50-269

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 26, 1997

ORGANIZATION: Duke Power Company

see Reports

SUBJECT: SUMMARY OF MEETING WITH DUKE POWER COMPANY ON LICENSE RENEWAL ACTIVITIES FOR OCONEE NUCLEAR STATION UNITS 1, 2, AND 3

On June 3, 1997, representatives of Duke Power Company (Duke) met with the Nuclear Regulatory Commission staff to discuss the status of Duke's license renewal activities for Oconee Nuclear Station, Units 1, 2, and 3. A list of meeting attendees is provided in Attachment 1. The Duke presentation slides are contained in Attachment 2 and additional Duke handouts are contained in Attachments 3 through 11.

The meeting was requested by Duke to present the results of its integrated plant assessment (IPA) and time-limited aging analysis (TLAA) reviews for two major areas of their Oconee License Renewal Technical Information Topical Report, OLRP-1001, structures and electrical components. To demonstrate the process for structures, Duke performed the IPA review for one structure (earthen embankments), and evaluated one structural TLAA (crane girder fatigue), which are contained in Attachment 3. The information provided addressed the identification of structures and components and their intended functions, identification of the structures and components subject to an aging management review, identification of aging effects, and the demonstration that the effects of aging for the selected structures are managed for the period of extended operation. Examples of information that is maintained onsite in Duke's specifications are contained in Attachments 4, 5, and 6.

Similar to the IPA and TLAA review for structures, Duke also provided Attachment 7 which is the review of electrical components. Duke selected insulators as the electrical component for the example IPA review and environmental qualification of Okonite EPR/Neoprene cables and Viking penetration assemblies as examples of TLAAs. Information on how Duke formed the electrical component groups and a flowchart of the electrical component IPA process are provided in Attachments 8 and 9. Attachments 10 and 11 provide an electrical schematic of the Oconee switchyard and a cross-section drawing of an insulator.

Duke requested that the staff review the examples provided (Attachments 3 and 7) and provide feedback on the adequacy of the information provided. Specific areas in which Duke is requesting staff feedback were subsequently documented

DF01

Meeting Summary

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in a June 10, 1997, Duke letter to the staff. A meeting is to be scheduled in July 1997 for Duke to present the results of its review of mechanical components.

Original signed by:

Stephen T. Hoffman, Senior Project Manager
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Division of Reactor Program Management
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Docket Nos. 50-269, 50-270
and 50-287

Attachments: As Stated

cc w/encls: See next page
R. L. Gill, Duke Power

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Stephen T. Hoffman

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Docket Nos. 50-269, 50-270
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Attachments: As Stated

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ATTENDANCE LIST
NRC MEETING WITH DUKE POWER COMPANY
June 3, 1997

	NAME	ORGANIZATION
1.	Steve Hoffman	NRC/NRR/PDLR
2.	Bill MacKay	Entergy - ANO
3.	Richard E. Johnson	NRC/RES/EMMEB
4.	Jit Vora	NRC/RES/EMMEB
5.	C. I. Grimes	NRC/NRR/PDLR
6.	Paul Shemanski	NRC/NRR/PDLR
7.	Greg Robison	Duke Power
8.	Debbie Ramsey	Duke Power
9.	R. Paul Colaianni	Duke Power
10.	David Masiero	GPU Nuclear
11.	Tricia Heroux	for EPRI
12.	Paul W. Thomas	PECO Energy
13.	Robert Gill	Duke Power
14.	Hai-Boh Wang	NRC/NRR/PDLR
15.	Winston W. C. Liu	NRC/NRR/PDLR
16.	William M. Denny	OGDEN Environ Mental & Energy

Attachment 1

Oconee License Renewal Project
Technical Meeting
Structures & Electrical

Duke / NRC Meeting
June 3, 1997

Agenda

- Opening Remarks
- Oconee Structural IPA and TLAA Review
- OLRP-1001 Structural Example
- Break
- Oconee Electrical IPA and TLAA Review
- OLRP-1001 Electrical Example
- Closing Remarks

Project Challenges

- Establishing a predictable framework for License Renewal
- Producing a technical product that has use today and tomorrow for Oconee
- Producing an Application for Renewal License that drives us toward maturity

Attachment 2

Near Term Key

Near term we need to know the standard by which we will be measured in order for us to be prepared to submit an application for a renewal license

Oconee Structural IPA and TLAA Review

Structural IPA Process Overview

- Consistent with guidance in NEI 95-10 Rev. 0.
- Process Methodology Includes:
  - Identification of structures and components and their intended functions
  - Identification of structures and components subject to an aging management review
  - Identification of the aging effects for the period of extended operation
  - Demonstration that the effects are managed for the period of extended operation

Structure Identification

Total list of Oconee structures was compiled from the following sources:

- Oconee Nuclear Station UFSAR
- Oconee Site General Arrangement Drawings
- Oconee Commodities and Facilities Drawings
- *Quality Standards Manual,* NSD 307

54.4(a)(1) and (a)(2) Scoping

- Structures are classified according to their design function and relationship to public safety
- Class 1 structures prevent uncontrolled release of radioactivity and are designed to withstand all loadings without loss of function
- Class 2 structures are those which do not perform a nuclear safety function but their failure could reduce the function of a nuclear safety system to an unacceptable level

54.4(a)(3) Scoping

- Structures which satisfy 54.4(a)(3) criteria were identified through review of licensing commitments for the regulated events:
  - Fire Protection
  - Environmental Qualification
  - Pressurized Thermal Shock
  - Anticipated Transient without Scram
  - Station Blackout

Scoping Results

- •230 kV Relay House
- •230 kV Switchyard Structures
- •Auxiliary Buildings
- •Intake Canal Dike
- •Intake Structure
- •Keowee River Dam
- •Keowee Breaker Vault
- •Keowee Crane
- •Keowee Intake Structure
- •Keowee Penstock
- •Keowee Powerhouse
- •Keowee Service Bay Structure
- •Keowee Spillway
- •Little River Dam
- •Radwaste Facility
- •Reactor Buildings
- •Spent Fuel Pools
- •Standby Shutdown Facility
- •Switchgear Enclosures
- •Turbine Buildings
- •Underwater Weir
- •Unit Vents

Consolidated List of Structures

- ➤ Auxiliary Buildings (Includes Spent Fuel Pools)
- ➤ Earthen Embankments (Includes Intake Canal Dike, Keowee Dam, Little River Dam and Dikes, and Underwater Weir)
- ➤ Intake Structure
- ➤ Keowee Structures (Includes Breaker Vault, Intake Structure, Penstock, Power House, Service Bay Structure, and Spillway)
- ➤ Radwaste Facility
- ➤ Reactor Buildings (Includes Internal Structures and Unit Vents)
- ➤ Standby Shutdown Facility
- ➤ Turbine Buildings (Includes Switchgear Enclosures)
- ➤ Yard Structures (Includes 230 kV Relay House & Switchyard Structures, Trenches, Towers, Elevated Water Storage Tank, Transformer Pads)

Structural Component Identification

- ➤ Appendix B of NEI 95-10 Rev. 0
- ➤ NUMARC Containment and Class I Structures Industry Report
- ➤ Regulated Events Commitments
- ➤ Oconee Civil / Structural Drawings
- ➤ Structure Design Basis Specifications
- ➤ Plant Walkdowns

Structural Component Listing

- Dependent on whether the components are uniquely identified and the magnitude of the component set
- Where possible, individual components are listed: cranes, battery racks, spent fuel racks, etc.
- Other components, because of the magnitude, are identified on Oconee specific drawings

Structure / Component Matrix

Commodity Groups for AMR

- Concrete
- Steel
- Steel in Fluid Environments
- Earthen Embankments
- Fire Barriers

Aging Effects Review

- Identify applicable aging effects for each commodity group
- Review NRC generic communications, operating experience, etc. for applicable aging effects for components
- For each structure, identify applicable aging effects for components

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Aging Effect Summary Table (Example)

[illegible]	[illegible]					[illegible]						[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
[illegible]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
[illegible]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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Aging Management Program Examples

- ASME Section XI Subsections IWE / IWL for Containment
- FERC Inspections of Dams
- ISI Inspections of Supports
- Civil Inspection for Maintenance Rule
- Chemistry Program
- Battery Rack Inspections
- Crane Inspections
- Fire Barrier Inspections
- Fire Door Inspections
- Transmission Tower Inspections
- Post-tensioning System Inspections

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Structural IPA Example
Earthen Embankments

- Keowee River Dam
- Little River Dam and Dikes
- Intake Canal Dike
- Underwater Weir

Structural IPA Example
Potential Aging Effects

- Loss of Material
- Cracking
- Change in Material Property

Structural IPA Example
Loss of Material

- Loss of material in earthen embankments is caused by erosion
- Erosion may result from wind, rain and surface runoff, subsurface seepage flow, or wave action
- Loss of material due to surface runoff and subsurface seepage flow is the applicable aging effect for the dams and dikes
- Loss of material due to wave action is an applicable aging effect for the Underwater Weir

Structural IPA Example
Cracking

- Cracking of earthen embankments may result from settlement or frost heave
- Cracking due to settlement is an applicable aging effect for the earthen embankments

Structural IPA Example
Change in Material Properties

- Change in material properties is due to desiccation
- Change in material properties due to desiccation is not an applicable aging effect for the earthen embankments

Structural IPA Example
Industry Experience

- Review included a search of LERs, NRC generic communications, and NRC contractor research reports
- Due to the applicability of dams outside NRC jurisdiction, industry information on dams in general was also reviewed

Structural IPA Example
RG 1.127

- Of the causes of dam failures, "the majority lie within the boundaries of modern technology and can be avoided."
- Causes of failures have included:
  - Excessive high pressure buildup
  - Unusually high uplift pressure
  - Soil saturation
  - Overgrown vegetation
  - Construction deficiencies

Structural IPA Example
Industry Experience

- Half the dam failures occur during the first 5 years of operation due to design or construction deficiencies
- Statistics on dam failures show a frequency of one failure every 1500 to 1800 dam years
- Aging effects identified in industry experience are loss of material

Structural IPA Example
Applicable Aging Effects

	Loss of Material				Cracking		[illegible]
Structure	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Keowee Dam	N	Y	Y	N	Y	N	N
Little River Dam & Dikes	N	Y	Y	N	Y	N	N
Oconee Intake Canal Dike	N	Y	Y	N	Y	N	N
[illegible]	N	N	N	Y	Y	N	N

[illegible]

Structural IPA Example
Aging Management Programs

- FERC Five Year Inspection
- FERC Annual Operation Inspection
- Duke Power Annual Inspection
- Duke Power Five Year Underwater Inspection

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Structural IPA Example
Regulatory Basis for Inspections

- The regulatory basis for inspecting Keowee, Little River Dam and Dikes and the Intake Canal Dike is found in 18 CFR Part 12
- The dams and dikes do not fall within NRC inspections
- There is substantial FERC oversight
- The demonstration of the acceptability of the programs is provided as in accordance with guidance in NEI 95-10 Rev. 0

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Structural IPA Example
FERC Five Year Inspection

Program Element	Results of Review
Purpose/Description	The purpose of the inspection is to assess the conditions affecting the safety of a project or project works
Application (Structures/Components)	Keowee Dam, Little River Dam, Little River Dikes A, B, C and D, Oconee Intake Canal Dike, Keowee Spillway and Left Abutment, Keowee Intake and Powerhouse
Aging Effects Managed	Settlement, movement, erosion, seepage, leakage, cracking, stability, internal stress and hydrostatic pressure of earthen structures. Cracking, spalling, erosion, settlement, and movement of concrete structures. Corrosion of structural steel
Frequency	Every five years
Acceptance Criteria	No acceptance criteria are identified. Acceptability of structure is based on the knowledge of the qualified independent consultant
Corrective Action Program	Corrective action plan and schedule is to be provided to FERC no later than 60 days after the independent consultant report is filed with FERC. The plan and schedule is approved by FERC. Incorporation of consultant recommendations are reviewed during subsequent inspections
Administrative Controls	FERC Administrative Controls
Regulatory Basis	18 CFR Part 12

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Structural IPA Example
FERC Annual Operation Inspection

Program Element	Results of Review
Purpose/Description	The purpose of the inspection is to assess the conditions affecting the safety and operation of the Keowee Development
Applications (Structure/Components)	Keowee Dam, Little River Dam, Little River Dikes A, B, C, and D, Intake Dike, Keowee Spillway, Keowee Intake and Powerhouse
Aging Effects Managed	Settlement, erosion, seepage, leakage, cracking, stability, internal stress and hydrostatic pressure
Frequency	Annually
Acceptance Criteria	No acceptance criteria are identified. Acceptance is based on the knowledge of the qualified FERC inspector
Corrective Action Program	Previous inspection reports are reviewed to determine compliance with recommendations
Administrative Controls	FERC Administrative Controls
Regulatory Basis	18 CFR Part 12

Structural IPA Example
Duke Power Annual Inspection

Program Element	Results of Review
Purpose/Description	The purpose of the inspection is to assess the conditions affecting the safety and operation of the Keowee Development
Applications (Structure/Components)	Keowee Dam, Little River Dam, Little River Dikes A, B, C, and D, Oconee Intake Dike, Keowee Spillway, Keowee Turbines, Keowee Intake and Powerhouse
Aging Effects Managed	Concrete cracking, spalling, leaching, [illegible], and leakage/seepage through concrete Earthen embankment, slides, seepage, erosion, [illegible] Steel corrosion, cracking, and leakage through steel
Frequency	Annually
Acceptance Criteria	Acceptable criteria are not documented. Acceptance criteria are based upon the knowledge of the qualified inspection team (at least one Professional Engineer)
Corrective Action Program	All prior inspection reports are reviewed to ensure implementation of recommended corrective actions. Each inspection team [illegible] reports or studies. The Operating department prepares plan to address recommendations.
Administrative Controls	Implemented per Specification [illegible]
Regulatory Basis	None

Structural IPA Example
Duke Power Five Year Underwater Inspection

Program Element	Results of Review
Purpose/Description	The purpose of the inspection is to assess the condition of the submerged Underwater Weir
Applications (Structure/Components)	Underwater Weir
Aging Effects Managed	Loss of material
Frequency	Once every five years
Acceptance Criteria	No specific acceptance criteria are identified. Acceptability of the structure is based on the ultrasonic readings of the profile
Corrective Action Program	Corrective actions are implemented and verified during subsequent inspections
Administrative Controls	Implemented per EDM 410 (Ref. Duke Power Engineering Directives Manual No. EDM 410, Inspection Program for Civil Engineering Structures and Components, June 27, 1996)
Regulatory Basis	Previously - None Currently - [illegible]

Structural IPA Example
Summary of Management of Aging Effects

- The FERC Five Year Inspection, FERC Annual Operation Inspection, Duke Power Annual Inspection, and the Duke Power Underwater Inspection include the key elements of effective programs as identified in NEI 95-10 Rev. 0
- These programs provide reasonable assurance that the aging effects will be managed so that the intended functions of the Intake Canal Dike, Keowee Dam, Little River Dam and Dikes, and the Underwater Weir will be maintained consistent with the CLB for the period of extended operation

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2 TLAA's for Structures

- Boraflex
- Crane Girder Fatigue

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OLRP-1001 Structural Example

- Earthen Embankments have been selected as the structural example
- Structural Components and Intended Functions will be listed and identified in Section 2.7
- Aging Management Reviews of Structural Components will be provided in Section 3.7
- Time-limited aging analyses for cranes are described and evaluated for 60 year period of operation in Section 3.7.11
- NRC review and feedback of this example is requested in a reasonable period of time

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BREAK

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Oconee Electrical IPA and TLAA Review

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Items to be Discussed

- Overview of the IPA & TLAA Processes for Electrical Components Including:
  - Electrical Component Identification and Screening
  - Electrical Component Group & Structure Scoping
  - Electrical Component AMR
  - Electrical Component Group AMR Example
  - Electrical TLAA Process
  - Electrical TLAA Examples
  - Oconee Position on GSI-168

