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SUBJECT: Responds to NRC 820717 request for addl info re standby shutdown facility.Subj facility designed to meet seismic criteria for auxiliary svc water sys as backup in event of DBE.

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September 20, 1982

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Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. John F. Stolz, Chief
Operating Reactors Branch No. 4

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Sir:

By letter dated July 17, 1982, the NRC Staff provided a request for additional information based on review of Duke submittals regarding the Oconee Standby Shutdown Facility. Our response to this request is attached. Additionally, Duke would like to provide comments on the Staff's review of this plant modification.

The concept of a dedicated shutdown facility has been presented to the Staff in three steps. An initial conceptual description was presented to the Staff during a meeting with Duke on January 18, 1978. This was formalized by the submittal of a conceptual description on February 1, 1978. This second phase of dialogue on this modification was completed by the Staff's issuance of an evaluation dated December 6, 1978 in which the conceptual design of the system was determined to be acceptable. Based on this, the third phase, which consisted of final design and construction efforts, began. On March 28, 1980, Duke submitted information in support of the Standby Shutdown Facility (SSF). Since that date several NRC requests for information have been responded to and the construction of the facility has been proceeding. Presently, this plant modification is nearing completion and could be completed and operational within the next two years. Any physical or analytical changes to the present design required by the NRC would be considered as potential backfits and would be handled in accordance with the requirements of 10 CFR 50, §50.109.

The original regulatory requirement for the SSF was contained in the Fire Protection Safety Evaluation Report issued by the NRC August 11, 1978 and was reflected as a License Condition to the Facility Operating License. Subsequently, the regulations governing fire protection requirements were incorporated into 10 CFR 50, §50.48 and Appendix R. This regulation states that only Sections III.G, III.J, and III.O of Appendix R are applicable to those plants licensed to operate prior to January 1, 1979. It is the original License Condition and Appendix R Section III.G to which the SSF was designed and constructed to meet. As such, it is considered neither necessary nor required that the SSF meet the requirements of Appendix R, III.L.

In the cover letter of the last request for information, the Staff listed the criteria used in their review. With respect to this, Duke provides the following:

A001

1. The SSF is designed to meet Seismic Category I requirements in order for the Auxiliary Service Water System in the SSF to be used as a backup for the emergency feedwater system in the event of a design basis earthquake.

2. The only interfaces between the SSF and the existing plant are the interconnection of the power and control "swap over" for selected valves and the piping tie to the Auxiliary Service Water System. Since the SSF and the existing plant are essentially independent of one another, no SSF failure will result in consequences more severe than those analyzed in the FSAR.

In summary, the SSF has been designed and constructed in accordance with the original design concept that was approved by the NRC and is consistent with current regulations. As such, no additional requirements for the SSF are deemed appropriate, nor are any considered necessary.

Very truly yours,

HBTucker/HW

Hal B. Tucker

RLG/php
Attachment

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Duke Power Company

Oconee Nuclear Station

Response to NRC Request for Information

Standby Shutdown Facility

A. 1. In the Staff's evaluation of the SSF, which was forwarded to the licensee December 29, 1978, the staff found the design criteria acceptable, subject to the following conditions:

"(a) DPC stated in their June 19, 1978 submittal that they would selectively apply portions of NUREG-75/087 to their design. We have requested that the licensee identify and justify those portions of the design not meeting NUREG-75/087.

(b) Any deviations from the above listed criteria, and/or the criteria specified in the Oconee FSAR, and/or the criteria described in NUREG-75/087, shall be identified by the licensee and submitted for NRC review in the final design submittal."

In the licensee's March 28, 1980 submittal, such a discussion was not included. The licensee is requested to provide a response.

Response

The following statement appeared in DPC's June 19, 1978 submittal: (item #7)

"The Safe Shutdown System will be designed to meet or exceed the applicable criteria contained in the Oconee FSAR. Additionally, ASME and IEEE codes will be utilized, as appropriate, in the design of various sub-systems and components. Individual sections of the Standard Review Plan will not (emphasis added) be specifically applied to the design of this system."

