The cable trench to the Intake Structure is a Class 2 structure. Class 2 structures have been determined to meet the intent of §54.4(a)(2).

2.7.10.5.4 BORATED WATER STORAGE TANK PIPE TRENCH

The borated water storage tank pipe trench is a reinforced concrete structure and is located between the Auxiliary Building and the borated water storage tank foundation. The Auxiliary Building foundation forms the east side trench wall. The borated water storage tank is addressed as part of the Low Pressure Injection System in Section 2.5 of OLRP-1001. The borated water storage tank pipe trench is a Class 1 structure. Class 1 structures have been determined to meet the intent of §54.4(a)(1).

2.7.10.6 Transmission Towers

The 230 kV transmission line from Keowee to Oconee is supported by two dead-end type lattice towers and one suspension lattice tower. The structures are designed for National Electric Code (NEC) heavy loading Grade B construction per the NEC, Section 25, Rule 252, and Section 26, Rule 261-A&B. The dead-end structures and the suspension structure were analyzed for 0.15g ground motion.

The shield wire pull-off structures located on the roof of the Turbine Building support the loads of the transmission lines from the 230 kV switchyard to the plant. The structures are constructed of hot-dipped galvanized steel with welded and bolted connections. The shield wire pull-off structures are seismically designed.

2.7.11 References for Section 2.7

2.7-1. *Pressurized Water Reactor Containment Structures License Renewal Industry Report,* NUMARC Report Number 90-01, Nuclear Management and Resources Council, Revision 1, September 1991.

2.7-2. *Class I Structures License Renewal Industry Report*, NUMARC Report Number 90-06, Nuclear Management and Resources Council, Revision 1, December 1991.

2.7-3. *NEI 95-10, Revision 0, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule*, Nuclear Energy Institute, March 1996.

2.7-4. *Oconee Nuclear Station, Updated Final Safety Analysis Report,* as revised.

2.7-5. ACI 318-63, *Building Code Requirements for Reinforced Concrete,* American Concrete Institute, Detroit, Michigan.

2.7-6. *Manual of Steel Construction*, 6^{th} Edition, American Institute of Steel Construction.

2.7-7. ACI 301, *Specifications for Structural Concrete for Buildings,* American Concrete Institute, Detroit, Michigan.

2.7-8. ACI 318-71, *Building Code Requirements for Reinforced Concrete*, American Concrete Institute, Detroit, Michigan.

2.7-9. AWWA D-100, *Welded Steel Tanks for Water Storage,* American Water Works Association, Denver, Colorado.

Table 2.7-1 Auxiliary Building Components and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the component does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete												
Anchorage		2					7					
Embedments		2					7					
Equipment Pads		2					7					
Flood Curbs								8				
Foundation		2					7					
Hatches			3	4		6						
Masonry Block & Brick Walls		2	3	4			7					
Reinforced Concrete Beams, Columns, Floor Slabs, and Walls	1	2	3	4		6	7	8			11	
Roof Slabs		2	3			6	7					
Sumps	1	2										
Steel in Air Environment												
Anchorage/Embedments (exposed surfaces)		2					7					
Battery Racks for the125 VDC Instrument and Control Batteries		2										
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Checkered Plate			3									
Control Boards		2	3				7					
Control Room Ceiling							7					

Table 2.7-1 continues on the next page.

Table 2.7-1 Auxiliary Building Components and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Crane Rails & Girders							7					
Electrical & Instrument Panels & Enclosures		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Flood, Pressure & Specialty Doors	1		3					8				
Instrument Line Supports		2					7					
Instrument Racks & Frames		2					7					
Lead Shielding Supports							7					
Metal Siding	1		3									
Pipe Supports		2					7					
Stairs, Platforms & Grating Supports		2					7					
Structural Steel Beams, Columns, Plates & trusses		2					7					
Steel in Fluid Environment												
Spent Fuel Pool Liner Plate • Unit 1&2 Pool • Unit 3 Pool	1		3		5							
Spent Fuel Storage Racks • Unit 1 & 2 • Unit 3		2										
Structural Steel & Plates							7					

Table 2.7-1 continues on the next page.