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Electrical IPA Process Overview

- Consistent with guidance in NEI 95-10 Rev. 0
- Process Methodology Includes:
  - Identification of Components and Functions
  - Identification of Components Subject to an Aging Management Review
  - Structural & Area Scoping
  - Identification of the Aging Effects for the Period of Extended Operation
  - Demonstration that the Effects are Managed for the Period of Extended Operation

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Electrical Component Groups Identification

- Started with §54.21(a)(1)(i) Components
- Added Component Groups from NEI 95-10 Rev. 0, Appendix B
- Reviewed Oconee Drawings & Documents Including the *Quality Standards Manual*, NSD 307
- List Reviewed & Expanded by Duke Electrical Support Experts
- Resulting List Reviewed & Restructured by Multi-Utility Electrical Peer Group

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Electrical Component Groups

- Alarm Units
- Analyzers
- Annunciators
- Batteries
- Battery Chargers
- Breakers
- Cables & Connections
- Industrial Communication Equipment
- Controllers
- Converters
- Electronic Devices
- Fuses
- Generators
- Heaters
- Heat Tracing
- Indicators
- Insulators
- Isolators
- Light Bulbs
- Line Traps
- Motors
- Motor-Generator Sets
- Phase Bussing
- Power Inverters
- Power Supplies
- Area Radiation Monitors
- Process Radiation
- Nuclear Radiation
- Recorders
- Regulators
- Relays
- Sensors
- Signal Conditioners
- Solenoid Operator
- Surge Suppressors
- Switches
- Switchgear, Load Centers, Motor Control Centers
- Power Distribution Panel Component Assemblies
- Electrical Control Panel Component Assemblies
- Transformers
- Transmitters

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Electrical Component Group 54.21(a)(1)(i) Screening

- Started with the List of Electrical Component Groups
- Reviewed Electrical Component Groups Using Criteria in §54.21(a)(1)(i)
  - Review Based on General Component Function
- Determined the Electrical Component Groups Subject to AMR*

* Assumes the component is within scope and is not a replacement item

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Electrical Component Groups Subject to an AMR

- Insulated Cables & Connections
- Uninsulated Cables & Connections
- Insulators [separate, high voltage equipment]
- Line Traps [separate, high voltage equipment]
- Electrical Penetrations
- Phase Bussing
- Surge suppressors [separate, high voltage equipment]

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Structure & Area 54.4(a) Scoping

- This step is performed to reduce the number of spaces to be reviewed for electrical component ambient environments
  - Started with Structural IPA Scoping Results
  - Removed Structures With No Electrical Components in Scope
  - Added Direct Buried as an Area of Review

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List of Structures & Areas

Area	Description
Auxiliary Buildings	Includes all levels of all 3 unit Auxiliary Buildings and Spent Fuel Pools
Intake Structure	CCW pump intake structure
Keowee Structures	Includes the Breaker Vault, Intake Structure, Penstock, Power House, Service Bay Structure, and Spillway
Reactor Buildings	Includes all levels of all 3 unit Reactor Buildings
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
Yard Structures	Includes all areas and components outside the other structures. Specifically, 230kV Switchyard structures and Relay House, overhead transmission lines, Keowee Transformer Yard, Oconee Transformer Yard, cable trenches, and direct buried components (installed below ground but not in a structure)

Electrical Component Group Scoping

- Electrical Component Groups Scoped Using Criteria of §54.4
- In-Progress Results:
  - Insulated Cables - All considered in Scope
  - Uninsulated Cables - Scoping in progress
  - Insulators - Safety-Related are in scope
  - Electrical Penetrations - All in scope & in EQ
  - Phase Bussing - Safety-Related are in scope
  - Surge suppressors - Scoping in progress

Electrical Component AMR General Process

- Define Component Group Evaluation Boundaries
- Identify Material Properties and Ambient Environments
  - Identify insulated cable areas of interest
  - Identify each insulated cable in areas of interest
  - Scope insulated cables in areas of interest
  - Identify material properties & ambient environments of in-scope insulated cables
- Identify and assess component aging effects

Demonstration of Electrical Component Aging Management

- Determine which Electrical Component Aging Effects Need Management
- Identify Existing or New Aging Management Programs for Each Aging Effect Needing Management
- Demonstrate Effectiveness of Aging Management Programs

Electrical IPA Example
Insulators

- Insulator Intended Functions
  - Provide physical support to an electrical conductor and to maintain adequate electrical separation between the conductor and other conductors or electrical ground sources
- Insulator Types
  - Station Post
  - Strain/Suspension
- Insulators in Scope
  - Insulators used in the Keowee Overhead Emergency Power Path
- Insulator Evaluation Boundaries
  - Insulator Connection to Support or Conductor

Electrical IPA Example
Insulators

- Materials
  - Porcelain, Steel or Iron Hardware, Cement
- Ambient Environment
  - Temperature: -7°F to 105°F
  - Precipitation: 9.8% of all hours of the year

Electrical IPA Example
Insulators

- Potential Aging Effects
  - Cracking
    - Cement growth has caused cracking only in isolated bad batches. The dates of manufacture of these batches are known and none were installed at Oconee
    - Physical contact with flying objects can cause cracks in the porcelain
    - This aging effect has been assessed and determined to be not applicable to the Oconee 230kV insulators

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Electrical IPA Example
Insulators

- Industry & Duke Experience
  - No Generic Aging Problems with the 230kV Strain/Suspension or Station Post Insulators Installed at Oconee
  - Never Required to Replace any 230kV Insulators at Oconee
- No Applicable Aging Effects Identified
- No Aging Management Program Required

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Oconee Electrical TLAA

- Electrical TLAA are analyses used in the qualification reports of Environmental Qualification (EQ) Program components
- There are over 30 EQ analyses covering 14 equipment types that qualify the equipment for a 40-year life or longer

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TLAA Evaluation Process

- Review Existing Qualification Report
- Obtain the Original Assumed Thermal and Radiation Testing Values
- Obtain Installed Thermal & Radiation Data for the Components
- Use the Arrhenius Method and Actual Ambient Environments to Calculate a New Qualified Life (Without Changing Material Activation Energies)

Electrical Equipment Types to be Evaluated

- Actuators (2 brands)
- Cables (7 brands)
- Hook-up wire
- Incore Thermocouples
- TEC Monitor Accelerometers
- Motors (4 brands)
- Penetrations (3 brands)
- RTD's (3 brands)
- Terminal Blocks (none in Containment)
- Switches
- Transmitters (4 brands)
- Solenoid Valves
- Heat Shrink Tubing
- Scotchcast 9 Brand Resin

Viking Penetration Assemblies

- Original Qualification Thermal
  - Thermal Test: 300°F for 350 Hours
  - Assumed Service Temperature: 120°F
  - Analysis Determined a 62 Year Qualified Life
- Original Qualification Radiation
  - Radiation Test: 1.0E8 rads
- Actual Radiation Dose:
  - Radiation: <6.2E7 rads (60 Years + LOCA)

Okonite EPR/Neoprene Cables

- Original Qualification Tests
  - Thermal: 40 Years at 90°C, >40% EAB
  - Radiation: 2.0E8 rads
- Actual Environments
  - Thermal: 75.8°C (Ambient + Ohmic Heat)
    New Arrhenius Plot: >60 Years, >40% EAB
  - Radiation: 1.06E8 rads (60 Years + LOCA)

GSI 168, NUREG-0933 EQ of Electrical Equipment

- **Issue 1:** "The staff concluded that differences in EQ requirements constituted a potential generic issue which should be evaluated for backfit independent of license renewal."
- **Issue 2:** GSI 168 raised the question of "the EQ and accident performance capability of certain artificially-aged cables" following NRC contracted tests performed by Sandia National Lab.

GSI 168 Oconee Position - Issue 1

- The staff has stated (NUREG/CR-6384, Vol. 2) that the licensing basis differences in requirements between older and newer plants has not created substantial differences in actual equipment qualifications among the plants and considers this issue closed. Oconee agrees with this position.

GSI 168
Oconee Position - Issue 2

- The tested cables were not representative of naturally aged cables due to incorrectly conducted tests. Oconee does have in place the following programs which provide data on the actual environmental conditions and material conditions of cables installed in containment:

GSI 168
Oconee Position - Issue 2 (cont.)

- Programs in Place:
  - Temperature Monitors installed in containment to validate assumptions in EQ evaluations
  - Radiation Monitors installed in containment to validate assumptions in EQ evaluations
  - Sacrificial Cables were installed in containment for the purpose of performing tests on cable insulation to validate EQ evaluations and trend the condition of the cable insulation

Proposed GSI-168 Resolution

- Based on the above information and concurrent with the TLAA review of cables at Oconee, Duke Power is prepared to propose a resolution of GSI-168 as part of the renewal license application

OLRP-1001 Electrical Example

- Insulators have been selected as the electrical example
- All electrical component types have been listed
- All electrical component types and intended functions will be listed and identified in Section 2.6
- Aging Management Reviews of Electrical Components will be provided in Section 3.6
- Time-limited aging analyses for Environmental Qualification will be described and evaluated in Section 3.6.9
- NRC review and feedback of this example is requested in a reasonable period of time

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Meeting Our Challenges

- Continue the technical reviews at Duke
- Continue to meet with NRC staff to discuss the results of our reviews as we proceed
- Continue to make formal submittals to obtain NRC review and approval
- Continue to support the development of the draft technical SRP
- Complete technical reviews to the extent possible prior to a renewal application being submitted

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OLRP-1001 Review Status

- TLAA Identification: Section 1.4
  - Submitted
  - Awaiting Staff RAIs
- Containment: Sections 2.3 & 3.3
  - Submitted
  - Awaiting Staff RAIs
- RCS: Sections 2.4 & 3.4
  - In preparation
  - Awaiting SE's of OG Topicals (as listed in Duke ltr dtd 5/19/97)

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OLRP-1001
Review Status

- Mechanical: Sections 2.5 & 3.5
  - In preparation
  - Technical meeting anticipated early July
- Electrical: Sections 2.6 & 3.6
  - In preparation
  - Awaiting Staff feedback on example
- Structures: Sections 2.7 & 3.7
  - In preparation
  - Awaiting Staff feedback on example

2.7 Structures and Structural Components

The identification of structures and structural components is a two step process. The first step involves the identification of the Oconee structures within the scope of license renewal and the second step involves the identification of the structural components within each of these structures. The determination of Oconee structures within the scope of license renewal was made by initially identifying all Oconee structures and then reviewing each structure to determine which ones satisfied one or more of the criteria contained in 10 CFR Part 54, §54.4. This process was described previously in Section 2.2 of this report. The results of this determination of structures within the scope of license renewal are maintained in documentation available in an auditable and retrievable form, in accordance with the requirements of §54.37(a).

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 review collectively because of their similar material of construction and aging management programs. The consolidated list of Oconee structures is as follows:

- Auxiliary Building (includes Spent Fuel Pools)
- Earthen Embankments (includes Intake Canal Dike, Keowee Dam, Little River Dam and Dikes, and Underwater Weir)
- Intake Structure
- Keowee Structures (includes Power House, Spillway, Breaker Vault, Intake Structure, Service Bay Structure, and Penstock)
- Radwaste Facility
- Reactor Buildings (Internal Structures and the Unit Vents)
- Standby Shutdown Facility
- Turbine Building (includes Switchgear enclosures)
- Yard Structures (includes items exposed to weather: e.g., 230 kV Relay House, Switchyard Structure, Trenches, Towers, EWST, Transformer Pads)

The second step involves the identification of the structural components within each of these structures. A generic list of structural components was developed by using the lists of components provided in NUMARC Containment and Class I Structures Industry Reports [References 1 & 2 , 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 list of structural components is maintained in documentation available in an auditable and retrievable form, in accordance with the requirements of §54.37(a).

The functions of the structures were determined from a review of information contained in the Oconee UFSAR [Reference 3], 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 which does not support the intended function of the structure. For example, a unique function of the spent fuel racks is to maintain separation of the fuel assemblies to prevent criticality. Tables 2.7-1 through 2.7-10 provide for each structure identified above, the structural components or component groups, that are within the scope of 10 CFR Part 54, 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 integrated plant assessment of these interfacing components is provided in other sections of this report. For example, the integrated plant assessment of Containment is provided in Sections 2.3 and 3.3; for reactor coolant system component supports, the integrated plant assessment is provided in Sections 2.4 and 3.4; and for non-Class 1 mechanical components, it is provided in Sections 2.5 and 3.5.

The following sections provide descriptions of each of the structures as well as the structural components within each structure.

2.7.1 AUXILIARY BUILDINGS

2.7.1.1 Steel Components

2.7.1.2 Steel Components in Fluid

2.7.1.3 Concrete Components

2.7.1.4 Miscellaneous

2.7.2 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
- Underwater Weir

The list of these structures along with their intended functions is also provided in Table 2.7-2.

2.7.2.1 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 with the following intended functions:

- Provides a source of cooling water for plant shutdown;
- Impounds water for ultimate heat sink during loss of Lake Keowee; and
- Impounds water for generation at Keowee Hydro Station

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.

2.7.2.2 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 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 3]. The Keowee River Dam is an Oconee Class 2 structure with the following intended functions:

- Provides a source of cooling water for plant shutdown;
- Impounds water for generation at Keowee Hydro Station

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 floor. The rock foundation under the main portion of the dam was pressure grouted during construction. Ground cover is provided to minimize erosion.

2.7.2.3 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 and 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 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 3]. The Little River Dam and Dikes are Oconee Class 2 structures with the following intended functions:

- Provides a source of cooling water for plant shutdown;
- Impounds water for generation at Keowee Hydro Station

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.

2.7.2.4 Underwater Weir

The Underwater Weir is an earth embankment constructed of impervious materials. The upstream and downstream slopes of the Underwater Weir have been analyzed for rapid drawdown and rapid drawdown in combination with the maximum hypothetical event. The Underwater Weir is designed to have an adequate factor of safety under the same conditions of seismic loadings as used for the design of Oconee. The Underwater Weir is an Oconee Class 2 structure with the following intended functions:

- Provides a source of cooling water for plant shutdown;
- Impounds water for ultimate heat sink during loss of Lake Keowee; and

The crest and side slopes are covered with four feet of grouted riprap. The upstream slope has a twelve inch filter below a 36-inch layer of riprap. A foundation drainage blanket starts upstream of the dam centerline and stops at the upstream toe of the dam. It is constructed of both coarse and fine size aggregates. The blanket helps prevent seepage erosion type of failure and increases the overall stability of the weir.

2.7.3 INTAKE STRUCTURE

2.7.3.1 Steel Components

2.7.3.2 Steel Components in Fluid

2.7.3.3 Concrete Components

2.7.3.4 Miscellaneous

2.7.4 KEOWEE STRUCTURES

2.7.4.1 Steel Components

2.7.4.2 Steel Components in Fluid

2.7.4.3 Concrete Components

2.7.4.4 Miscellaneous

2.7.5 RADWASTE FACILITY

2.7.6 REACTOR BUILDINGS (INTERNAL STRUCTURES AND THE UNIT VENTS)

2.7.6.1 Steel Components

2.7.6.2 Steel Components in Fluid

2.7.6.3 Concrete Components

2.7.6.4 Miscellaneous

2.7.7 STANDBY SHUTDOWN FACILITY

2.7.7.1 Steel Components

2.7.7.2 Steel Components in Fluid

2.7.7.3 Concrete Components

2.7.7.4 Miscellaneous

2.7.8 TURBINE BUILDINGS

2.7.8.1 Steel Components

2.7.8.2 Steel Components in Fluid

2.7.8.3 Concrete Components

2.7.8.4 Miscellaneous

2.7.9 YARD STRUCTURES

2.7.9.1 Steel Components

2.7.9.2 Steel Components in Fluid

2.7.9.3 Concrete Components

2.7.9.4 Miscellaneous

2.7.10 References

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. *Class I Structures License Renewal Industry Report,* NUMARC Report Number 90-06, Nuclear Management and Resources Council, Revision 1, December 1991.

