T. PRESTON GILLESPIE, JR.
Vice President
Oconee Nuclear Station

Duke Energy
ON01VP / 7800 Rochester Hwy.
Seneca, SC 29672

864-873-4478
864-873-4208 fax
T.Gillespie@duke-energy.com

April 29, 2011

Mr. Victor McCree, Regional Administrator
U.S. Nuclear Regulatory Commission – Region II
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, Georgia 30303-1257

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Site, Units 1, 2, and 3
Renewed Facility Operating License, DPR-38, DPR-47, and DPR-55
Docket Numbers 50-269, 50-270, and 50-287
Oconee Response to Confirmatory Action Letter (CAL) 2-10-003

References:

1. Nuclear Regulatory Commission (NRC) letter from Luis A. Reyes to Dave Baxter (Duke Energy), "Confirmatory Action Letter – Oconee Nuclear Station, Units 1, 2, and 3 Commitments to Address External Flooding Concerns (TAC Nos. ME3065, ME3066, and ME3067)" dated June 22, 2010

2. Nuclear Regulatory Commission (NRC) letter from Eric Leeds to Preston Gillespie (Duke Energy), "Staff Assessment of Duke's Response to Confirmatory Action Letter Regarding Duke's Commitments to Address External Flooding Concerns at the Oconee Nuclear Station, Units 1, 2, and 3 (ONS) (TAC Nos. ME3065, ME3066, and ME3067)" dated January 28, 2011

3. Duke Energy letter from T. Preston Gillespie to Luis Reyes (Nuclear Regulatory Commission), "Oconee Response to Confirmatory Action Letter (CAL) 2-10-003" dated November 29, 2010

4. Duke Energy letter from Dave Baxter to U.S. Nuclear Regulatory Commission, "Oconee External Flood Interim Actions" dated January 15, 2010

The purpose of this letter is to respond to the NRC's request, as noted in the Confirmatory Action Letter dated June 22, 2010 (Reference 1), for a list of all modifications necessary to adequately protect the Oconee site from the impact of a postulated failure of the Jocassee Dam.

Duke Energy agreed to provide this list and the associated implementation dates by April 30, 2011 (Reference 3).

In Reference 2, the NRC found that the documentation previously supplied by Duke Energy provided sufficient justification that the parameters and analysis used to evaluate the inundation of the Oconee Nuclear Station (ONS) site, resulting from the postulated failure of the Jocassee Dam, were bounded. The information provided by Duke Energy was in response to one of the NRC's requests in Reference 1.

Attachment 1 is a proposed strategy for mitigating the external flood impacts from a postulated failure of the Jocassee Dam. Calculations supporting this strategy are in progress and have not been finalized. Attachment 2 is a description of proposed site modifications necessary to implement the mitigation strategy. During design and implementation of these modifications, the actions required by Reference 1 will remain in place. Also, periodic independent assessments and emergency response organization drills of the interim actions will be conducted to verify continued viability.

Design of the modifications is in progress and details may change as the process continues. The capability to provide adequate protection of the Oconee units and the spent fuel from a postulated failure of the Jocassee dam will be documented within the Updated Final Safety Analysis Report (UFSAR).

Duke Energy will submit the design of the Intake Dike Diversion Wall and the Intake Dike Tie Section modification (discussed in Attachment 2) to the Federal Energy Regulatory Commission (FERC). Duke Energy will also submit any License Amendment Requests (LARs) to the NRC that are necessitated by the power block flood wall modification. The modifications identified in Attachment 2 will be completed within a time frame of thirty (30) months plus FERC and NRC LAR review and approval time.

Duke Energy is committed to an orderly and thorough approach to resolution of the external flood mitigation issues at ONS so that the dates provided above and completion of the related modifications can be achieved. Duke Energy is proceeding, consistent with its corporate governance requirements, to obtain necessary internal approvals to fund the implementation of these commitments. Additionally, Duke Energy must undergo additional land acquisitions for relocation of the 100 kV (Fant) line towers.

Since this letter contains security sensitive information, Duke Energy hereby requests the NRC withhold the letter and its attachments from public disclosure pursuant to 10 CFR 2.390(d)(1), "Public inspections, exemptions, requests for withholding."