Table 2.7-1 Auxiliary Building Components and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Fire Barriers												
Fire Doors				4								
Fire Walls				4								
Fire Barrier Penetration Seals				4								

Structural Intended Functions:

1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.

Table 2.7-2 Earthen Embankments and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the structure does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Earthen Embankments												
Intake Canal Dike					5							12
Keowee River Dam					5							12
Little River Dam and Dikes					5							12

Structural Intended Functions:
1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.

Table 2.7-3 Intake Structure Components and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the component does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete												
Anchorage		2					7					
Embedments		2					7					
Foundation		2					7					
Reinforced Concrete Beams, Columns, Floor Slabs, and Walls		2	3				7					
Steel in Air Environment												
Anchorage/Embedments (exposed surfaces)		2					7					
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Checkered Plate			3									
Electrical & Instrument Panels & Enclosures		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Instrument Racks & Frames		2					7					
Pipe Supports		2					7					
Stairs, Platforms & Grating Supports		2					7					
Structural Steel Beams, Columns, Plates & Trusses		2					7					

Table 2.7-3 continues on the next page.

Table 2.7-3 Intake Structure Components and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel in Fluid Environment												
Equipment Component Supports		2					7					
Trash Rack & Screens		2										

Structural Intended Functions:

1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.

Table 2.7-4 Keowee Structure Components and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the component does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete												
Anchorage		2					7					
Embedments		2					7					
Equipment Pads		2					7					
Foundation		2					7					
Foundation Dowels		2					7					
Hatches			3									
Masonry Block & Brick Walls		2	3				7					
Penstock, Intake, Spillway		2					7					
Reinforced Concrete Beams, Columns, Floor Slabs, and Walls		2	3			6	7					
Roof Slabs		2	3			6	7					
Sumps		2										
Steel in Air Environment												
Anchorage/Embedments (exposed surfaces)		2					7					
Battery Racks for the 125 VDC Instrumentation and Control Batteries		2										
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Checkered Plate			3									
Control Boards		2	3				7					
Control Room Ceiling							7					
Crane Rails & Girders							7					

Table 2.7-4 continues on the next page.

Table 2.7-4 Keowee Structure Components and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel in Air Environment (continued)												
Electrical & Instrument Panels & Enclosures		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Flood, Pressure & Specialty Doors			3									
Instrument Line Supports		2					7					
Instrument Racks & Frames		2					7					
Pipe Supports		2					7					
Stairs, Platforms & Grating Supports		2					7					
Structural Steel Beams, Columns, Plates & Trusses		2					7					
Steel in Fluid Environment												
Structural Steel & Plates		2					7					

Structural Intended Functions:
1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.

Table 2.7-5 Reactor Building Components (Internal Structural Components and the Unit Vent Stacks) and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the component does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete												
Anchorage		2					7					
Embedments		2					7					
Equipment Pads		2					7					
Flood Curbs		2						8				
Hatches			3			6						
Masonry Block & Brick Walls		2	3				7					
Missile Shields			3			6						
Reinforced Concrete Beams, Columns, Floor Slabs, and Walls		2	3			6	7				11	
Sumps	1	2										
Steel in Air Environment												
Anchorage/Embedments (exposed surfaces)		2					7					
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Checkered Plate			3									
Crane Rails & Girders							7					
Electrical & Instrument Panels & Enclosures		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Flood, Pressure & Specialty Doors	1		3					8				
Instrument Line Supports		2					7					

Table 2.7-5 continues on the next page.

Table 2.7-5 Reactor Building Components (Internal Structural Components and the Unit Vent Stacks) and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel in Air Environment (continued)												
Instrument Racks & Frames		2					7					
Lead Shielding Supports							7					
Pipe Supports		2					7					
Stair, Platform & Grating Supports		2					7					
Structural Steel Beams, Columns, Plates & Trusses		2					7					
Sump Screens		2										
Unit Vent Stack									9			
Steel in Fluid Environment												
Fuel Transfer Canal Liner Plate	1											
Miscellaneous												
Post-Tensioning System		2										

Structural Intended Functions:
1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.

