TIA

Could you please provide answers to the following questions in relation to the licensing basis for flooding (GDC-2) for the safe shutdown facility (SSF) at Oconee Station?

1. Details of Design Basis Issue Related to External Flooding

On May 18, 1978 the NRC sent the licensee a RAI regarding the proposed SSF design. Question 6 asked, "Some equipment appears to be below grade. Provide the design features needed to prevent flooding. Provide the maximum limiting flood elevation at the structure location."

On **June 19, 1978**, the licensee responded to question 6 of the May 18, 1978 RAI as follows:

"Normal groundwater infiltration of the Safe Shutdown Facilities Equipment Enclosure will be limited by standard waterproofing techniques. **Flood studies documented in the Oconee FSAR, Section 2.4.3 show that Lake Keowee and Jocassee are designed with adequate margins to contain and control floods so as to pose no risk to the Oconee Station site.** The Safe Shutdown Facility is within the site boundary, southwest of the Unit 2 Reactor Building, therefore, it is not subject to flooding from lake waters. The Safe Shutdown Facility will be waterproofed to an elevation slightly above yard grade to prevent inflow of yard surface waters."

A February 2, 1982 study, found in OSC-631 (SSF Design), concludes that a Jocassee Dam failure will overtop the Keowee Dam by 4 feet for 2.4 hours, resulting in 32.5 feet of flood water on site.

On **July 17, 1982**, the NRC sent the licensee a RAI regarding the SSF.

Question 8 of the RAI asked "State the elevation of the grade level entrance to the SSF. If this elevation is below the maximum lake levels, provide a discussion of the means by which the equipment within the SSF is protected from the effects of flooding caused by an unisolable break of the non-seismic CCW system/piping located in the Turbine Building. The discussion should also state the maximum expected water level within the site boundary should such an event occur." (SRI comment. Since 1978, the licensee had convinced the NRC reviewers that the only flooding of concern would be from a turbine building circulating water pipe failure.)

Question 19 of the RAI asked "Describe those features of the design that assure that single failures within SSF components or that **design basis events do not result in consequential failures of the SSF** that would lead to conditions which exceed that for which safety systems have been designed."

On **September 20, 1982**, the licensee responded to question 8 and 19 of the July 17, 1982 RAI, as follows:

Q8) "The elevation of the grade level entrance to the SSF is EL 797 + 0. This elevation is below Keowee full pond elevation of 800 as well as the maximum lake elevation of 808.

(Ref. Oconee FSAR, Section 2.4.3). In the event of flooding due to a break of the non-seismic CCW system/piping located in the Turbine Building, the maximum expected water level within the site boundary is EL 796.5. Since the maximum expected water level is below the elevation of the grade level entrance to the SSF, the structure will not be flooded by such an incident."

Q19) "Interconnections to essential plant systems have been inherently minimized by the SSF design objective (alternate means to achieve hot shutdown). The only ties to essential systems are the interconnection of the power and control "swap over" for selected valves and the piping tie to the Emergency Feedwater System and reactor coolant pump seals. SSF ties to the existing plant are such that no SSF failure will result in consequence more severe than those analyzed in the FSAR.".

A January 17, 1983 memo to file documents that a Jocassee Dam failure would overtop the Keowee Dam by 2.45 feet, resulting in 4.71 feet of water on site. The memo also states that, "Similar dam failure studies were done for the Oconee PRA study as documented in the March 15, 1982 Memo to File and April 5, 1982 letter to K S Canady."

On April 28, 1983, the NRC sent the SSF SER to the licensee, which contained the following:

Section 4.8 Flooding Review

DPC has concluded that the most likely reason for flooding of the turbine building would be from a condenser circulating water pipe break resulting from a seismic event. The licensee therefore decided that the SSF would be a seismic Category 1 structure (which implies it is designed to withstand the effects of tornadoes). The missile & spectrum upon which their analysis is based, is in conformance with the guidelines of the SRP Section 3.5.1.4, Revision 1, for a tornado Zone 1 site. The grade level entrance elevation of the SSF is 797.0 feet above mean sea level (msl). This elevation is below Keowee full pond elevation of 800 ft. as well as the maximum lake elevation of 808 ft. However, in the event of flooding due to a break in the non-seismic condenser circulating water (CCW) system piping located in the turbine building, the maximum expected water level within the site boundary' is 796.5 ft. Since the maximum expected water level below the elevation of the grade level entrance to the SSF, the structure will not be flooded by such an incident. In addition, the structure will be water proofed to prevent infiltration of normal ground water. **Thus, the structure meets the requirements of GDC 2, and the guidelines of Regulatory Guide 1.102 with respect to protection against flooding.**

OSC-631 (SSF Design), contains the initial design of the 5 foot flood barriers located at the North and South entrances of the SSF, and is dated **June 8, 1984.** (Comment from SRI. The licensee considered the flood threat significant enough to install flood barriers around the SSF, but not significant enough to inform the NRC prior to licensing of the SSF.)