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

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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel Components												
Battery Racks for the125 VDC Instrument and Control Batteries		2										
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Class 2 & 3 Pipe Supports		2										
Control Room Ceiling							7					
Controlled Leakage Doors	1											
Crane Rails & Girders • Evaporator pump monorail • Low pressure injection hoist • Reactor Building spray hoist • Waste drumming hoist • Decay heat cooler hoist • Demineralizer area hoist • High pressure injection hoist • Spent fuel cooler monorail • Spent fuel pool crane • Spent fuel pool auxiliary crane							7					
Electrical Racks, Panels & Cabinets		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Fire Doors				4								
Flood Curbs (Steel)								8				
Flood Doors								8				
HVAC Duct Supports		2					7					
Impulse Line Supports		2					7					
Instrument Racks, Panels, & Frames		2					7					
Lead Shielding			3									
Non-Class Pipe Supports							7					
Platform Supports							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
Steel Components in Fluid												
Fuel Pool Liner • Unit 1&2 Pool • Unit 3 Pool	1		3		5							
Spent Fuel Rack • Unit 1 & 2 • Unit 3		2										
Sump Liners	1											
Sump Screens		2										
Concrete Components												
Anchorage		2					7					
Embedments		2					7					
Equipment Foundations		2					7					
Fire Walls				4								
Hatches			3	4		6						
Masonry Block Walls		2		4			7					
Masonry Brick Walls			3									
Reinforced Concrete - Columns, Walls, Beams, Floor Slabs, Roof Slabs		2	3				7				11	
Miscellaneous												
Compressible Joints & Shields	1							8				
Fire Barriers				4								
Vibration Isolators		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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 component is not required to perform an intended 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					10		12
Keowee River Dam					5							12
Little River Dam and Dikes					5							12
Underwater Weir					5					10		

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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel Components												
Cable Tray & Conduit		2					7					
Electrical Racks, Panels & Cabinets		2	3				7					
Expansion Anchors		2					7					
Instrument Racks, Panels & Frames		2					7					
Steel Components in Fluid												
Trash Rack & Screens		2										
Concrete Components												
Anchorage		2					7					
Embedments		2					7					
Equipment Foundations		2					7					
Reinforced Concrete - Columns, Walls, Beams, Floor Slabs, Roof Slabs		2					7					
Miscellaneous												
Compressible Joints & Seals	1							8				

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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel Components												
Battery Racks for the 125 VDC Instrumentation and Control Batteries		2										
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Class 2 & 3 Pipe Supports		2										
Control Room Ceiling							7					
Crane Rails & Girders • 270 ton crane • Intake hoist							7					
Electrical Racks, Panels & Cabinets		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Fire Doors				4								
HVAC Duct Supports		2					7					
Instrument Racks, Panels & Frames		2					7					
Non-Class Pipe Supports							7					
Structural Steel		2					7					
Concrete Components												
Anchorage		2					7					
Embedments		2					7					
Equipment Foundations		2					7					
Masonry Block Walls		2		4			7					
Reinforced Concrete - Columns, Walls, Beams, Floor Slabs, Roof Slabs		2				6	7					

Table 2.7-4 continues on the next page.

Table 2.7-4 Keowee Structure Components and Their Intended Functions (Continued)

Key: Structural function numbers identified in the table correspond to the 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	8	9	10	11	12
Miscellaneous												
Compressible Joints & Seals								8				

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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 Radwaste 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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Concrete Components												
Flood Curbs (Concrete)	1							8				

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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 Reactor Building (Internal structures and Unit Vents) 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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel Components												
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Class 2 & 3 Pipe Supports		2										
Crane Rails & Girders • Polar crane							7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
HVAC Duct Supports		2					7					
Instrument Racks, Panels & Frames		2					7					
Jet Barriers			3									
Missile Shields		2				6						
Pipe Whip Restraints			3									
Platform Supports							7					
Structural Steel		2					7		9		11	
Steel in Fluid												
Sump Liners	1											
Sump Screens		2										
Concrete Components												
Anchorage		2					7					
Embedments		2					7					
Equipment Foundations		2					7					
Reinforced Concrete - Columns, Walls, Beams, Floor Slabs, Roof Slabs		2	3				7				11	
Removable Missile Shields			3			6						

Table 2.7-6 continues on the next page.

Table 2.7-6 Reactor Building (Internal structures and Unit Vents) Components and Their Intended Functions (Continued)

Key: Structural function numbers identified in the table correspond to the 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	8	9	10	11	12
Miscellaneous												
Lubrite Plate		2										
Post-Tensioning System			3									

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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel Components												
Battery Racks for the 125 VDC SSF batteries		2										
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Class 2 & 3 Pipe Supports		2										
Control Room Ceiling							7					
Crane Rails & Girders • Generator Room crane • Equipment hatch monorail • Second floor equipment hatch monorail							7					
Electrical Racks, Panels & Cabinets		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Fire Doors				4								
Flood Curbs (Steel)								8				
Flood Doors								8				
Instrument Racks, Panels & Frames		2					7					
Non-Class Pipe Supports							7					

Table 2.7-7 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
Concrete Components												
Anchorage		2					7					
Embedments		2					7					
Equipment Foundations		2					7					
Flood Curbs (Concrete)								8				
Hatches			3	4		6						
Reinforced Concrete - Columns, Walls, Beams, Floor Slabs, Roof Slabs		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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel Components												
Cable Tray & Conduit		2					7					
Cable Tray & Conduit Supports		2					7					
Crane Rails & Girders • Pump aisle crane • Turbine aisle crane • Turbine aisle auxiliary crane • Heater bay crane • Condensate booster pump monorail							7					
Electrical Racks, Panels & Cabinets		2	3				7					
Equipment Component Supports		2					7					
Expansion Anchors		2					7					
Fire Doors				4								
Flood Doors								8				
HVAC Duct Supports		2					7					
Impulse Line Supports		2					7					
Instrument Racks, Panels & Frames		2					7					
Stairs, Platforms, Grating Support (QA4)							7					
Structural Steel		2					7					
Concrete Components												
Anchorage		2					7					
Embedments		2					7					
Equipment Foundations		2					7					
Fire Walls				4								
Flood Curbs (Concrete)								8				
Foundation Dowels		2										
Masonry Block Walls		2		4			7					
Reinforced Concrete - Columns, Walls, Beams, Floor Slabs, Roof Slabs		2					7					

Table 2.7-8 continues on the next page.

Table 2.7-8 Turbine Building Components and Their Intended Functions (Continued)

Key: Structural function numbers identified in the table correspond to the 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	8	9	10	11	12
Miscellaneous												
Compressible Joints & Seals	1							8				
Fire Barriers				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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 2.7-9 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 is not required to perform an intended function.

	Intended Functions (Identified in the note below)											
	1	2	3	4	5	6	7	8	9	10	11	12
Steel Components												
Battery Racks for the 125 VDC 230 kV Switchyard batteries		2										
Equipment Component Supports		2					7					
Structural Steel		2					7					
Transmission Towers		2										
Concrete Components												
Anchorage		2					7					
Embedments		2					7					
Equipment Foundations		2					7					
Masonry Block Walls		2		4			7					
Reinforced Concrete - Columns, Walls, Beams, Floor Slabs, Roof Slabs		2					7					
Trench			3									

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 and external flood event.
9. Provides structural integrity of unit vent stack and 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.

3.7 STRUCTURES AND STRUCTURAL COMPONENTS

Structures and structural component groups that are within the scope of license renewal that require aging management reviews and their intended functions were identified and listed in Section 2.7. The approach used to perform the aging management review of these components is consistent with that provided in NEI 95-10, Section 4.2 [Reference 1]. The aging management review consists of identifying the applicable aging effects for each of the identified structural component groups and then demonstrating the ability of programs and activities to manage those effects. The aging management review is presented structure by structure.

The applicable aging effects that can challenge the intended functions have been identified for each of the structural component groups by reviewing the materials of construction and the service environment for each component group. In order to validate the identified aging effects, a review of industry experience and NRC generic communications relative to structural components was performed. In addition, a review of relevant Oconee experience was performed.

The programs that are credited for managing the effects of aging are described in Section 3.7.11. The demonstration process consists of evaluating these programs by using the guidance of NEI 95-10, Section 4.2 [Reference 1].

The aging management review is considered complete when the credited programs provide reasonable assurance that the applicable aging effects are managed so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) for the renewal license period of extended operation. The process described in this section is intended to meet the requirements of §54.21(a)(3) and to permit the staff to make the finding identified in §54.29(a).

In addition to the above aging management reviews, the time limited aging analyses associated with structural components that were identified in Table 1.4-1 of this report have been evaluated and the results are presented in Section 3.7.11.

3.7.1 AUXILIARY BUILDING

3.7.1.1 Aging Management Review of Steel Components

3.7.1.1.1 APPLICABLE AGING EFFECTS

3.7.1.1.2 AGING MANAGEMENT PROGRAMS

3.7.1.2 Aging Management Review of Steel Components in Fluid

3.7.1.2.1 APPLICABLE AGING EFFECTS

3.7.1.2.2 AGING MANAGEMENT PROGRAMS

3.7.1.3 Aging Management Review of Concrete Components

3.7.1.3.1 APPLICABLE AGING EFFECTS

3.7.1.3.2 AGING MANAGEMENT PROGRAMS

3.7.1.4 Aging Management Review of Miscellaneous Components

3.7.1.4.1 APPLICABLE AGING EFFECTS

3.7.1.4.2 AGING MANAGEMENT PROGRAMS

3.7.2 EARTHEN EMBANKMENTS

3.7.2.1 Aging Management Review

3.7.2.1.1 APPLICABLE AGING EFFECTS

The aging effects that could potentially result in loss of the intended functions of the earthen embankments are: loss of material, cracking, and change in material properties. Each aging effect has been assessed for the Oconee earthen embankments. In addition, reviews of industry experience, NRC generic communications, and Oconee operating experience were performed to validate the appropriate set of the applicable aging effects. The results of these evaluations are provided in the following paragraphs and are summarized in Table 3.7-2.

3.7.2.1.1.1 LOSS OF MATERIAL ASSESSMENT

Loss of material in earthen structures is caused by erosion. Erosion may result from wind, rain and surface runoff, subsurface seepage flow, or wave action. During dry periods, wind can erode loose surface soil for the earthen embankment. Wind erosion is generally limited to earthen embankments that are not provided with good ground cover vegetation or riprap. As described in Section 2.7, the Intake Canal Dike, Keowee Dam, and Little River Dam and Dikes are provided with ground cover and riprap to protect against loss of material due to wind. The Underwater Weir is not exposed to wind as it is totally submerged. Therefore, loss of material due to erosion from wind is not an applicable aging effect for the Intake Canal Dike, Keowee Dam, Little River Dam and Dikes and the Underwater Weir.

The energy of rain and subsequent surface runoff can loosen soil particles and scour exposed surfaces. Erosion occurs when the loosened soil is carried away by surface flows. Topography is a major factor in the erosion process. Steeper topography increases the flow of water and results in more erosion. Loss of material due to runoff is minimized by good design practices such as limiting embankment slopes to minimize overland flow velocities and providing ground cover vegetation or riprap in areas with high fluid velocities and hydraulic jumps. While the dams and dikes at Oconee are provided with ground cover and riprap to protect against loss of material due to rain and surface runoff, erosion is an applicable aging effect that needs to be managed for the period of extended operation for Keowee Dam, Little River Dam and Dikes, and the Oconee Intake Canal Dike. The Underwater Weir is not subjected to rain and runoff since it is completely submerged; therefore, erosion due to rain and runoff is not an applicable aging effect for the Underwater Weir.

Subsurface flow is caused by water seeping through the soil and forming underground soil "pipes." Foundations of all dams will have some seepage under prolonged storage conditions. It is important that foundation seepage be controlled or kept within tolerable limits in all areas to maintain a stable foundation and dam [Reference 2]. Seepage becomes a safety concern when there has been any progressive increase in volume of flow and there is evidence of piping of solids or removal of soluble materials, when hydrostatic pressure have increased in the foundation, or if soft areas have developed in the embankment downstream [Reference 3]. The added concern of seepage is that it will lead to piping. Piping is internal erosion of the soil due to the velocity of the seeping water and can lead to rapid deterioration of the embankment. Indications of subsurface flow include new downhill springs or sudden unexplained water level drops, surface cracks, and unexplained settlement. Loss of material due to seepage and piping is an applicable aging effect for the Intake Canal Dike, Keowee Dam, and the Little River Dam and Dikes. The Underwater Weir is designed with a foundation drainage blanket to prevent seepage erosion; therefore, erosion due to seepage is not an applicable aging effect for the Underwater Weir.

Earthen structures may experience loss of material owing to wave action adjacent to the shore line. This effect is primarily caused by wind blowing across the water surface or by the flow of the water. This effect could cause a loss of slope stability of the dam and dikes due to the undercutting erosion action of the waves. This effect is precluded by installation of riprap at the shore line of the Intake Canal Dike, Keowee Dam, and the Little River Dam and Dikes.

Submerged earthen structures such as the Underwater Weir may also experience the effects of underwater currents or flows. These currents could be naturally occurring currents or man-made due to suction from an intake structure. Therefore, loss of material due to underwater flow is an applicable aging effect for the Underwater Weir and needs to be managed for the period of extended operation.

3.7.2.1.1.2 Cracking Assessment

Cracking of earthen structures may result from settlement and frost heave. Settlement is found to some degree in all earthen structures. As the below surface soil is loaded, it settles under the pressure of the overburden. Slowly decreasing settlement due to consolidation is not a serious problem unless the crest camber is lost and the freeboard reduced below permissible limit [Reference 4]. Most settlement is typically discovered during or soon (generally less than one year) after construction. Sudden or rapid settlement may result from seepage through thin or degraded areas of the impermeable soil liner or if large water fluctuations occur where expansive clay was used in the construction of the embankment [Reference 4]. Differential settlement can cause transverse cracking of the embankment. Conditions causing settlement may be detected and corrected with a careful periodic inspection program. Cracking due to settlement is an applicable aging effect for the Intake Canal Dike, Keowee Dam, Little River Dam and Dikes, and the Underwater Weir and must be managed for the period of extended operation.

When the daily mean temperature remains below 32° F for a period of time, soil moisture begins to freeze. As groundwater continues to freeze, earthen structures may experience deformation caused by a phenomenon called frost heave [Reference 5]. Frost heave is caused by water in the soil which expands approximately 10% when it freezes. Over a period of extended cold periods, frost heave may cause permanent deformation and cracking of an earthen structure. However, this effect only occurs in areas with deep frost line with fine grain soils. In areas that experience noticeable frost heave, careful periodic inspections should be performed to determine if any permanent , long-term deformation is occurring. Oconee Nuclear Station is not located in a geographic region where there is a deep frost line; therefore, cracking due to frost heave is not an applicable aging effect for Keowee Dam, Little River Dam and Dikes, and the Intake Canal Dike.

3.7.2.1.1.3 CHANGE IN MATERIAL PROPERTIES ASSESSMENT

The primary change to material properties for earthen structures is desiccation. Desiccation may occur when soil is exposed to the air for extended periods of time. Water not ionically combined with the soil is drawn toward the surface where it evaporates [Reference 6]. Highly plastic preloaded clay is especially susceptible owing to its potential for shrinkage and loss in pliability. This in turn, may cause the exposed surface of the clay to become brittle and flake off or delaminate. Desiccation, coupled with flow, wind, or wave action may accelerate these effects of erosion. Desiccation is not an applicable aging mechanism for submerged structures since the soil is continuously exposed to water and does not lose moisture due to evaporation. No provisions are required to manage desiccation for continuously submerged portions of earthen structures. The Underwater Weir is continuously submerged; therefore, change in material properties due to desiccation is not an applicable aging effect for the Underwater Weir.

The effects of desiccation may be controlled through proper material selection and embankment slope during design and construction. In addition, the presence of vegetation can minimize this effect since plants tend to hold moisture in the soil. Keowee Dam, Little River Dam and Dikes, and the Intake Canal Dike are provided with adequate ground cover vegetation to prevent desiccation; therefore, desiccation is not an applicable aging effect for these structures.