If you have questions concerning this matter, please contact Bob Meixell, Oconee Regulatory Compliance, at 864-873-3279.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 29, 2011.

Sincerely,

TPGillespie

T. Preston Gillespie, Jr.
Vice President
Oconee Nuclear Station

Attachments:

Attachment 1 – Jocassee Dam Failure Flood Mitigation Strategy
Attachment 2 – Description of Modifications

cc:

Mr. Joseph G. Giitter, Director
Division of Operating Reactor Licensing
U. S. Nuclear Regulatory Commission
Mail Stop O-8 E1A
Washington, D. C. 20555

Mr. John Stang, Project Manager
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O-8 G9A
Washington, D. C. 20555

Mr. Andy Sabisch
Senior Resident Inspector
Oconee Nuclear Site

Susan E. Jenkins, Manager
Radioactive & Infectious Waste Management
Division of Waste Management
SC Dept. of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

# ATTACHMENT 1

# JOCASSEE DAM FAILURE FLOOD MITIGATION STRATEGY

Jocassee Dam Failure Flood Mitigation Strategy

The strategy proposed within this attachment will continue to ensure adequate protection of the Oconee units and spent fuel in the unlikely occurrence of a Jocassee Dam failure. This strategy is provided based on the following initial Oconee site conditions:

- All three units are at power operation
- Unit 1&2 and Unit 3 Spent Fuel Pools (SFP) heat rates are consistent with that associated with all three units at power operation (no full core offload)
- Condenser Circulating Water (CCW) is not dewatered
- The Standby Shutdown Facility (SSF) is available
- The Lee Steam Station combustion turbine path through CT5 is available
- Credited Systems, Structures, and Components are in normal alignments

When the Oconee site is not within these initial conditions or associated mitigation systems are unavailable, appropriate compensatory measures will be taken based on the insight provided through the 10 CFR 50.65(a)(4) program, as applicable.

Furthermore, the mitigation strategy assumes the following:

- The Jocassee Dam failure does not occur concurrent with design basis accidents, design events, or transients.
- The Jocassee Dam failure does not occur concurrent with an earthquake.
- The occurrence of a single failure, as well as the failure of a control rod to fully insert, is not assumed.
- Systems, Structures, and Components (SSCs) to mitigate a Jocassee Dam failure are not required to be QA-1.

UFSAR Section 2.4.2.2 documents the Flood Design Considerations for both the Keowee and Jocassee Reservoirs. The dams and other hydraulic structures were designed with adequate freeboard and structural safety factors to safely accommodate the effects of Probable Maximum Precipitation (PMP). UFSAR Section 2.4.4 documents that Jocassee has been designed to the same seismic input conditions as Oconee Nuclear Station (ONS). Flooding due to the potential failure of the Jocassee Dam or Keowee Dam was not addressed and was considered to be beyond design basis. Thus, the current ONS licensing basis defines protection from external flooding caused by a Probable Maximum Flood (PMF) applicable to ONS which was analyzed based on the PMP. This basis satisfied General Design Criterion 2 of the UFSAR (Section 3.1.2).

Criterion 2 of the UFSAR imposes design criteria on select (designated as Essential) SSCs associated with the forces and conditions associated with natural phenomena. As such, natural phenomena events are not design basis events at Oconee, instead they impose design criteria on SSCs identified for mitigation of accidents. As was the original site design for flooding conditions, these design criteria are to remain within the constraints of the PMF applicable to ONS which was analyzed based on the PMP. Therefore, the original PMF analysis will remain as the flood design criteria for the Essential SSCs.

A Jocassee Dam failure can subject the Oconee Nuclear Site to adverse conditions beyond the plant design basis. Specifically, the postulated failure of the Jocassee Dam could result in a loss of off-site and emergency power, loss of external water sources and inundation of a majority of the station's SSCs. As described and accepted within Reference 1, compensatory measures are in place to mitigate these potential adverse consequences. Modifications are planned and discussed in Attachment 2 to improve the capability to maintain the three Oconee units as well as both SFPs in a condition that adequately protects the fuel. Upon completion of these modifications and implementation of the mitigation strategy within station procedures and processes, the compensatory measures described within Reference 1 will no longer be required.