Question 1. Should the licensee have provided the known information on flooding of the site for the Jocasse dam failure?

Question 2. If the licensee had submitted the information of flooding from Jocasse, would the licensing basis have included a Jocasse dam break with flooding up to 4.71 ft for 2.4 hours?

Question 3. Does the failure to provide the information prior to the NRC prior to issuance of the SER constitute a 50.9 violation for failure to provide complete and accurate information?

2. Additional Details and 50.59 Issue

On **October 9, 1987**, IN 87-49, Deficiencies in Outside Containment Flooding Protection was issued.

This IN was "...provided to alert recipients to a potentially significant problem pertaining to the flooding of safety-related equipment as a result of the inadequate design, installation, and maintenance of features intended to protect against flooding."

The IN discusses "... the potential for the loss of safe shutdown capability as a consequence of potential flooding of safety-related equipment outside containment."

The IN goes on to state that, "Serious consequences may result if the design features of the plant are not adequate to direct the resulting flood water safely away from important equipment. Such design inadequacies may result from (1) the inadvertent use of non-conservative assumptions in the flooding design analysis, (2) the failure to recognize all possible flooding flow paths, (3) the failure to install flood protection features that have been determined to be necessary, or (4) the failure to properly maintain installed flood protection features."

A **March 20, 1990** licensee letter and a April 16, 1990 followup licensee letter document the Duke sites attempt to use IN 87-49 and design studies to identify flooding deficiencies. Oconee's design study is identified as ONDS-268, Identification of Outside containment Flood Protection Barriers.

A **June 21, 1990** licensee letter discusses the scope of Oconee's effort for ONDS-268 (Identification of Outside containment Flood Protection Barriers), and that the results of the study will be used to create a DBD on flooding. The letter specifically states that, "A review of all applicable design documents (drawings, specifications, calculations, etc.) will be made in order to compile a list of flooding protection features. A review of the applicable Station Probabilistic Risk Assessment (PRA) will be made to determine flood sources or flood events associated with each flood protection feature. Features identified will have their function described and theirs relation to flooding states." The letter goes on to state areas of responsibility and a schedule for completion of the study with a final due date of December 31, 1991.

A **February 15, 1991** licensee letter documents the completion of identifying the flood events for ONDS-268 (Identification of Outside containment Flood Protection Barriers) and high risk areas derived from the Oconee PRA. With respect to the SSF, the letter states that, "**The SSF is equipped with 5 ft. flood barriers at its two entrances, and has otherwise been made impervious to site flooding. Therefore, the SSF would be available to mitigate all external flooding sequences.** Two sump pumps in the basement of the SSF building eliminate interior flooding of the SSF safety related

equipment."

A **December 20, 1991** licensee letter documents the discovery of an unsealed flood penetrations surrounding the CO_2 piping entering SW corner of the SSF. The deficiency was discovered during the Oconee Design Study, ONDS-268, Identification of Outside containment Flood Protection Barriers. PIR (Problem Investigation Report) 4-092-0052 was generated for the deficiency, on March 30, 1992.

An attachment to the letter discusses "Features for Protection from External Floods" and states that, "The Oconee PRA identifies two potential events that could lead to external flooding of the Oconee site. The first is a general flooding of the rivers and reservoirs in the area due to a rainfall in excess of the Probable Maximum Precipitation (PMP). The FSAR addressees Oconee's location as on a ridge 100' above maximum known floods. Therefore, external flooding due to rainfall affecting rivers and reservoirs is not a problem. The second source of external flooding is a failure of the Jocassee Dam. Failure of the Jocassee Dam would result in a postulated wave height of 4.71 feet in the yard at the oconee site. The SSF provides Oconee's most secure method of safely shutting down the plant following an external flood due to a Jocassee Dam failure." With regards to the SSF, the attachment also discusses the 5 foot flood wall at the North and South entrances to the SSF, along with the SSF sump and its pumps and level control switches.