3.7.2.1.1.4 INDUSTRY EXPERIENCE

In order to validate the set of applicable aging effects and to assure no additional aging effects beyond those discussed herein, a review of industry experience was performed. This review included a search of Licensee Event Reports (LERs), NRC generic communications, and NRC contractor research reports (NUREG/CRs). No LERs or NRC generic communications were identified applicable to earthen embankments. Due to the applicability of dams outside NRC jurisdiction, industry information on dams in general was also reviewed. The following provide summaries of the information from this investigation:

Previous investigations into the frequency of dam failure indicate that it decreases with later years of construction [Reference 7]. This is generally attributed to improvements in the methods of design and construction. The age of the dam is another factor that has been identified as having an effect on the rate of dam failure. Approximately half the dam failure occur during the first 5 years of operation [Reference 8].

Earthen structures have extremely low failure rates. In fact, statistics on dam (earthen and concrete) failures, based on the sum of operation years of a regional group of dams, show a frequency of one failure every 1500 to 1800 dam years [Reference 9]. These statistics indicate that earthen structures have a natural resistance to aging.

The Executive Committee of the United States Committee on Large Dams (USCOLD) authorized the Dam Safety Committee's Subcommittee on Dam Incidents and Accidents to compile a list of dam incidents from 1972 through 1986. The compilation of data was documented in *Lessons from Dam Incidents, USA-II* [Reference 10]. There were 164 incidents documented for earthen dams over fifty feet in height. Six of the incidents were major failure of an operating dam which resulted in complete abandonment of the dam. Seven of the incidents were the failure of an operating dam which permitted the damage to be successfully repaired and the dam again placed in operation. The majority of the incidents (eighty-four) were identified as repairs that were required because of deterioration or to update certain features. The cause of the incidents were due to piping, sliding, overtopping, or deficiency in the construction or design of the dam/foundation/spillway.

Based upon the review of industry experience, no additional aging effects beyond those evaluated in the preceding sections were identified for the Oconee earthen embankments.

3.7.2.1.2 AGING MANAGEMENT PROGRAMS

Loss of material and cracking have been identified as aging effects requiring programmatic management for the Intake Canal, Keowee Dam, the Little River Dam and Dikes, and the Underwater Weir. Four current aging management programs cover the Keowee Dam, Little River Dam and Dikes, and the Oconee Intake Canal Dike:

- Federal Energy Regulatory Commission (FERC) Five Year Inspection
- FERC Annual Operational Inspection

- Duke Power Annual Inspection
- Duke Power Five Year Underwater Inspection

The inspection of the Underwater Weir is performed as part of the Oconee Five Year Civil Inspection. The demonstration of the effectiveness of these programs is provided in Section 3.7.10.

3.7.3 INTAKE STRUCTURE

3.7.3.1 Aging Management Review of Steel Components

3.7.3.1.1 APPLICABLE AGING EFFECTS

3.7.3.1.2 AGING MANAGEMENT PROGRAMS

3.7.3.2 Aging Management Review of Steel Components in Fluid

3.7.3.2.1 APPLICABLE AGING EFFECTS

3.7.3.2.2 AGING MANAGEMENT PROGRAMS

3.7.3.3 Aging Management Review of Concrete Components

3.7.3.3.1 APPLICABLE AGING EFFECTS

3.7.3.3.2 AGING MANAGEMENT PROGRAMS

3.7.3.4 Aging Management Review of Miscellaneous Components

3.7.3.4.1 APPLICABLE AGING EFFECTS

3.7.3.4.2 AGING MANAGEMENT PROGRAMS

3.7.4 KEOWEE STRUCTURES

3.7.4.1 Aging Management Review

3.7.4.1.1 APPLICABLE AGING EFFECTS

3.7.4.1.2 AGING MANAGEMENT PROGRAMS

3.7.5 RADWASTE FACILITY

3.7.5.1 Aging Management Review

3.7.5.1.1 APPLICABLE AGING EFFECTS

3.7.5.1.2 AGING MANAGEMENT PROGRAMS

3.7.6 REACTOR BUILDINGS (INTERNAL STRUCTURES AND THE UNIT VENTS)

3.7.6.1 Aging Management Review

3.7.6.1.1 APPLICABLE AGING EFFECTS

3.7.6.1.2 AGING MANAGEMENT PROGRAMS

3.7.7 STANDBY SHUTDOWN FACILITY

3.7.7.1 Aging Management Review

3.7.7.1.1 APPLICABLE AGING EFFECTS

3.7.7.1.2 AGING MANAGEMENT PROGRAMS

3.7.8 TURBINE BUILDING

3.7.8.1 Aging Management Review

3.7.8.1.1 APPLICABLE AGING EFFECTS

3.7.8.1.2 AGING MANAGEMENT PROGRAMS

3.7.9 YARD STRUCTURES

3.7.9.1 Aging Management Review

3.7.9.1.1 APPLICABLE AGING EFFECTS

3.7.9.1.2 AGING MANAGEMENT PROGRAMS

3.7.10 AGING MANAGEMENT PROGRAM DEMONSTRATIONS

3.7.10.1 Earthen Embankment Inspection Programs

As background, the regulatory basis for inspecting Keowee, Little River Dam and Dikes, and the Oconee Intake Dike is found in 18 CFR Part 12. The original basis for the regulations were developed by the Federal Power Commission. On December 27, 1965, the Federal Power Commission (FPC), the FERC's predecessor agency, provided in Order No. 315 n 3 for complete safety inspection of licensed water power project works by an independent consultant at five-year intervals, or more frequently if necessary. Ensuing dam failures in the 1970's prompted President Carter to initiate The Federal Dam Safety Program in 1977 [Reference 11]. An interagency committee prepared the Federal Guidelines for Dam Safety [Reference 12]. In a memorandum to the Chairman of NRC and FERC (et al.) dated October 4, 1979 [Reference 13], President Carter requested that "the head of each Federal Agency responsible for or involved with .... regulation... of dams adopt and implement the Federal Guidelines."

In response to the Federal Guidelines, Generic Letter 83-38 [Reference 14] was written to identify the dams which could be considered "NRC" dams in the context of the Guidelines of the Federal Dam Safety Program [Reference 12]. NUREG-0965 [Reference 15] documents the study which addressed identification of "NRC" dams. In NUREG-0965, Keowee and Little River Dams were identified as offsite dams which provide cooling water for normal and emergency operations of Oconee. NUREG-0965 also documents that Keowee and Little River Dams are regulated by the FERC and are therefore not included in the listing of dams within NRC responsibility.

Dam inspections were a standard part of FERC's program at the time. However, FERC determined that it was advisable to consolidate the various regulations, orders, and practices relating to project safety. On January 28, 1981, FERC issued the Final Rule Governing the Safety of Water Power Projects and Project Works [Reference 16].

Each of the existing aging management programs has been evaluated consistent with the guidance provided in NEI 95-10, Revision 0 [Reference1] to provide reasonable assurance that the effects of aging can be adequately managed for the earthen embankments so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation.

3.7.10.1.1 FERC FIVE YEAR INSPECTION

18 CFR Part 12 contains the requirements for an independent inspection of the safety of the development (that part of a project comprising an impoundment and its associated dams, forebays, water conveyance facilities, power plants, and other appurtenant facilities) [Reference 17]. This independent inspection is required to be performed every

five years by an independent consultant approved by FERC. The FERC Five Year Inspection has been evaluated against the aging management program elements identified in NEI 95-10 [Reference 1].

Because loss of material and cracking can lead to major failure of the structural integrity of the earthen embankments, the FERC inspections require that embankments be inspected for erosion, seepage, settlement, cracking, and other pertinent effects. The initial FERC Five Year Inspection was performed in 1976 on the Keowee Project. There have been a total of five inspections performed. FERC Five Year Inspections have revealed only minor degradation. Observations include seepage at the toe of Little River Dam, minor saturation of areas of the little River Dam, erosion of the shoreline at Little River Dam, seepage at the toe of Little River Dike A, slight seepage at the low point of Dike D, minor saturation of an area in the Intake Canal Dike, minor erosion at abutments to the Intake Canal Dike, seepage from Keowee Dam, and erosion at the downstream toe of Keowee dam. Inspection of the earthen structures showed no outward signs of leakage, damage, settlement or movement. The general appearance and condition of the earthen structures is good. All seepage is well controlled and monitored. [References 18, 19, 20, and 21].

Any identified seepage is monitored for sedimentation, change in color of sediment, and increase in flow. Minor saturated areas are monitored for any change such as flow of water on the ground surface, boils, or transportation of soil. Trench drains or drainage blankets are installed where necessary. Erosion is corrected as part of the routine maintenance program.

The observed aging effects are minor and have no impact on the ability of the Keowee Project structures to perform their intended functions. The FERC Five Year Inspection has been demonstrated to detect and manage loss of material and cracking so that the intended functions of the Keowee Project earthen structures will be maintained consistent with the CLB for the period of extended operation.

3.7.10.1.2 FERC ANNUAL OPERATION INSPECTION

Because loss of material and cracking can lead to major failure of the structural integrity of the earthen embankments, the FERC inspections require that embankments be inspected for erosion, seepage, settlement, cracking, and other pertinent effects. Once a water power project becomes operational, members of the Federal Energy Regulatory Commission staff conduct an annual review of the Project's operating history, compliance with licensing conditions, and inspect the project works. 18 CFR Part 12 provides FERC the authority to perform inspections of projects. FERC "Internal Operating Manual" stipulates that they inspect high hazard dams on a yearly basis. Keowee Development has been identified as a high hazard dam. The FERC Annual Operation Inspection Program has been evaluated for the aging management program elements identified in NEI 95-10 [Reference 1].

A total of 17 FERC Annual Inspections have been performed for the structures included within the Keowee development. The structures have been found to be in satisfactory condition. No conditions were identified that represent immediate danger to the safety and permanence of the Keowee project. The inspections have noted seepage and saturated conditions on the Keowee Dam, seepage on the Little River Dam, erosion of ditch below toe of Dike A, seepage on Dike D, slight saturation of Oconee Intake Dike, and minor erosion adjacent to the spillway. Seepage is controlled and monitored for any changes, erosion is repaired, and saturated conditions are modified and monitored

Instrumentation at the Keowee project includes seepage measurement weirs, drain pipes, settlement and deflection points, and piezometers at Keowee dam; weirs and piezometers at Intake Canal Dike; flumes at Little River Dam; drain pipes and seepage monitoring points at Dike A; and drain pipes at Dike D. Monitoring data is submitted annually to the FERC. Monitoring data has indicated no unusual observations or trends.

3.7.10.1.3 DUKE POWER ANNUAL INSPECTION

Duke Power provides an annual inspection of Keowee Development. This inspection includes an evaluation of the Keowee Dam, Keowee powerhouse, tailrace, intake structure and spillway; Little River Dam, Little River Dikes A, B, C, and D; and the Oconee intake dike. The Duke Power Annual Inspection is evaluated for the aging management program elements identified in NEI 95-10 [Reference 1].

A total of 20 Duke Power Annual Inspections have been performed for the Keowee Development. The structures have been found to be in satisfactory condition. No conditions were identified that represent immediate danger to the safety and permanence of the Keowee Development. The inspections have documented minor seepage and erosion for Keowee Dam, Little River Dam and Dikes, and the Oconee Intake Canal Duke. The erosion has been repaired and the seepage has been controlled and monitored through a drainage system. The annual inspection also includes a review of the instrumentation (piezometers, seepage monitor) for any abnormal conditions or trends.

Routine visual inspections of the Keowee development dams and dikes are performed once very two weeks when the observation wells/piezometers are. Survey monuments were installed on Keowee, Oconee Intake structure, Little River Dam, and Dike A. These monuments are monitored annually for horizontal and vertical movements.

3.7.10.1.4 DUKE POWER FIVE YEAR UNDERWATER INSPECTION

The Underwater Weir is required for containing cooling water in the Intake Canal for plant shutdown in the event of a loss of Lake Keowee. Therefore, it is important that the Underwater Weir maintain its overall form as settlement may lead to cracking and structural failure of the weir. The profile of the Underwater Weir is verified using ultrasonic soundings from the water surface. The inspection of the Underwater Weir is performed as part of the Oconee Five Year Civil Inspection. The Underwater Weir Inspection is evaluated for the aging management program elements identified in NEI 95-10 [Reference 1].

An ultrasonic inspection of the Underwater Weir was performed in 1993. None of the sonar readings indicate any deviation from "as-built" conditions. No slides were noted and the top elevation of the weir is level and at the proper depth. This inspection will be performed as part of the five year civil inspection program

Loss of material due to wave action and cracking due to settlement have been identified as applicable aging effects which can lead to the loss of ability to contain water. The Underwater Weir inspection will detect loss of material and settlement so that corrective actions can be taken so that the intended function will be maintained consistent with the CLB for the period of extended operation.

In summary, the FERC Five Year Inspection, FERC Annual Operation Inspection, Duke Power Annual Inspection, and the Duke Power Underwater Weir Inspection include the key elements of effective programs as identified in NEI 95-10 [Reference 1] necessary to ensure that the earthen structures can continue to perform their intended functions for the period of extended operation consistent with the current licensing basis. The FERC Five Year Inspection, FERC Annual Operation Inspection, and the Duke Power Annual Inspection have been demonstrated to detect and manage loss of material due to erosion and subsurface flow and cracking due to settlement. The Underwater Weir Inspection has been demonstrated to detect and manage loss of material due to wave action and cracking due to settlement for the Underwater Weir. These programs provide reasonable assurance that the aging effects will be managed so that the intended functions of Keowee Dam, Little River Dam and Dikes, Intake Canal Dike, and the Underwater Weir will be maintained consistent with the CLB for the period of extended operation.

3.7.10.2 Program 2

3.7.10.3 Program 3

3.7.10.4 Program 4

3.7.10.5 Program 5

3.7.11 Time - Limited Aging Analyses

3.7.11.1 Polar Cranes and Spent Fuel Pool Cranes

The load cycle limit of the Oconee Polar Cranes has been identified as a time-limited aging analysis by reviewing correspondence on the Oconee dockets associated with the control of heavy loads. In 1981, NRC issued Generic Letter 81-07 and NUREG-0612 [Reference 22]. NRC issued a letter [Reference 23] requesting additional information which Duke Power responded to by letter [Reference 24]. One of the concerns expressed in NUREG-0612 was the potential for fatigue of the crane due to frequent loadings at or near design conditions. Cranes at Oconee are not generally subjected to frequent loads at or near design conditions. The topic of lift cycles of cranes at or near rated load is considered to be a time-limited aging analysis for Oconee because all of the criteria contained in 10 CFR Part 54, §54.3 are met; that is the topic:

(1) involves a component that is within the scope of license renewal - cranes;
(2) considers the effects of aging - cracking due to fatigue;
(3) involves a time-limited assumption - estimated number of heavy lift cycles for 40 years;
(4) is determined to be relevant by Duke in making a safety determination;
(5) involves a conclusion related to the capability of the component to perform its intended function; and
(6) is contained in the current licensing basis.

In the written response to NUREG-0612, Duke stated that the polar crane was the bounding Oconee crane for the lift of loads at or near rated load. Other cranes at Oconee at the time were considered to be bounded by the polar crane since the projected number of lifts of loads at or near capacity for the life of the plant were less than the number of projected lifts by the polar crane for the life of the plant. The number of lifts at or near the rated capacity of the polar crane over a 40 year life was estimated to be approximately 100. The estimated number of lifts at or near capacity of the polar crane was based upon the expected number of annual refueling cycles for the life of the plant and two lifts at or near capacity for each refueling outage. One lift is to remove the reactor vessel head at the beginning of refueling and the second lift is to replace it on the reactor vessel at the end of refueling. The number of lifts is conservative because Duke now projects fewer refueling outages through the remaining licensed life of Oconee because they now occur approximately once every 18 months instead of annually.