Flood barriers will be designed to protect the credited SSCs including the Turbine Building, Auxiliary Building and the SSF, and the surrounding yard (including CT5) following the postulated Jocassee Dam failure. The 100kV (Fant) line towers will be relocated or protected to maintain the integrity of the dedicated power path. This ensures a dedicated flood protected power source for plant systems. The new flood protected power source would also allow the SSF to be powered without starting the SSF diesel generator, thus preserving CCW inventory. The CT5 substation and its associated electrical distribution system will be modified to provide additional power connections for operation of recovery equipment.

With the planned modifications to the site, the credited SSCs and dedicated flood protected power through CT5 would be available following a Jocassee Dam failure. Thus, mitigation of the Jocassee Dam failure would be limited by the loss of external water sources to ONS. The water inventory trapped in the CCW system piping system would be the credited source of water for core decay heat removal and SFP makeup.

The planned modifications have been assumed to be implemented in the mitigation strategy for establishing and maintaining the three Oconee units as well as both SFPs in a condition that adequately protects the fuel. The mitigation strategy for this scenario has been subdivided into the following phases:

- Phase 1: Reactor shutdown and establishment of Mode 3
- Phase 2: Initiation of Natural Circulation Cooldown of the Reactor Coolant System (RCS) to 250°F
- Phase 3: Maintain RCS at ≤250°F

Phase 1: Reactor shutdown and establishment of Mode 3

Notification of a Jocassee Dam failure (Condition A) alerts plant operators to begin preparing the units for a loss of offsite power and site flooding conditions. The operators notify Lee Steam Station to align emergency power to transformer CT5 from a Lee Steam Station combustion turbine using a dedicated line which is separated from the grid. In addition, actions are taken to ensure a timely electrical power system transfer to CT5. Actions are taken to establish the flood protective features, such as isolating Turbine Building and yard drain flowpaths and closing flood barrier access openings.

A loss of offsite power is not postulated to occur immediately following the initiation of the Jocassee Dam failure. Following notification, the ONS Switchyards are assumed to remain available to each unit's startup transformer which provides power to normal and emergency systems.

The operators will take actions to shutdown the reactor(s) and establish Mode 3 with $T_{ave}$ and RCS pressure at approximately 525°F and 2155 psig respectively, using normal plant systems. Operator actions will be undertaken to begin boration of the RCS for cold shutdown conditions. Normal secondary plant systems will remain in operation during this phase.

The operators will take actions to disable the Essential Siphon Vacuum System and vent it to prevent reverse siphon flow from the CCW inlet piping back to the Intake Canal when it is lost. The emergency CCW discharge flow path will be disabled by operators to prevent any loss of CCW. Actions will be taken to isolate the High Pressure Service Water (HPSW) outside of the flood protected area to ensure its capability to provide cooling water to the High Pressure Injection (HPI) pump motors.

Phase 2: Initiation of Natural Circulation Cooldown of the Reactor Coolant System to 250°F

At approximately two hours after Jocassee Dam failure initiation, both Keowee Hydro units and the ONS Switchyards are assumed to be lost due to overtopping of the Keowee Dam. This results in a momentary loss of power to each of the units. The Reactor Coolant Pumps (RCPs) are lost due to the loss of power to the startup transformers from the 230kV switchyard. Power will be regained to the 4160VAC Main Feeder Buses (MFB) from the Standby Buses. The Standby Buses are receiving power from a flood protected source via CT5. The SSF is normally powered from Unit 2's MFB, but it is load shed. Operator action will be taken to restore power to the SSF from Unit 2's MFB. Following reset of the load shed, power for the SSF would be provided from Unit 2's MFB to minimize any usage of the CCW inventory for SSF diesel operation.

The rising flood water in the ONS Intake Canal is postulated to result in failure of the Lake Keowee impoundment including the intake canal. This requires the shutdown of the Low Pressure Service Water (LPSW) pumps to conserve water inventory in the CCW piping.