A December 10, 1992, Jocassee Dam Failure Inundation Study (FERC Project No. 2503) predicted that a Jocassee Dam failure could result in flood waters of approximately 12.5 to 16.8 feet deep at the Oconee Nuclear Site.

A December 14, 1993 memo to file documents the results of the Jocassee Dam Failure Inundation Study. The memo discusses the differences between the 1992 FERC and the 1983 PRA study (12.5 to 16.8 feet of water on site, compared with 4.71 feet of water). **The memo also states that the Oconee FSAR and PRA will be revised to reflect the potential loss of the SSF during a Jocassee Dam failure.**

On **March 31, 1994**, IN 94-27, Facility Operating Concerns Resulting From Local Area Flooding was issued.

This IN was issued "... to alert addressees to emergency preparedness, equipment operability and radiological control problems that may result from local area flooding."

The IN discusses that, "This event demonstrates that flooding problems and degradation of equipment may be caused by water inleakage even though flood waters are not above grade elevations. Water leaking through underground walls may impinge on electrical equipment or may enter radiologically controlled areas and spread contamination to other areas. Underground cable and pipe tunnels may become flooded and serve as pathways for water to enter plant buildings. Management and plant personnel attention to these conditions is important to ensure that equipment is protected and unsafe facility conditions are not created."

On June 2, 1994, OSC-5781, USQ Evaluation for Change in FSAR Concerning SSF and Jocassee Flood, was approved.

The calculation discusses the rationale behind using 50.59 to remove information in the

SSF portion of the FSAR with regards to external flood protection of the site during a Jocassee Dam failure (using 1983 PRA study flood level of 4.71 feet on site). The calculation states that, "**FSAR Section 9.6 was revised in the 1992 Update of the FSAR to address external flood protection of the yard as a result of the rapid failure of the Jocassee Dam.** The information was determined to describe a PRA study and is not part of the design basis for Oconee. The FSAR statements are to be revised or removed to correct the information in the FSAR and reflect the existing licensing basis of Oconee."

On June 13, 1994, Flooding from External Sources DBD was issued. Section 2 discusses GDC 2 and that SSC important to safety shall not be effected by flooding and maximum precipitation. Section 3.2.6, Potential Dam Failure, states that, "Dam breaks have no bearing on the design basis flood."

Question 4. Should the Jocasse dam break and flooding response requested by the INs constitute an "analysis requested by the Commission" which would require the updated information be included in the next update to the UFSAR?

Question 5. The Jocasse dam break and flooding of the Oconee site was included in the 1992 update to the UFSAR. This update also included the use of the 5 ft walls at the SSF to preclude flooding. Was it appropriate to use the 50.59 process to remove the Jocasse flood from the UFSAR in 1994?

3. Inadequate/Untimely Corrective Actions

On September 3, 2002, PIP O-02-4678 documents a level 2 assessment conducted to identify improvements that would reduce plant risk, increase design margin, and reduce regulatory risk.

The PIP states that, "... the following areas for improvement are identified: ... 12. External flooding is a very high risk event that has not been analyzed in detail. The scenario of interest is the Jocassee dam failure. It is recommended that all facets of this event be revisited, including credible causes, flood levels and associated consequences, method of analysis, preventative and mitigative measures and updated risk analysis. It is recommended that the DBG [Design Basis Group] develop a project plan to throughly review external flooding risk."

Proposed corrective action #12 of the PIP requested that the recommendations of the PIP be completed by December 31, 2003. However, no actual corrective action was taken until the DBG manager made an May 11, 2006 entry stating that, "This issue is being addressed by PIP 04-863." PIP 04-863 is discussed below and its completion due date has been moved 7 times ("Delayed due to other higher priority work."). Its newest completion due date is September 27, 2006.

On February 21, 2004, PIP O-04-0863 was generated. The PIP documents the need to re-examine the PRA event of a Jocassee Dam failure. As stated above its completion due date has been moved 7 times ("Delayed due to other higher priority work."). Its newest completion due date is September 27, 2006.

Question 6. Should the licensee's delay in resolving the Jocasse flood issue be considered as a violation of 10 CFR 50, Appendix B, Criterion XVI, for untimely corrective

actions?