The NRC evaluated the written Duke response to NUREG-0612 and in its evaluation [Reference 25] stated that since the number of cycles is far below the 20,000 loading cycles specified by CMAA-70 [Reference 26], fatigue is not a concern at Oconee. Duke notes that even for operation of the Oconee polar cranes through 60 years, the estimated number of heavy load cycles of the polar crane is still far below 20,000 loading cycles.

Subsequent to the above NUREG-0612 review, Oconee installed an Independent Spent Fuel Storage Installation (ISFSI) which became operational in 1990. The operation of the ISFSI resulted in additional lifts by the spent fuel pools cranes near their rated lifting capacity. Spent fuel pool cranes lift near their rated capacity when they are lifting full spent fuel casks. For each cask, there two are full lifts:

(1) moving from the support frame to the decon pit and
(2) moving from the decon pit to the transfer car.

The ISFSI is currently licensed for 88 casks which equates to 176 full lifts over the life of the plant. Because the NUHOMS-24P canisters in the Oconee ISFSI are assumed to be non-transportable, they will need to be returned to the spent fuel pool so that the spent fuel can be removed and repackaged into multi-purpose canisters. Repackaging will result in three full lifts per cask:

(1) moving the canisters from the transfer car to the pool;
(2) moving the canisters from the support frame to the decon pit; and
(3) moving the canisters from the decon pit to the car.

This will result in an additional 264 full lifts for the 88 casks and a total of 440 full load lifts of one spent fuel pool crane for the 88 casks. This is conservative because all lifts are assigned to one spent fuel pool crane rather than dividing the lifts between the two Oconee spent fuel pool cranes. The estimate of the number of heavy load lifts of the spent fuel pool cranes requires assumptions associated with when the high level waste repository is licensed and capable of accepting spent fuel. Current estimates are that this will not occur until late in the current licensed term of Oconee. Duke estimates that an additional 123 casks would be needed to store spent fuel onsite through 2013 and to completely empty the pools. Each cask will require two full lifts to initially load each cask and then three full lifts to repackage each cask for shipment. It is possible that these casks would be multi-purpose casks thereby eliminating the need for three additional lifts per cask, but three additional lifts have been assumed for conservatism. This results in 615 additional heavy load lifts through 2013 for a total of 1055 lifts on one spent fuel crane for the current operating term. Extending this estimate through 2034 still results in a number of estimated heavy lifts below the threshold of 20,000 cycles from CMAA-70.

Based on the above reviews, Duke concludes that the time-limited aging analyses associated with heavy load lifts of both the polar cranes and the spent fuel pool cranes remain valid for the period of extended operation.

A description of this analysis will be included in the Supplement to the Oconee UFSAR, as required by §54.21(d).

3.7.11.2 Spent Fuel Rack Boraflex

Later

3.7.12 References

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

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3. "When is Foundation Seepage Unsafe," William A. Clevenger, *Inspection Maintenance and Rehabilitation of Old Dams*, American Society of civil Engineers, New York, New York, 1974.

4. EPRI Report No. AP-4714, *Inspection and Performance Evaluation of Dams*, Electric Power Research Institute, Palo Alto, California, September, 1986.

5. G. B. Sowers and G. F. Sowers, *Introductory Soil Mechanics and Foundations, Third Edition*, The MacMillan Company, 1970.

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9. E. Gruner, "Classification of Risk," Proceedings International Congress on Large Dams, Vol. 1, Madrid, 1973, pp. 55-68.

10. *Lessons from Dam Incidents, USA-II*, American Society of Civil Engineers, New York, New York, 1988.

11. Memorandum from President Carter to the Chairman of the Nuclear Regulatory Commission and FERC (and to heads of other Federal agencies dealing with dams), April 23, 1977.

12. Federal Coordinating Council for Science, Engineering and Technology, "Federal Guidelines for Dam Safety," June 25, 1979.

13. Memorandum from President Carter to the Chairman of the Nuclear Regulatory Commission (and to heads of other Federal agencies dealing with dams), October 4, 1979.

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15. NURG-0965, "NRC Inventory of Dams, U. S. Nuclear Regulatory Commission, January 1983.

16. 46 FR 9029, 18 CFR Part 12, Water Power Projects and Project Works Safety, January 28, 1981.

17. 18 CFR Part 12 - *Safety of Water Power Projects and Project Works*, 59 FR 54815, Nov. 2, 1994.

18. Duke Power Company Keowee Development F. P. C. Project No. 2503, Inspection and Report by Chas. T. Main, Inc., April, 1976.

19. Duke Power Company Keowee Development F. P. C. Project No. 2503, Inspection and Report by Chas. T. Main, Inc., February, 1981.

20. Duke Power Company Keowee Development F. P. C. Project No. 2503, Third Five Year Independent Consultant Inspection, Law Engineering Testing Company, March, 1986.

21. Report of Fourth Independent Consultant Inspection Per FERC Order No. 122, Keowee Development FERC Project No. 2503, Law Environmental, Inc. April, 1991.

22. Generic Letter 81-07, NUREG-0612, Control of Heavy Loads, NRC, February 3, 1981.

23. J. F. Stolz (NRC) to W. O. Parker (Duke) letter dated February 18, 1982, Oconee Nuclear Station, Docket Numbers 50-269, 50-270, 50-287.

24. W. O. Parker (Duke) letter to Document Control Desk (NRC) dated October 8, 1982, Oconee Nuclear Station, Docket Numbers 50-269, 50-270, 50-287.

25. J. F. Stolz (NRC) letter H. B. Tucker (Duke) dated April 20, 1983, Oconee Nuclear Station, Docket Numbers 50-269, 50-270, 50-287.

26. Crane Manufacturers Association of America (CMAA) Specification #70, "Specifications for Electric Overhead Traveling Cranes," Revised 1975.

Table 3.7-1 Aging Management Review Results for Auxiliary Building Components

Table 3.7-2 Aging Management Review Results for Earthen Embankments

Earthen Embankment Subject to Aging Management Review	Applicable Aging Effects	Aging Management Programs
Earthen Embankments		
Intake Canal Dike	Loss of Material Cracking	FERC Five Year Inspection FERC Annual Operation Inspection Duke Power Annual Inspection
Keowee River Dam	Loss of Material Cracking	FERC Five Year Inspection FERC Annual Operation Inspection Duke Power Annual Inspection
Little River Dam and Dikes	Loss of Material Cracking	FERC Five Year Inspection FERC Annual Operation Inspection Duke Power Annual Inspection
Underwater Weir	Loss of Material Cracking	Duke Power Five Year Underwater Inspection

Table 3.7-3 Aging Management Review Results for Intake Structure Components

Table 3.7-4 Aging Management Review Results for Keowee Structure Components

Table 3.7-5 Aging Management Review Results for Radwaste Facility Components

Table 3.7-6 Aging Management Review Results for Reactor Building (Internal structures and Unit Vents) Components

Table 3.7-7 Aging Management Review Results for Standby Shutdown Facility Components

Table 3.7-8 Aging Management Review Results for Turbine Building Components

Table 3.7-9 Aging Management Review Results for Yard Components

Table 3.1
Oconee Nuclear Station
Structure Scoping Summary (Includes All Oconee Structures)

Structure[1]	Class[4]	LR	Function[2]	SR	NSR	FP	EQ	PTS	ATWS	SBO	Documentation
100 kv Structure	3	N		N	N	N	N	N	N	N	
230 kv Relay House (8063)	2	Y	2,3	N	Y	N	N	N	N	N	OSS-0254.00-00-3000 - Class 2, Functions
230 kv Switchyard Structure	2	Y	2,3	N	Y	N	N	N	N	N	OSS-0254.00-00-3000 - Class 2, Functions
525 kv Relay House (8046)	3	N		N	N	N	N	N	N	N	
525kv Switchyard Structure	3	N		N	N	N	N	N	N	N	
6900V Switchgear Enclosure	3	N		N	N	N	N	N	N	N	
Administration Building (8004)	3	N		N	N	N	N	N	N	N	
Advanced Training Facility	3	N		N	N	N	N	N	N	N	
Air Compressor Building	3	N		N	N	N	N	N	N	N	
Auxiliary Building Unit 1 (8075)	1,2	Y	1,2,3,4,8,11	Y	Y	Y	N	N	N	Y	FSAR - Class 1,2 TJ Coyle Memo - Class 1,2 SBO SER
Auxiliary Building Unit 2 (8078)	1,2	Y	1,2,3,4,8,11	Y	Y	Y	N	N	N	Y	FSAR - Class 1,2 TJ Coyle Memo - Class 1,2 SBO SER
Auxiliary Building Unit 3 (8082)	1,2	Y	1,2,3,4,8,11	Y	Y	Y	N	N	N	Y	FSAR - Class 1,2 TJ Coyle Memo - Class 1,2 SBO SER
Bathhouse (8043)	3	N		N	N	N	N	N	N	N	
Canteen Facility (8025)	3	N		N	N	N	N	N	N	N	
Chemical Treatment Pond System	3	N		N	N	N	N	N	N	N	
Discharge Structure	3	N		N	N	N	N	N	N	N	
Dry Cask Modular Storage (8015)	3	N		N	N	N	N	N	N	N	OSS-0254.00-00-3002
Environmental Storage (8009)	3	N		N	N	N	N	N	N	N	
Environmental Storage (8011)	3	N		N	N	N	N	N	N	N	
Fuel Oil Storage Facility (8062)	3	N		N	N	N	N	N	N	N	
Geotechnical Center (8029)	3	N		N	N	N	N	N	N	N	
Hot Machine Shop (8095)	2	Y		N	Y	N	N	N	N	N	OSS-0254.00-00-3004 - Class 2
HP Office Building (8080)	3	N		N	N	N	N	N	N	N	
Hydrogen Storage House (8064)	3	N		N	N	N	N	N	N	N	

Table 3.1
Oconee Nuclear Station
Structure Scoping Summary (Includes All Oconee Structures)

Notes:

[1] Structure identification numbers in parentheses are from Dwg. No. CFD-8000-Z-0001.

[2] Structural Function numbers identified in the table correspond to the functions listed below:

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 and external flood event.
9. Provides structural integrity of unit vent stack and 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 power generation at Keowee Hydro Station.

[3] Only seismic "bathtub" (concrete mat and walls to elev. 799+6) is in scope.

[4] Class 1 structures are those which prevent uncontrolled release of radioactivity and are designed to withstand all loadings without loss of functions. All Class 1 structures are within LR scope.

Class 2 structures are those whose limited damage would not result in a release in radioactivity and would permit a controlled plant shutdown but could interrupt power generation. Class 2 structures do not perform a nuclear safety function but their failure could reduce the function of a nuclear safety system to an unacceptable level. Class 2 structures are within LR scope.

Class 3 structures are those whose failure could inconvenience operation but are not essential to power generation, orderly shutdown or maintenance of the reactor in a safe shutdown. Class 3 structures are not within LR scope.

Table 4.1
Oconee Nuclear Station
Structural Components and Functions

Category and Component	Function(s) - See Table 3.1 for Master List of Functions	Disposition
Dampers		Covered in Mechanical scope
Electrical Racks Panels & Cabinets	2. Provides structural and/or functional support to safety related equipment. 3. Provides shelter/protection to safety-related equipment. 7. Provide 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.	In scope
Equipment Component Supports	2. Provides structural and/or functional support to safety related equipment. 7. Provide 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.	In scope
Expansion Anchors	2. Provides structural and/or functional support to safety related equipment. 7. Provide 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.	In scope
Fire doors	4. Provides a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.	In scope
Flood Curbs (Steel)	8. Provides a protective barrier for internal flood event.	In scope
Flood Doors	8. Provides a protective barrier for internal flood event.	In scope
HVAC Duct Supports	2. Provides structural and/or functional support to safety related equipment. 7. Provide 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.	In scope
Impulse Line Supports	2. Provides structural and/or functional support to safety related equipment. 7. Provide 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.	In scope

Table 4.2
Oconee Nuclear Station
Structure and Component Matrix

	Component	Auxiliary Buildings	Earthen Embankments	Intake Structure	Keowee Structures	Radwaste Facility	Reactor Buildings	Standby Shutdown Facility	Turbine Buildings	Yard Structures
Steel	Battery Racks	X			X			X		X
Steel	Cable Tray & Conduit	X		X	X		X	X	X	
Steel	Cable Tray & Conduit Supports	X			X		X	X	X	
Steel	Class 1 Pipe Supports	X			X		X			
Steel	Class 2 & 3 Pipe Supports	X			X		X	X		
Steel	Control Room Ceiling	X			X			X		
Steel	Controlled Leakage Doors	X								
Steel	Crane Rails & Girders	X			X		X		X	
Steel	Electrical Racks, Panels & Cabinets	X		X	X			X	X	
Steel	Equipment Component Supports	X			X		X	X	X	
Steel	Expansion Anchors	X		X	X		X	X	X	
Steel	Fire Doors	X			X			X	X	
Steel	Flood Curbs (Steel)	X						X		
Steel	Flood Doors	X						X	X	
Steel	HVAC Duct Supports	X			X		X		X	
Steel	Impulse Line Supports	X							X	
Steel	Instrument Racks, Panels, & Frames	X		X	X		X	X	X	
Steel	Jet Barriers						X			
Steel	Lead Shielding	X								
Steel	Missile Shields						X		X	
Steel	Non-Class Pipe Supports	X			X			X		
Steel	Pipe Whip Restraints						X			
Steel	Platform Supports	X					X			
Steel	Stairs, Platform, Grating Support (QA4)								X	
Steel	Structural Steel				X		X		X	
Steel	Transmission Towers									X
Steel In Fluid	Fuel Pool Liner	X								
Steel In Fluid	Spent Fuel Rack	X								
Steel In Fluid	Sump Liners	X					X			
Steel In Fluid	Sump Screens	X					X			
Steel In Fluid	Trash Rack & Screens			X						

2.6 Electrical Components

The identification of electrical components is a four step process. The first step involves the identification of Oconee electrical component groups, the second step of the process involves the identification of the electrical component types that meet the criteria contained in 10 CFR Part 54, §54.21(a)(1)(i) [Reference 1], the third step involves identification of the Oconee structures which contain electrical components within scope and the fourth step involves scoping of several electrical component groups.

The first step of the process is the determination of Oconee electrical component types was made by reviewing §54.21(a)(1)(i), Appendix B of NEI 95-10 [Reference 2], Revision 0, and Oconee engineering documents to identify electrical components. This initial list was then reviewed by Duke electrical support experts as well as a multi-utility peer group. The electrical component types were combined into groups based on the way the components performed their functions.

The second step involves the identification of electrical components from this initial listing that meet the criteria contained in 10 CFR Part 54, §54.21(a)(1)(i). This review resulted in the determination that the following electrical component groups are subject to aging management review:

- Insulated cables & connections
- Uninsulated cables & connections
- Insulators [separate, high voltage equipment]
- Line traps [separate, high voltage equipment]
- Electrical penetrations
- Phase bussing
- Surge suppressors [separate, high voltage equipment]

These results of this review along with the component intended functions are presented in Table 2.6-1.

The third step of the process involves the identification of the structures which contain electrical components within scope. The results of the structural scoping process, described in Section 2.7, were used. Two structures which clearly do not contain electrical components within scope were identified: Radwaste Facility (Concrete Curb only) and Earthen Embankments. In addition, direct buried components were added as a subset of Yard Structures. The following is a list of those Oconee structures which contain electrical components within scope:

- Auxiliary Buildings
- Intake Structure
- Keowee Structures
- Reactor Buildings

- Standby Shutdown Facility
- Turbine Buildings
- Yard Structures

These structures are further described in Section 2.6.7 of this report.

The fourth step of the process involves the review electrical component groups against the criteria of §54.4, with one exception. This one exception is the insulated cable and connections electrical component group which contain a large number of insulated cables installed at Oconee. Scoping of cables to the criteria of §54.4 at this stage of the integrated plant assessment is inefficient. At this stage of the assessment all insulated cables and connections are considered to be within the scope of license renewal for evaluation purposes. The lists of electrical components within the scope of license renewal and subject to aging management review are described in the following sections of this report.