Heat removal from the Spent Fuel Cooling system is normally provided by the Recirculated Cooling Water (RCW) system. Following the overtopping of the Keowee Dam, the loss of CCW flow results in a loss of RCW cooling. This leaves the Units 1 & 2 shared SFP and the Unit 3 SFP without cooling. The SFP will eventually heat up to the point of boiling. When boiling occurs, the SFP level will decrease. Makeup to the SFP would be initiated from available sources including the water contained within the CCW buried piping to maintain a sufficient water level above the spent fuel stored in the pools.

The shutdown of the LPSW pumps results in a loss of cooling to such items as the Reactor Building, HPI pumps, the Component Cooling System, the motor-driven EFW pumps, and the Low Pressure Injection coolers.

With the shutdown of the CCW and LPSW systems, environmental conditions within the plant would be established as needed by the use of temporary equipment and operation of necessary existing and temporary ventilation systems. The temporary equipment will be powered from a 4160VAC electrical bus that receives power from CT5.

The HPI pumps can continue to operate because backup cooling is provided from the HPSW system via the Elevated Water Storage Tank (EWST). Power to an HPSW pump would be restored and the pump would be operated to replenish the EWST to maintain cooling water to the HPI pump motor coolers. The HPI system operates to maintain pressurizer level at the desired setpoint.

A loss of normal secondary systems is experienced due to the temporary loss of power to the main feeder buses. Decay heat removal would initially be maintained by the EFW System. The motor-driven EFW pumps must be secured due to the loss of LPSW cooling. The turbine-driven EFW pump does not require LPSW for cooling and is therefore allowed to continue to operate to feed the SGs. The loss of condenser cooling will result in the SGs being steamed to atmosphere using the Atmospheric Dump Valves which results in depletion of the condensate inventory.

Upon a loss of normal RCS letdown capability a cooldown is initiated. Since RCPs cannot be operated based on a loss of cooling and power to the pumps, a natural circulation cooldown must be performed. Depressurization of the RCS would be accomplished by means of the Power Operated Relief Valve and/or auxiliary spray.

Core decay heat removal would eventually be transferred to the SSF Auxiliary Service Water (ASW) system to utilize the trapped water inventory in the CCW piping. With the use of the SSF ASW system, valve alignments would be made to maximize the available trapped water inventory in the CCW piping to the SSF ASW pump suction. This would be accomplished by cross-connecting the CCW inlet and discharge piping between all three units.

When the cooldown has been completed, the operating HPI pump would be stopped. The SSF ASW system would continue to supply the steam generators (SGs) to maintain decay heat removal.

Phase 3: Maintain RCS at ≤250°F

Core decay heat removal will be maintained by natural circulation of the RCS with the SSF ASW system providing decay heat removal by means of SG feeding and steaming through the ADVs. The HPI system will be operated as needed to maintain RCS water level within an acceptable band. Pressurizer heaters will be operated as necessary to maintain RCS pressure. Water level in the SFP will be maintained at a sufficient level above the spent fuel stored in the pools. The suction source for the SSF ASW system and the SFP makeup system is the water inventory trapped in the CCW piping.

# ATTACHMENT 2

# DESCRIPTION OF MODIFICATIONS

Based on the mitigation strategy discussed within Attachment 1, the following table identifies proposed modifications to mitigate site flooding following the postulated failure of the Jocassee Dam.

Specifically, modifications will be required to protect the required SSCs to meet the mitigation strategy and provide a dedicated flood protected power supply following a postulated Jocassee Dam failure. Protection of the credited SSCs including the Turbine Building, Auxiliary Building, SSF, and the surrounding yard (including CT5 Substation) will be accomplished with flood barriers and associated infrastructure. A dedicated flood protected power supply and thus a protected power source for credited plant systems and equipment will be accomplished with the relocation or protection of the 100kV (Fant) line towers and the addition of power connections at CT5 for recovery equipment.