Table 2.7-6 Standby Shutdown Facility Components and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the component does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete												
Anchorage		2					7					
Embedments		2					7					
Equipment Pads		2					7					
Flood Curbs								8				
Foundation		2					7					
Hatches			3			6						
Reinforced Concrete Beams, Columns, Floor Slabs, and Walls		2	3			6	7					
Roof Slabs		2	3			6	7					
Steel in Air Environment												
Anchorage/Embedments (exposed surfaces)		2					7					
Battery Racks for the 125 VDC Standby Shutdown Facility Batteries		2										
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Checkered Plate			3									
Control Boards		2	3				7					
Control Room Ceiling							7					
Crane Rails & Girders							7					
Electrical & Instrument Panels & Enclosures		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Flood, Pressure & Specialty Doors			3					8				

Table 2.7-6 continues on the next page.

Table 2.7-6 Standby Shutdown Facility Components and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel in Air Environment (continued)												
HVAC Duct Supports		2										
Instrument Line Supports		2					7					
Instrument Racks & Frames		2					7					
Pipe Supports		2					7					
Stairs, Platforms & Grating Supports		2					7					

Structural Intended Functions:
1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.

Table 2.7-7 Turbine Building Components and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the component does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete												
Anchorage		2					7					
Embedments		2					7					
Equipment Pads		2					7					
Flood Curbs								8				
Foundation		2					7					
Foundation Dowels		2					7					
Masonry Block & Brick Walls		2		4			7					
Missile Shields			3			6						
Pipe Piles		2					7					
Reinforced Concrete Beams, Columns, Floor Slabs, and Walls		2	3	4		6	7					
Roof Slabs		2	3			6	7					
Sumps		2										
Steel in Air Environment												
Anchorage/Embedments (exposed surfaces)		2					7					
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Checkered Plate			3									
Crane Rails & Girders							7					
Electrical & Instrument Panels & Enclosures		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Flood, Pressure & Specialty Doors			3					8				
Instrument Line Supports		2					7					

Table 2.7-7 continues on the next page.

Table 2.7-7 Turbine Building Components and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Instrument Racks & Frames		2					7					
Pipe Supports		2					7					
Stairs, Platforms & Grating Supports		2					7					
Structural Steel Beams, Columns, Plates & Trusses		2					7					
Fire Barriers												
Fire Doors				4								
Fire Walls				4								
Fire Barrier Penetration Seals				4								

Structural Intended Functions:
1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.

Table 2.7-8 Yard Structure Components and Their Intended Functions

Key: Structural function numbers identified in the Table correspond to the functions listed following the Table. Shaded cells indicate that the component does not perform the listed function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete												
Anchorage		2					7					
Embedments		2					7					
Equipment Pads		2					7					
Foundation		2					7					
Masonry Block & Brick Walls		2					7					
Pipe Piles		2					7					
Reinforced Concrete Beams, Columns, Floor Slabs, and Walls		2	3				7					
Trenches			3									
Steel in Air Environment												
Anchorage/Embedments (exposed surface)		2					7					
Battery Racks for the 230 kV Switchyard Batteries in the 230 kV Relay House		2										
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Checkered Plate			3									
Electrical & Instrument Panels & Enclosures		2	3				7					
Elevated Water Storage Tank (exterior)		2										
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Piles		2					7					
Pipe Supports		2					7					

Table 2.7-8 continued on next page.

Table 2.7-8 Yard Structure Components and Their Intended Functions (continued)

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel in Air Environment (continued)												
Structural Steel Beams, Columns, Plates & Trusses		2					7					
Transmission Towers		2										
Steel in Fluid Environment												
Elevated Water Storage Tank (interior)		2										

Structural Intended Functions:

1. Provides pressure boundary and / or fission product barrier.
2. Provides structural and / or functional support to safety-related equipment.
3. Provides shelter/protection to safety-related equipment (including radiation shielding).
4. Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
5. Provides source of cooling water for plant shutdown.
6. Serves as missile (internal or external) barrier.
7. Provides structural and / or functional support to non-safety related equipment where failure of this structural component could directly prevent satisfactory accomplishment of any of the required safety-related functions.
8. Provides a protective barrier for internal / external flood event.
9. Provides path for release of filtered and unfiltered gaseous discharge.
10. Impounds water for ultimate heat sink during loss of Lake Keowee.
11. Provides heat sink during SBO or design basis accidents.
12. Impounds water for generation at Keowee Hydro Station.