Electrical components interface with other types of components at Oconee and the integrated plant assessments of these interfacing components are provided in other sections of this report. For example, the integrated plant assessment of the essentially leaktight barrier of the electrical penetrations is provided in Sections 2.3 and 3.3 and for cable trays, conduits and their supports, the integrated plant assessment is provided in Sections 2.7 and 3.7.

2.6.1 Insulated Cables and Connections

Electrical components that are required to perform their intended functions under a harsh environment are considered as TLAA and are addressed in Section 3.6.9 of this report. Table 2.6-2 Types of Insulated Cable

2.6.2 Uninsulated Cables and Connections

Table 2.6-3 Uninsulated Cables

2.6.3 Electrical Penetrations

Electrical components that are required to perform their intended functions under a harsh environment are considered as TLAA and are addressed in Section 3.6.9 of this report. The list of electrical penetrations is contained in the documentation maintained as required by 10 CFR Part 50, §50.49(d).

2.6.4 Insulators

Insulators are electrical components designed to support a conductor physically and separate the conductor electrically from another conductor or object. The insulators at Oconee that are within the scope of license renewal and subject to aging management review are the 230 kV insulators used to support the emergency power path from Keowee to the Oconee 4160 Volt power system. Two basic types of insulators used in this application at Oconee are:

- station post,
- strain/suspension.

Station post insulators are large and rigid and are used to support stationary electrical equipment such as bussing and disconnect switches. Strain/suspension insulators are constructed of several individual but connected insulators which can move individually. Strain insulators are used on transmission lines and the catch-off point for line support from a building or structure. These types of insulators are used where high voltage power conductors and busses can be exposed to the environment.

Both types of insulators are constructed of porcelain, steel or iron, and cement. Oconee insulators were constructed and tested in accordance with ANSI C29.9-1983 and ANSI C29.1-1988 [References 3 & 4]. ANSI C29.9-1983 covers outdoor high-voltage post-type insulators of porcelain used in transmission and distribution systems. ANSI C29.1 provides test methods to be followed in order to determine the characteristics of electrical insulators. The list of insulators determined to be subject to aging management review is provided in Table 2.6-4.

2.6.5 PHASE BUSSING

Table 2.6-5 Phase Bussing

2.6.6 SURGE SUPPRESSORS

Table 2.6-6 Surge Suppressors

2.6.7 PHYSICAL BOUNDARIES FOR THE AGING MANAGEMENT REVIEW

2.6.7.1 AUXILIARY BUILDINGS

2.6.7.2 INTAKE STRUCTURE

2.6.7.3 KEOWEE STRUCTURES

(includes Breaker Vault, Intake Structure, Penstock , Power House, Service Bay Structure, and Spillway)

2.6.7.4 REACTOR BUILDINGS

2.6.7.5 STANDBY SHUTDOWN FACILITY

2.6.7.6 TURBINE BUILDINGS

(includes Switchgear Blockhouses)

2.6.7.7 YARD STRUCTURES

(includes all areas and components outside the other structures: e.g., 230 kV Switchyard Structures and Relay House, overhead transmission lines, Keowee transformer yard, Oconee transformer yard, cable trenches, and direct buried components.)

2.6.8 REFERENCES

1. Requirements for Renewal of Operating Licenses for Nuclear Power Plants, 10 CFR Part 54.

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

3. ANSI C29.9-1983, *American National Standard for Wet-Process Porcelain Insulators - Apparatus, Post-Type,*

4. ANSI C29.1-1988, *American National Standard for Electrical Power Insulators - Test Methods,*

Table 2.6-1 Electrical Components and Their Intended Functions

Electrical Components	Component Intended Functions
Insulated Cables & Connections	Transport electrical energy between the end terminations of the cable.
Uninsulated Cables & Connections	Transport electrical energy between end terminations of the cable.
Electrical Penetrations	Transport electrical energy through electrical conductors between the outer and inner containment wall while maintaining containment integrity.
Insulators	Provide physical support of an electrical conductor and to maintain adequate electrical separation between the conductor and other conductors or electrical ground sources.
Phase Bussing • Isolated Phase Bus • Non-Segregated Phase Bus • Switchyard Phase Bus	
Surge Suppressors	

Table 2.6-2 Types of Insulated Cable

The types of insulated cable at Oconee are listed in this table. The key to each cable type designated is listed below. The actual cable types at Oconee are listed on the following page.

Key:
Example: 100PS24G.3

1st number	1st letter combination	2nd number	2nd letter combination	3rd number
Number of conductors or conductor pairs	**Construction:** X - Interlocked Armor XJ - Interlocked Armor with overall jacket A - Served or braided armor AA - Aluminum Armor BA - Bronze Armor CA - Copper Armor Z - Plain P - Pair(s) S - Shielded SP - Shielded Pairs SPA - Shielded Pair with overall served or braided armor IC - Iron-Constantan thermocouple wire CHA - Chromel-Alumel thermocouple wire RHH - NEC Type RHH-RHW wire ALS - Aluminum Sheath cable	**Conductor Size:** 24 - #24 AWG 22 - #22 AWG 20 - #20 AWG 18 - #18 AWG 16 - #16 AWG 14 - #14 AWG 12 - #12 AWG 10 - #10 AWG 9 - #9 AWG 8 - #8 AWG 6 - #6 AWG 4 - #4 AWG 2 - #2 AWG 1 - #1 AWG 1/0 - #1/0 AWG 2/0 - #2/0 AWG 3/0 - #3/0 AWG 4/0 - #4/0 AWG 250 - #250 AWG 350 - #350 AWG 500 - #500 AWG 600 - #600 AWG	**Application:** DB - Direct Burial F - Fire Retardant G - General H - High Radiation HT - High Temperature U - Universal	**Insulation Voltage Level:** .1 - 100V .2 - 200V .3 - 300V .6 - 600V 1 - 1000V 2 - 2000V 5 - 5000V 15 - 15000V

Table 2.6-2 Types of Insulated Cable (Continued)

Cable Type	Cable Type	Cable Type
100PS24G.3	1Z2G5	3XJ350G2
10SPA20G.3	1Z350G1	3XJ4/0G1
12A16G.6	1Z4/0G5	3XJ4G2
12BA12U.6	1Z500G1	3XJ500G2
12SPXJ20G.3	1Z6G1	3XJ500G5
12XJ12G1	20SPA20G.3	3XJ600G5
14SXJ18G.6	25PAA22G.3	3XJ6G2
15P22G.2	25PCA22DB.3	4A16G.6
19BA12U.6	25PX22G.3	4ALS10G.6
19BA12U.6	2A16G.6	4ALS12G.6
19XJ12G1	2ALS10G.6	4BA12U.6
1BA250DB5	2ALS12G.6	4BA9U.6
1BA500DB15	2PAA16G.3	4PSX16H.3
1P22G.2	2PSA16H.3	4SA14H.3
1PAA16G.3	2PSX16H.3	4SPA16G.3
1PSA16H.3	2SPA16G.3	4SPICA16G.3
1PSX16H.3	2SPICA16H.3	4SPX16G.3
1RHH10G.6	30SX16H.6	4SPXJ16G.3
1RHH12.6	3ALS12G.6	4SPXJ20G.3
1RHH2/0G.6	3BA12U.6	4SX14G.6
1RHH250G.6	3BA9U.6	4SX14H.3
1RHH2G.6	3SA16G.3	4SX16G.6
1RHH6G.6	3X10G1	4X2/0G.6
1SP16G.3	3X2/0G1	4X2G.6
1SPA16G.3	3X250G1	4X500G.6
1SPCHAA20H.3	3X2G1	4XJ12G1
1SPICA16G.3	3X500G1	4XJ1G1
1SPICA16H.3	3X600U15	7A16G.6
1SPICA16H.3	3X6G1	80S20F.1
1SPICX16G.3	3X8HT.6	8BA12U.6
1SPX16G.3	3XJ10G2	8BA9U.6
1Z10G1	3XJ12G1	8BA9U.6
1Z10G2	3XJ2/0G2	8SPA16G.3
1Z12G.6	3XJ250G2	8SPICA16G.3
1Z12G1	3XJ250G5	8SPXJ16G.3
1Z14G.6	3XJ2G2	8SX16H.3
1Z2/0G1	3XJ2G5	8XJ12G1
1Z2G1	3XJ3/0G5	

Table 2.6-3 Uninsulated Cables

1. Transmission Line Conductors:
   - 230 kV Keowee transmission conductor, connecting the 230 kV Keowee Main Step-up Transformer to the 230 kV switchyard bussing.

   - Bus line conductors from the 230 kV Switchyard to each of the Oconee Start-up Transformers CT1, CT2 and CT3.

2. Grounding system conductors (working list):
   - Ground Mat O-1, Discharge Channel
   - Grounding connection - GM-O-1 connection to 230kV Switchyard Ground Mat
   - 230kV Switchyard Ground Mat
   - Grounding connection - 230kV Switchyard to 525kV Switchyard
   - 525kV Switchyard Ground Mat
   - Grounding connection - 230kV Switchyard & 525kV Switchyard to plant grounding system (Plant Grounding system includes step-up/start-up transformer yard, switchgear structures, Turbine Buildings, Auxiliary Buildings, Reactor Buildings, misc. buildings)
   - Grounding connection - Plant Grounding system to Keowee ground
   - Keowee Ground Mat
   - Grounding connection - Plant Grounding system to Radwaste Facility
   - Grounding connection - Plant Grounding system to Standby Shutdown Facility
   - Grounding connection - Plant Grounding system to Microwave Tower, Meteorological Tower, and Raw Water Storage tank
   - Grounding connection - Plant Grounding system & Raw Water Storage Tank ground to 115kV Switching Station
   - 115kV Switching Station Ground Mat
   - Grounding connection - Plant & Radwaste Facility ground to Intake Structure ground
   - Grounding connection - Intake Structure ground to Ground Mat O-2, Intake Canal
   - Ground Mat O-2, Intake Canal

Table 2.6-4 Insulators

1. Insulators supporting the bus lines from Start-up Transformers CT1, CT2 and CT3 to the 230kV Switchyard.
2. Insulators supporting the 230 kV Switchyard disconnect switches on the buslines to Start-up Transformers CT1, CT2 and CT3.
3. Insulators supporting the 230 kV Switchyard disconnect switches on the Yellow Bus side of PCB's 8, 12, 15, 17, 24, 26, 28 and 33.
4. Insulators supporting the 230 kV Switchyard disconnect switches on both sides of PCB's 9, 18, 27, 29, and 30.
5. Insulators supporting the 230 kV Switchyard Yellow Bus.
6. Insulators supporting the Keowee Line in the 230 kV Switchyard and from the switchyard to the Keowee Main Step-up Transformer.
7. Insulators supporting the Keowee Line disconnect switches at the Keowee Main Step-up Transformer.

Table 2.6-5 Phase Bussing

Description	Structure
15 KV Bus from Generator 1 to ACB1 and ACB3	Keowee
15 KV Bus from Generator 2 to ACB2 and ACB4	Keowee
15KV Bus from ACB1 to Main Transformer	Keowee
15KV Bus from ACB2 to Main Transformer	Keowee
0TS1 4KV Potential Standby Transfer Bus	Standby Shutdown Facility
Unit 1 Bus 6900 Volt #TA	Turbine Building
Unit 2 Bus 6900 Volt #TA	Turbine Building
Unit 3 Bus 6900 Volt #TA	Turbine Building
Unit 1 Bus 6900 Volt #TB	Turbine Building
Unit 2 Bus 6900 Volt #TB	Turbine Building
Unit 3 Bus 6900 Volt #TB	Turbine Building
Unit 1 Bus 4160 Volt #TC	Turbine Building
Unit 2 Bus 4160 Volt #TC	Turbine Building
Unit 3 Bus 4160 Volt #TC	Turbine Building
Unit 1 Bus 4160 Volt #TD	Turbine Building
Unit 2 Bus 4160 Volt #TD	Turbine Building
Unit 3 Bus 4160 Volt #TD	Turbine Building
Unit 1 Bus 4160 Volt #TE	Turbine Building
Unit 2 Bus 4160 Volt #TE	Turbine Building
Unit 3 Bus 4160 Volt #TE	Turbine Building
Standby Bus 1 to Unit 1 (Part of MFB1)	Turbine Building
Standby Bus 1 to Unit 2 (Part of MFB1)	Turbine Building
Standby Bus 1 to Unit 3 (Part of MFB1)	Turbine Building
Standby Bus 2 to Unit 1 (Part of MFB2)	Turbine Building
Standby Bus 2 to Unit 2 (Part of MFB2)	Turbine Building
Standby Bus 2 to Unit 3 (Part of MFB2)	Turbine Building
4160 Volt Bus #1 Unit #3	Turbine Building
4160 Volt Startup Bus Unit#3	Turbine Building
CT1 4160 Volt Startup Bus	Turbine Building
CT2 4160 Volt Startup Bus	Turbine Building
CT3 4160 Volt Startup Bus	Turbine Building
CT4 4160 Volt Startup Bus	Turbine Building
Unit 1 to Unit 2 4160 Volt Emergency Tie Bus	Turbine Building
Unit 2 to Unit 3 4160 Volt Emergency Tie Bus	Turbine Building
4160 Volt Standby Bus 1	Turbine Building
4160 Volt Standby Bus 2	Turbine Building
1T 4160 Volt Normal Bus	Turbine Building
2T 4160 Volt Normal Bus	Turbine Building
3T 4160 Volt Normal Bus	Turbine Building
CT1 6900 Volt Startup Bus	Turbine Building
CT2 6900 Volt Startup Bus	Turbine Building
CT3 6900 Volt Startup Bus	Turbine Building
Unit 1 to Unit 2 6900 Volt Emergency Tie Bus	Turbine Building
Unit 2 to Unit 3 6900 Volt Emergency Tie Bus	Turbine Building
1T 6900 Volt Normal Bus	Turbine Building
2T 6900 Volt Normal Bus	Turbine Building
3T 6900 Volt Normal Bus	Turbine Building
4160 Volt Main Feeder Bus 1	Turbine Building
4160 Volt Main Feeder Bus 2	Turbine Building
230 kV Yellow Bus	230 kV Switchyard

Table 2.6-6 Surge Suppressors

3.6 ELECTRICAL COMPONENTS

Electrical component groups that are within the scope of license renewal that require aging management reviews and their intended functions were identified and listed in Section 2.6. The approach used to perform the aging management review of these components is consistent with that provided in NEI 95-10, Section 4.2 [Reference 1]. The aging management review consists of identifying the applicable aging effects for each of the identified electrical component groups and then demonstrating the ability of programs and activities to manage those effects. The aging management review is presented for each electrical component group within each structure.

The applicable aging effects that can challenge the intended functions have been identified for each of the electrical component groups by reviewing the materials of construction and the service environment for each component group. In order to validate the identified aging effects, a review of industry experience and NRC generic communications relative to electrical components was performed. In addition, a review of relevant Oconee experience was performed.

The aging management review is performed on an entire electrical component group using data that conservatively bounds all individual components within the group. Then, if necessary, a second more detailed aging management review is performed on individual components which are found not to be acceptable for the period of extended operation using the bounding analysis. In this latter instance, data applicable to the individual components will be used and an aging management determination made. This process is primarily used for insulated cables and connections, but may be used for any electrical component that is subject to aging management review.

The programs that are credited for managing the effects of aging are described in Section 3.6.8. The demonstration process consists of evaluating these programs by using the guidance of NEI 95-10, Section 4.2 [Reference 1].

The aging management review is considered complete when the credited programs provide reasonable assurance that the applicable aging effects are managed so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) for the renewal license period of extended operation. The process described in this section is intended to meet the requirements of §54.21(a)(3) and to permit the staff to make the finding identified in §54.29(a).

In addition to the above aging management reviews, the time limited aging analyses associated with structural components that were identified in Table 1.4-1 of this report have been evaluated and the results are presented in Section 3.6.9.