| No | Category | Description |
|---|---|---|
| **1** | **Dedicated, Flood Protected Power** | **Perform necessary modifications to ensure a dedicated, flood protected power path from the Lee Steam Station combustion turbine via the 100kV (Fant) line to the CT5 Substation.** |
| 1A | 100kV (Fant) Line Tower Relocation or Protection | Relocate or protect 100kV (Fant) line towers subject to inundation |
| 1B | CT5 Substation | Modify CT5 Substation to supply the standby bus and a new recovery equipment bus. |
| | | |
| **2** | **Protect Required SSCs and the Surrounding Yard** | **Protect required SSCs and the surrounding yard due to Keowee impoundment failures and rising waters in the tailrace area** |
| 2A | Power Block Flood Wall | Install a new flood wall located on the east side of the Oconee site. |
| 2B | Intake Dike Diversion Wall | Install a new diversion wall along the northern side of the ONS intake dike |
| 2C | Turbine Building Drain Isolation | Install barriers to minimize flood waters from entering into the Turbine Building from rising waters in the tailrace area |
| 2D | Yard Drain Isolation | Install barriers to minimize flood waters from entering the site |
| | | |
| **3** | **SFP Makeup** | **Utilizes stored water inventory for makeup to the SFP** |
| 3A | SSF Service Water Discharge Flow Path | SSF ASW minimum flow line diverted to outside SSF for transfer to SFP |
| 3B | SFP Level Instrumentation | Install new SFP level instrumentation rated for post-flood conditions |
| | | |

Description of Modifications:

**1-Dedicated, Flood Protected Power**

In order to ensure an adequate dedicated power path to the Oconee site after a Jocassee Dam failure, the following modifications are required:

1A – Relocate/Protect 100kV (Fant) Line

A review was performed of the flood elevations and topography associated with the 100kV (Fant) line power path from the Lee Steam Station combustion turbine to the onsite CT5 transformer. Based on this review, relocation or protection of the transmission towers will be performed to ensure that there are no adverse interactions which would lead to failure of the transmission line. The effects of scouring, flood debris, and hydrodynamic loads will be accounted for in the tower design, as appropriate.

1B – CT5 Substation

The Lee Steam Station to CT5 Substation power path is designed as an offsite emergency power source that provides power to the Oconee Standby Buses. The Jocassee Dam failure requires modification of the CT5 Substation to add multiple power paths for mitigation. The initial function of the CT5 Substation will be to provide emergency power to loads required to mitigate the Jocassee Dam failure from the Oconee Standby Buses. Isolation for CT5 to the Standby Bus power path will be provided by a new breaker in the CT5 Substation. A secondary function of the CT5 Substation will be to provide an additional power path to temporary loads used for mitigation. These loads will be powered by a new recovery equipment bus designed for the CT5 Substation. This bus will provide power to portable distribution trailers at voltage levels of 4160V, 600V, 480V, 208V, and 120V for these temporary loads. Isolation/protection of this bus will be provided by a new breaker. Individual loads will be isolated/protected by load-specific fusible gang switches on the load side of this bus.

General Design Parameters:

Loading of CT5 transformer does not exceed the 12/16/20MVA rating consistent with UFSAR Section 8.2.1.4.

**2-Protect Required SSCs and the Surrounding Yard**

In order to prevent flood waters from flowing into the site from the Keowee impoundment failure and from rising waters in the tailrace area, the following modifications are required:

2A - Power Block Flood Wall

The new Power Block Flood Wall will envelope the eastern side and the southern end of the ONS protected area. The wall is comprised of 3 sections: The Discharge Diversion Section, The East Wall, and the Intake Dike Tie Section. The wall will have at least one vehicular access and one personnel access located at the north road crossing, each of which will have flood protection capability.

General Design Parameters:

Classification: Class 3, consistent with UFSAR Section 3.2.1.1.3
Design Loadings:
Dead + Wind (UFSAR Section 3.3.2.4) or
Dead + Hydrodynamic (Flood) (Reference 2)

Additional Design Considerations: General erosion; flood scour; debris; leakage from access gates, expansion joints, and unidentified locations (details to be determined); site drainage; and soil exploration and characterization. Interactions of non-seismic SSCs with seismic SSCs will be addressed.

Discharge Diversion Section (approximately 300 ft long)

Wall Height: Top Elev. 830 ft. msl (min), approximately 15 ft. high
Protection Height Margin: Approximately 2 ft.
Wall Thickness: Material dependent
Design Codes: Similar to UFSAR Section 3.8.5.4.3
Design Methodology: UFSAR Section 3.8.5.4.3

East Wall Section (approximately 2000 ft. long)

Wall Height: Top Elev. 808 ft. msl (min), approximately 12 ft. high
Protection Height Margin: Approximately 2 ft.
Wall Thickness: Material dependent
Design Codes: Similar to UFSAR Section 3.8.5.4.3
Design Methodology: UFSAR Section 3.8.5.4.3

Access Barriers: Vehicular access closure is planned to be a gate (sliding or hinged, possibly designed with some mechanical sealing devices), or stop logs (concrete or steel), similar to standard flood gates or other similar barriers.

Intake Dike Tie Section (approximately 160 ft. long)

Wall Height: Top Elev. 808 ft. msl (min), approximately 12 ft. high tapering to zero height
Protection Height Margin: Approximately 2 ft.
Wall Thickness: Material dependent. Wall is planned to be a combination of Power Block Wall transitioning to an embankment (compacted fill) wall tied to the existing Intake Canal Dike embankment.
Design Codes: Similar to UFSAR Section 3.8.5.4.3
Design Methodology: UFSAR Section 3.8.5.4.3

2B - Intake Dike Diversion Wall

This wall will prevent the rising waters on Lake Keowee, more specifically the Oconee Intake Canal, from flowing over the northern crest of the dike and directly into the yard. The wall will be located on the northern side of the dike crest, going from the northeast corner of the dike to the northwest corner of the dike where it will tie to higher ground. One access gate is planned for the existing roadway connecting the western portion of the nuclear site to the crest of the dike. Design parameters for the Intake Dike Diversion Wall are described below:

General Design Parameters

Classification: Class 3, consistent with UFSAR Section 3.2.1.1.3
Design Loadings:
Dead + Wind (UFSAR Section 3.3.2.4) or
Dead + Hydrodynamic (Flood) (Reference 2)

Additional Design Considerations: General erosion; flood scour; debris; leakage from access gates, expansion joints, and unidentified locations (details to be determined); and soil exploration and characterization. Interactions of non-seismic SSCs with seismic SSCs will be addressed.

Wall Height: Top Elev. 825 ft. msl (min), approximately 10 ft high
Protection Height Margin: Approximately 2 ft.
Wall Thickness: Material dependent
Design Codes: Similar to UFSAR Section 3.8.5.4.3
Design Methodology: UFSAR Section 3.8.5.4.3

Access Barriers: Vehicular access closure is planned to be a gate or stop logs similar to standard flood gates or other similar barriers.

2C - Turbine Building Drain Isolation

The free-flowing capability of the Turbine Building drain will be restricted during the site external flood by a flood gate or other similar barrier to minimize water flowing into the Turbine Building from the flooded tailrace area. Design parameters are described below:

Classification: Class 3, consistent with UFSAR Section 3.2.1.1.3
Design Loadings: Dead + Hydrodynamic (Flood) (Reference 2)
Design Code: Sluice gate or valve, standard to be determined

2D - Yard Drain Isolation

This modification adds a flood gate or other similar barrier to minimize the amount of water entering the flood protected area via the yard drains. Design parameters are described below:

Classification: Class 3, consistent with UFSAR Section 3.2.1.1.3
Design Loadings: Dead + Hydrodynamic (Flood) (Reference 2)
Design Code: Sluice gate or valve, standard to be determined

**3-SFP Makeup**

In order to provide makeup to the Spent Fuel Pools after a Jocassee Dam failure, the following modifications are required:

3A – SSF Service Water Discharge Flow Path

The capability to remove water from the CCW pipe by means of the SSF ASW Minimum Flow Line will be added for collection and transfer to the Units 1 & 2 shared SFP and the Unit 3 SFP.

3B – SFP Level Instrumentation

SFP level instrumentation will be designed to monitor the SFP level to ensure proper level is maintained during SFP boiling conditions.