3.6.1 AUXILIARY BUILDINGS

3.6.1.1 Aging Management Review of Insulated Cables and Connections

3.6.1.1.1 APPLICABLE AGING EFFECTS

3.6.1.1.2 AGING MANAGEMENT PROGRAMS

3.6.1.2 Aging Management Review of Electrical Penetrations

3.6.1.2.1 APPLICABLE AGING EFFECTS

3.6.1.2.2 AGING MANAGEMENT PROGRAMS

3.6.2 INTAKE STRUCTURE

3.6.2.1 Aging Management Review of Insulated Cables and Connections

3.6.2.1.1 APPLICABLE AGING EFFECTS

3.6.2.1.2 AGING MANAGEMENT PROGRAMS

3.6.3 KEOWEE STRUCTURES

3.6.3.1 Aging Management Review Insulated Cables and Connections

3.6.3.1.1 APPLICABLE AGING EFFECTS

3.6.3.1.2 AGING MANAGEMENT PROGRAMS

3.6.3.2 Aging Management Review of Phase Bussing

3.6.3.2.1 APPLICABLE AGING EFFECTS

3.6.3.2.2 AGING MANAGEMENT PROGRAMS

3.6.4 REACTOR BUILDINGS

3.6.4.1 Aging Management Review of Insulated Cables and Connections

3.6.4.1.1 APPLICABLE AGING EFFECTS

3.6.4.1.2 AGING MANAGEMENT PROGRAMS

3.6.4.2 Aging Management Review of Electrical Penetrations

3.6.4.2.1 APPLICABLE AGING EFFECTS

3.6.4.2.2 AGING MANAGEMENT PROGRAMS

3.6.5 STANDBY SHUTDOWN FACILITY

3.6.5.1 Aging Management Review of Insulated Cables and Connections

3.6.5.1.1 APPLICABLE AGING EFFECTS

3.6.5.1.2 AGING MANAGEMENT PROGRAMS

3.6.6 TURBINE BUILDINGS

3.6.6.1 Aging Management Review of Insulated Cables and Connections

3.6.6.1.1 APPLICABLE AGING EFFECTS

3.6.6.1.2 AGING MANAGEMENT PROGRAMS

3.6.6.2 Aging Management Review of Phase Bussing

3.6.6.2.1 APPLICABLE AGING EFFECTS

3.6.6.2.2 AGING MANAGEMENT PROGRAMS

3.6.7 YARD STRUCTURES

3.6.7.1 Aging Management Review of Bare Cables and Connections

3.6.7.1.1 APPLICABLE AGING EFFECTS

3.6.7.1.2 AGING MANAGEMENT PROGRAMS

3.6.7.2 Aging Management Review of Phase Bussing

3.6.7.2.1 APPLICABLE AGING EFFECTS

3.6.7.2.2 AGING MANAGEMENT PROGRAMS

3.6.7.3 Aging Management Review of Insulators

3.6.7.3.1 APPLICABLE AGING EFFECTS

There is no industry wide or Duke database maintained on insulator failures or aging effects. Information obtained on aging effects was provided by experts in this field at Duke and by insulator manufacturers. Cracking of the porcelain is the only identified aging effect for porcelain insulators. Porcelain cracking has been known to have two causes: cement growth of the cement used to bind the metal parts to the porcelain and physical contact. These both are discussed below.

3.6.7.3.1.1 CEMENT GROWTH

Cement is used to hold the metal and porcelain parts of an insulator together. This cement is prepared using standards which provide a good quality, dense, low permeability cement. Cement growth is caused by moisture intrusion into the cement resulting in excessive pressure being applied to the porcelain. This excessive pressure can cause the porcelain to crack. For the types of insulators installed in the 230kV system at Oconee, this aging effect has occurred in only one instance. This instance involved strain/suspension insulators of a specific manufacturer constructed during a specific and limited time period. An inspection of the insulators installed at Oconee confirmed that none of the suspect insulators were installed on site. Cracking of the porcelain due to cement growth is not an applicable aging effect for the 230kV insulators at Oconee.

3.6.7.3.1.2 PHYSICAL CONTACT

Porcelain is used as the insulating material in the station post and strain/suspension insulators at Oconee. Cracks in the porcelain of these types of insulators normally only occurs due to physical damage; the most common cause is damage during a storm. When a hard object with enough velocity hits the porcelain it will crack or break. Damage of this nature is not considered an aging effect.

3.6.7.3.1.3 DUKE AND INDUSTRY EXPERIENCE

Duke Power has had thousands of 230kV insulators of the type at Oconee installed throughout the Duke Power service area for more than 20 years. Prior to Duke replacing all the strain/suspension insulators suspected of being susceptible to cement growth problems, only one of these strain/suspension insulators was found to have a crack caused by cement growth. The insulators at Oconee were checked for suspect insulators and although they did not need to be, some insulators close in description to the suspect ones were replaced. Although Duke has had to replace numerous insulators system wide due to storm and other physical damage, none of the insulators in scope have ever been physically damaged. No industry wide or Duke database is maintained on insulator failures. Experts in this field at Duke know of no other generic problems due to aging effects with insulators on the Duke system or elsewhere in the United States.

3.6.7.3.2 AGING MANAGEMENT PROGRAMS

After review of the information obtained from experts in the industry coupled with Duke Power and Oconee experience, no applicable aging effects were identified for the Oconee 230kV station post or strain/suspension insulators. Therefore no aging management program is necessary to manage the 230kV insulators for the period of extended operation.

3.6.8 AGING MANAGEMENT PROGRAM DEMONSTRATIONS

3.6.8.1 Program 1

3.6.8.2 Program 2

3.6.8.3 Program 3

3.6.9 TIME-LIMITED AGING ANALYSES

The environmental qualification of electrical components has been identified as a time-limited aging analysis for Oconee by reviewing correspondence on the Oconee dockets, the Oconee UFSAR [Reference , Section 3.11], and Oconee engineering documents. In 1979, the NRC issued IE Bulletin 79-01B [Reference]. Subsequently, NRC incorporated the requirements to environmentally qualify safety-related electrical components into 10 CFR Part 50, §50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants". The Duke environmental qualification program includes the identification of all electric components that are included within the program as well as the qualification records. Based on a review of the documentation, Duke identified several electrical components which have a qualified life of at least 40 years. The qualified life establishes the time period that assurance is provided that the electrical component can perform its function under postulated harsh environmental conditions resulting from a loss of coolant accident or a high energy line break inside the Reactor Building and a high energy line break outside the Reactor Building [Reference UFSAR, Section 3.11]. The topic of environmental qualification of electrical components is considered to be a time-limited aging analysis for Oconee because all of the criteria contained in 10 CFR Part 54, §54.3 are met; that is the topic:

(1) Involves a component that is within the scope of license renewal - safety-related electrical components;
(2) considers the effects of aging - degradation of non-metallic portions due to service environment;

(3) involves a time-limited assumption - qualification life of 40 years;
(4) is determined to relevant by Duke in making a safety determination;
(5) involves a conclusion related to the capability of the component to perform its intended function; and
(6) is contained in the current licensing basis.

The Oconee environmental qualification records have been evaluated for operation of Oconee during the period of extended operation. The evaluation consists of determining whether:

(1) the analyses remain valid as is for the period of extended operation, or
(2) the analyses must be revised to include the period of extended operation.

The results of these evaluations are presented in the following sections. Information supporting these results is maintained in a retrievable form onsite as required by 10 CFR Part 50, §50.49(d) and 10 CFR Part 54, §54.37(a).

3.6.9.1 Accelerometers, TEC Monitor

3.6.9.2 Actuators, Limitorque

3.6.9.3 Actuators, Rotork

3.6.9.4 Cables, Okonite EPR / Neoprene

Okonite cables with EPR insulation and a Neoprene jacket are used throughout Oconee. The existing Okonite thermal testing that supports the current qualified life tested the cable for 40 years at 90 °C. The original Okonite report contained charts that plotted the Arrhenius curve for several insulation materials and predicts the time to 40% of retention of elongation. The 90 °C temperature rating is a combination of the heat rise in the conductors and the ambient temperature. Heat rise in the conductor (ohmic heating) can be calculated as a function of the actual current flowing in the conductor and the rated current of the conductor. Based on a conductor heat rise of 25.8 °C, the resulting conductor temperature is 75.8°C. Plotting these results on the Arrhenius chart predicts that the cable has a projected qualified life in excess of 60 years.

The cables were also tested and qualified to 2.0E8 rads. The bounding case inside containment 40 year radiation dose is 3.0E7 rads. Extrapolating this value for 60 years yields 4.5E7 rads. The worst case LOCA dose is 6.1E7 rads. Combining these results yields the total integrated dose for 60 years as 1.06E8 rads. Comparing the total integrated dose for 60 years to the original qualified dose shows that it is well within the original cable radiation qualification.

The original qualification thermal and radiation tests for Okonite EPR / Neoprene cables at Oconee remain valid. Therefore, these cables are qualified through the period of extended operation.

3.6.9.5 Heat Shrink Tubing, Raychem

3.6.9.6 Incore Thermocouples

3.6.9.7 Motors, Joy/Reliance

3.6.9.8 Motors, Louis-Allis

3.6.9.9 Motors, Reliance

3.6.9.10 Motors, Westinghouse

3.6.9.11 Penetration Assemblies, Conax

3.6.9.12 Penetration Assemblies, D.G. O'Brien

3.6.9.13 Penetration Assemblies, Viking Electrical

The organic materials used in the Viking penetration assemblies are in the slide-lock subassemblies. During the original qualification, the slide-lock assemblies were heat aged at 300 °F for 350 hours. Using the most conservative activation energy of the organic materials of the subassembly with the heat aging parameters and a service temperature of 120 °F (ambient), the original analysis estbalished a qualified life of greater than 60 years for the Viking penetration assemblies.

In addition, the Viking penetration assemblies were originally tested and qualified to 1.0E8 rads. The 40-year radiation dose where the Viking penetration assemblies are located is 3.0E4 rads. Extrapolating to 60 years, the cumulative dose equals 4.5E4 rads. The worst case LOCA dose is 6.1E7 rads. Combining these, the total integrated dose for 60 years, including the postulated accident dose, is 6.1E7 rads. The total integrated dose for 60 years is well within the original qualified dose value of 1.0E8 rads. Therefore, the original radiation qualification remains valid for the period of extended operation.

In conclusion, the existing thermal and radiation qualification analyses for the Viking electrical penetration assemblies remain valid for the period of extended operation.

3.6.9.14 RTD, Rosemount

3.6.9.15 RTD, Weed Instrument

3.6.9.16 Scotch Cast 9

3.6.9.17 Solenoid Valves, Valcor

3.6.9.18 Terminal Blocks, States

3.6.9.19 Transmitters, Barton/Westinghouse

3.6.9.20 Transmitters, Delaval, Gems

3.6.9.21 Transmitters, ITT Barton

3.6.10 References

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

Table 3.6-1 Aging Management Review Results for Electrical Components Located in the Auxiliary Buildings

Electrical Components	Applicable Aging Effects	Aging Management Program
Insulated Cables and Connections	later	later
Electrical Penetrations	later	EQ covers all

Table 3.6-2 Aging Management Review Results for Electrical Components Located in the Intake Structure

Electrical Components	Applicable Aging Effects	Aging Management Program
Insulated Cables and Connections	later	later

Table 3.6-3 Aging Management Review Results for Electrical Components Located in Keowee Structures

Electrical Components	Applicable Aging Effects	Aging Management Program
Insulated Cables and Connections	later	later
Phase Bussing	later	later

Table 3.6-4 Aging Management Review Results for Electrical Components Located in the Reactor Buildings

Electrical Components	Applicable Aging Effects	Aging Management Program
Insulated Cables and Connections	later	later
Electrical Penetrations	later	EQ covers all
Surge Suppressors	later	later

Table 3.6-5 Aging Management Review Results for Electrical Components Located in the Standby Shutdown Facility

Electrical Components	Applicable Aging Effects	Aging Management Program
Insulated Cables and Connections	later	later

Table 3.6-6 Aging Management Review Results for Electrical Components Located in the Turbine Buildings

Electrical Components	Applicable Aging Effects	Aging Management Program
Insulated Cables and Connections	later	later
Phase Bussing	later	later
Surge Suppressors	later	later

Table 3.6-7 Aging Management Review Results for Electrical Components Located in Yard Structures

Electrical Components	Applicable Aging Effects	Aging Management Program
Bare Cables and Connections	later	later
Phase Bussing	later	later
Insulators	None	None Required

Formation of Oconee Electrical Component Groups

PURPOSE

The purpose of this process was to have a complete list of electrical component groups that includes all electrical component types found at Oconee and to determine, based on function and the criteria of §54.21(a)(1)(i), which groups are subject to an aging management review.

PROCESS

The process followed is described below:

(a) Started with components listed in §54.21(a)(1)(i).

(b) Added component groups from NEI 95-10 Rev. 0 Appendix B.

(c) Reviewed Oconee electrical drawings and documents including the *Quality Standards Manual*, NSD 207, for additional components.

(d) The combined list was reviewed and expanded by Oconee and electrical supports experts in the Duke Power general office.

(e) The resulting list was then reviewed and restructured by a multi-utility electrical peer group.

RESULTS

The results of this process are detailed on the attached tables that are described below.

Table 1 - Comparison of Oconee Electrical Component Groups
This table compares the components listed in §54.21(a)(1)(i), NEI 95-10 Rev. 0 Appendix B, and the Oconee Electrical Component Groups.

Table 2 - Oconee Electrical Component Group §54.21(a)(1)(i) Screening Designations
This table lists the component groups along with example components within some of the groups. All components listed in either §54.21(a)(1)(i) and NEI 95-10 Rev. 0 Appendix B can be found in this table, either as the group name or as an example within a group. This table also shows the determination as to whether components within the group are subject to aging management review.

Comparison of Oconee Electrical Component Groups
Table 1

(A)	(B)	OCONEE ELECTRICAL COMPONENT GROUPS
	■	Alarm Units
	■	Analyzers
	■	Annunciators
■	■	Batteries
■	■	Battery Chargers
■	■	Breakers
■	■	Cables & Connections
		Installed Communication Equipment
	■	Controllers
	■	Converters
■	■	Electronic Devices
		Fuses
■	■	Generators
	■	Heaters
	■	Heat Tracing
■	■	Indicators
		Insulators
	■	Isolators
	■	Light Bulbs
		Line Traps
■	■	Motors
	■	Motor-Generator Sets
		Phase Bussing
■	■	Power Inverters
■	■	Power Supplies
	■	Area Radiation Monitors
	■	Process Radiation Monitors
	■	Nuclear Radiation Detectors
	■	Recorders
		Regulators
■	■	Relays
	■	Sensors
	■	Signal Conditioners
	■	Solenoid Operator
		Surge Suppressers
■	■	Switches
■	■	Switchgear, Load Centers, Motor Control Centers
	■	Power Distribution Panel Component Assemblies
	■	Electrical Control Panel Component Assemblies
	■	Transformers
■	■	Transmitters

(A) Shaded block indicates a group that includes component types listed in 10 CFR 54.21(a)(1)(i)
(B) Shaded block indicates a group that includes component types listed in NEI 95-10 Rev. 0, App. B

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Oconee Electrical Component Group
§54.21(a)(1)(i) Screening Designations
Table 2

ELECTRICAL COMPONENT GROUPS	SUBJECT TO AN AMR *
Alarm Units (e.g., Bistable)	No
Analyzers (e.g., Gas Analyzer, Conductivity Analyzer)	No
Annunciators (e.g., Lights, Audible Sound Equipment)	No
Batteries	No
Battery Chargers	No
Breakers (e.g., Air Circuit Breaker, Molded Case Circuit Breaker, Oil-Filled Circuit Breaker)	No
Cables & Connections (e.g., Power Cable, Instrument Cable, Control Cable, Communication Cable, Bare Cable, Connector, Splice, Terminal Block)	Yes
Installed Communication Equipment (e.g., Telephone, Video Equipment)	No
Controllers (e.g., Differential Pressure Indicating Controller, Flow Indicating Controller, Programmable Logic Controller, Single Loop Digital Controller, Speed Controller, Temperature Controller, Manual Loader, Valve Positioner)	No
Converters (e.g., Voltage/Current Converter, Voltage/Pneumatic Converter, Watt Transducer, Amp Transducer, Frequency Transducer, Power Factor Transducer, Speed Transducer, VAR Transducer, Vibration Transducer, Voltage Transducer)	No
Electronic Devices (e.g., circuit board, transistor, computer)	No
Fuses (e.g., large power, instrument)	No
Generators (e.g., Diesel Generator, Steam Turbine Generator, Combustion Turbine Generator)	No
Heaters	No (Yes for a pressure boundary function)
Heat Tracing	No
Indicators (e.g., Temperature Indicator, Flow Indicator, Differential Pressure Indicator, Pressure Indicator, Level Indicator, Ammeter, Speed Indicator, Conductivity Meter, Volt Meter, Frequency Meter, VAR Meter, Watt Meter, Power Factor Meter, Watthour Meter)	No
Insulators [separate, high voltage equipment] (e.g., Porcelain Insulator)	Yes
Isolators (e.g., Transformer Isolator, Optical Isolator, Isolation Relay, Isolating Transfer Diode)	No
Light Bulbs (e.g., Incandescent Light Bulb, Fluorescent Light Bulb)	No
Line Traps [separate, high voltage equipment] (e.g., Transmission Line Trap)	Yes
Motors (e.g., Fan Motor, Pump Motor, Valve Motor, Air Compressor Motor)	No
Motor-Generator Sets	No
Phase Bussing (e.g., Isolated Phase Bus, Non-segregated Phase Bus, Switchyard Phase Bus)	Yes
Power Inverters	No
Power Supplies	No
Area Radiation Monitors	No

* Assumes the component is within scope and is not a replacement item.

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Oconee Electrical Component Group
§54.21(a)(1)(i) Screening Designations
Table 2

ELECTRICAL COMPONENT GROUPS	SUBJECT TO AN AMR *
Process Radiation Monitors	No (Yes for a pressure boundary function)
Nuclear Radiation Detectors (e.g., Source Range Detector, Intermediate Range Detectors, Power Range Detector)	No
Recorders (e.g., Chart Recorder, Conductivity Recorder, Digital Recorder, Events Recorder, Fault Recorder)	No
Regulators (e.g., Voltage Regulator, Current Regulator, Frequency Regulator)	No
Relays (e.g., Protective Relay, Control/Logic Relay, Auxiliary Relay)	No
Sensors (e.g., Temperature Sensor, Conductivity Element, Flow Element, Radiation Sensor, Thermocouple, RTD, Vibration Probe)	No (Yes for a pressure boundary function)
Signal Conditioners	No
Solenoid Operator	No
Surge Suppressers [separate, high voltage equipment] (e.g., Surge Capacitor, Lightning Arrester)	Yes
Switches (e.g., Differential Pressure Indicating Switch, Differential Pressure Switch, Pressure Indicator Switch, Pressure Switch, Flow Switch, Conductivity Switch, Level Indicating Switch, Temperature Indicating Switch, Temperature Switch, Moisture Switch, Position Switch, Vibration Switch, Level Switch, Control Switch, Automatic Transfer Switch, Manual Transfer Switch, Manual Disconnect Switch, Current Switch, Limit Switch, Knife Switch)	No
Switchgear, Load Centers, Motor Control Centers (includes component assemblies such as, but not limited to, busses, breakers, indicating lights, transformers, relays, meters, switches, fuses, fuse blocks, terminal blocks, hook-up wire, insulators)	No
Power Distribution Panel Component Assemblies (includes devices such as, but not limited to, breakers, busses, fuses, fuse blocks, terminal blocks, hook-up wire, insulators)	No
Electrical Control Panel Component Assemblies (includes devices such as, but not limited to, switches, indicating lights, annunciators, recorders, indicators, meters, relays, fuses, fuse blocks, terminal blocks, hook-up wire, insulators)	No
Transformers (e.g., Large Power Transformer, Small Distribution Transformer, Instrument Transformer)	No
Transmitters (e.g., Flow Transmitter, Radiation Transmitter, Level Transmitter, Differential Pressure Transmitter, Pressure Transmitter, Conductivity Transmitter, Temperature Transmitter, Valve Position Transmitter)	No

* Assumes the component is within scope and is not a replacement item.

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OCONEE ELECTRICAL COMPONENT IPA PROCESS

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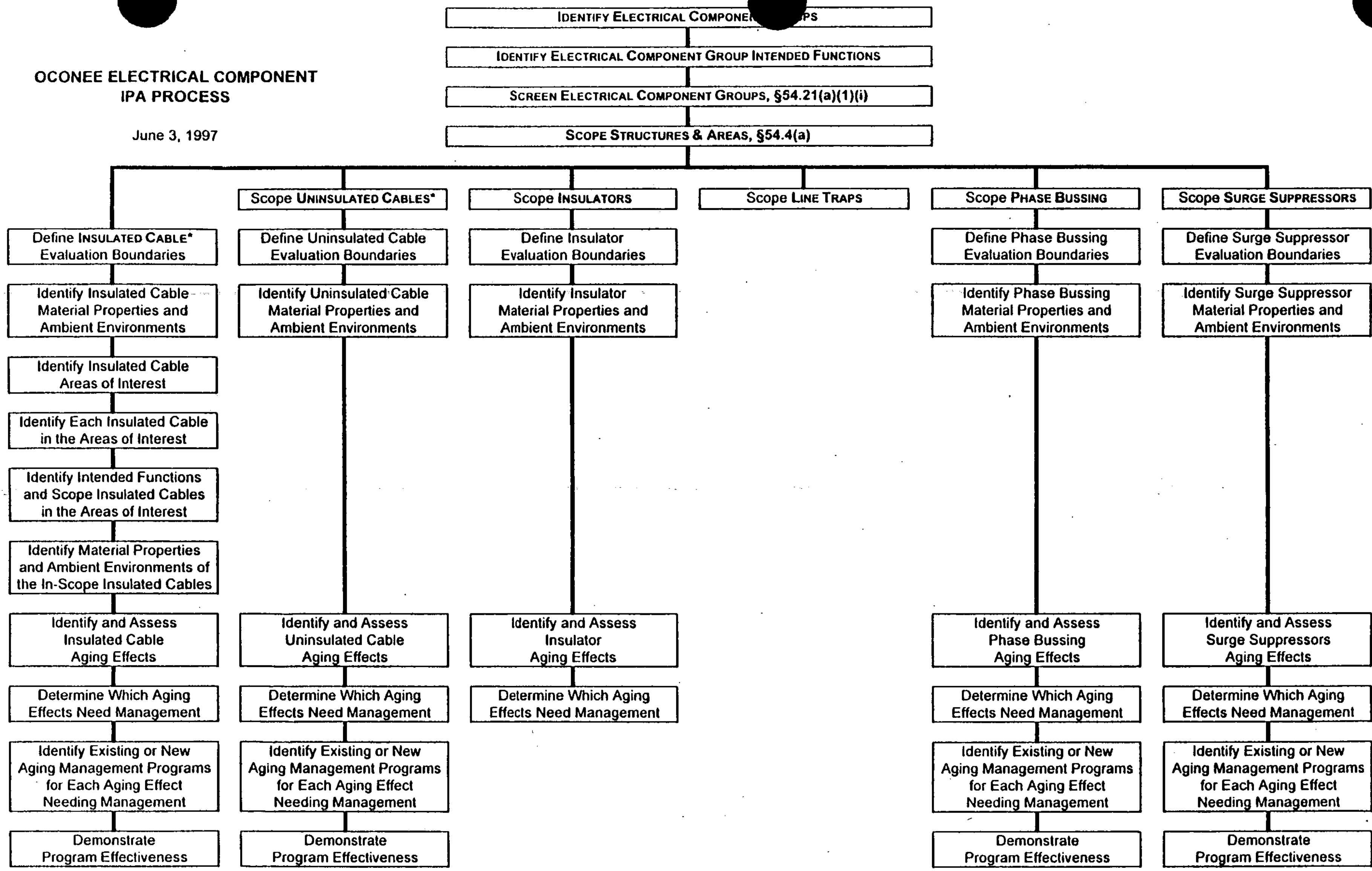
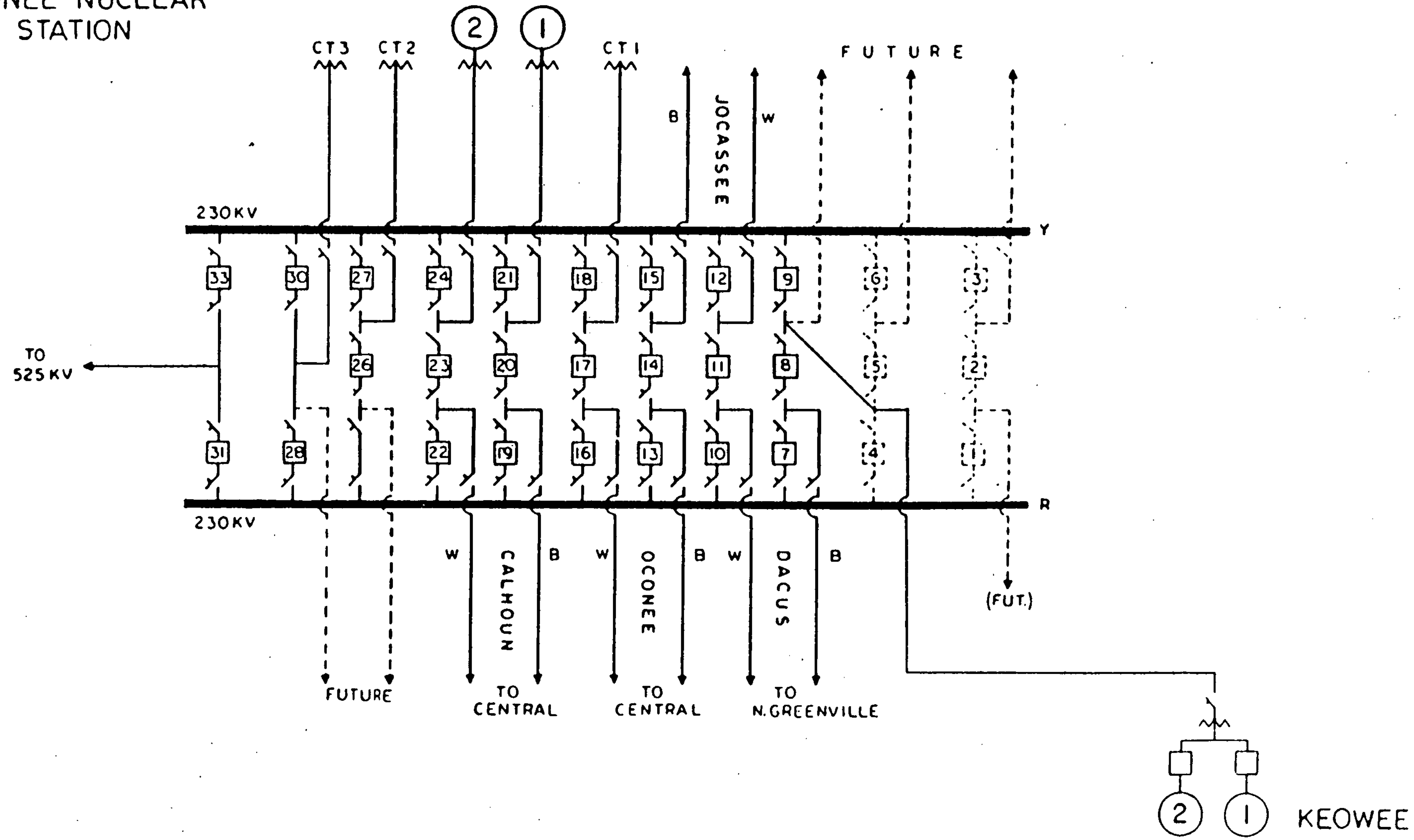


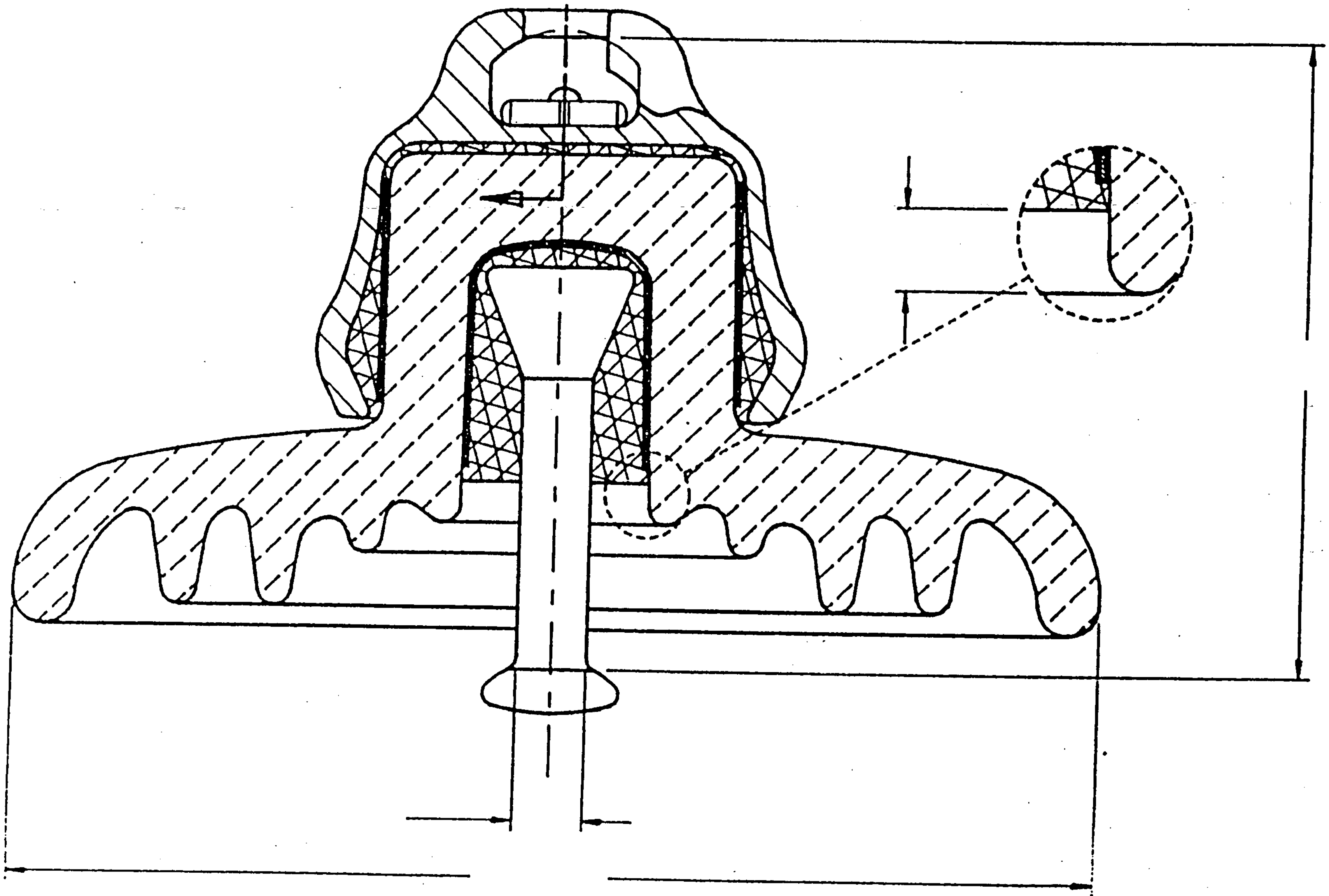
* Cable include the cable and cable connections.

Attachment 9

OCONEE NUCLEAR STATION



Attachment 10



Attachment 11