In addition, a Final Rule published in the Federal Register on March 18, 1982, (47FR11651) the NRC requires future applicants to identify and evaluate differences from the acceptance criteria of the Standard Review Plan. Operating reactors and pending operating license applicants were excluded from the rule in order to "reduce the impact on available short-term engineering resources." In addition, as the Commission clarified in the discussion of the Final Rule, the Standard Review Plan is not a regulation and compliance with it is not required.

In view of the foregoing, Duke Power Company does not feel that application and evaluation of the SRP is appropriate.

2. The licensee has indicated that AC and DC power supply systems including the standby power system for the Standby Shutdown Facility will meet or exceed the requirements of Class 1E power systems and equipment except for the single failure criterion. Provide a description of how the power systems for SSF satisfy the criteria for Class 1E equipment.

Response

In our June 19, 1978 submittal there was no commitment to meet the requirements of Class 1E power systems or equipment; however, the Standby Shutdown Facility is designed to meet or exceed the applicable criteria contained in the Oconee FSAR (Sections 8.1.2 and 8.3.1.2). IEEE standards were utilized, as appropriate, in the design of various subsystems and components.

Additionally, the SSF AC and DC Power Systems necessary to support the SSF essential functions have been designed and installed consistent with the Duke QA Program. Seismic qualification of electrical equipment is addressed in item 14.

3. Please describe the adequacy (in capacity) of the 26 gpm SSF RC makeup pump for primary RCS inventory loss control (e.g., leakage, shrinkage) when utilizing the condenser for cooldown during a fire concurrent with loss of offsite power scenario.

Response

The SSF is not designed to bring the unit and/or units to cold shutdown without taking damage control measures. Utilization of the condenser for cooldown is not part of the design and would bring the unit to cold shutdown. The 26 GPM capacity is based upon achieving hot shutdown utilizing one OTSG operating at the lowest code relief valve set pressure.

4. Describe the means by which the spurious operation of the following valves is prevented to assure primary boundary integrity (fire scenario):

   (a) RHR isolation valves
   (b) letdown valve
   (c) excess letdown
   (d) head vent valve
   (e) sampling line valves

   If manual isolation of any of the above valves is required, the licensee should demonstrate that the SSF makeup pump can quickly return reactor coolant level in the pressurizer to the normal shutdown range after delayed isolation. A delay time of 30 minutes should be used to evaluate leakage from these unisolated paths in accordance with draft ANSI standard ANS 58.8, ANSI N660 Revision 2 March, 1981 which specifies an operator action time of 30 minutes outside the control room.

   The licensee is also requested to address the spurious operations of valves or components which may affect the safe shutdown capability.

Response

The originally accepted design concept for SSF operation was based on a 10 minute capability to transfer control to the SSF. Hot shorts or supurious actuation due to fire within the first 10 minutes of the event are not part of the design basis.

This justification was based on the extreme unlikelihood of multiple spurious operations resulting in unacceptable coolant loss essentially coincident with loss of multiple mitigating systems within a 10 minute period.

Fires cannot instantaneously incapacitiate all equipment in a large area and can only propagate in some real finite time within finite physical limits.

Furthermore, upon confirmation of a fire in the plant, operating personnel will be dispatched to the SSF where they will establish communication with the control room. As long as capability exists to perform vital reactor control and monitoring from the control room, the operator will maintain control from that location. If vital control and monitoring functions (e.g. reactor coolant pressure boundary, reactor coolant makeup capability) become unacceptably degraded or unavailable from the control room, a prompt transfer can be made and control established from the SSF.

As stated above, spurious operation is extremely unlikely within the first 10 minutes. To preclude unacceptable consequences of spurious operation in the longer term, circuits are designed to either preclude spurious operation or retain operability of the systems necessary to mitigate such operation. For the specific valves referenced in 4a, 4b, and 4c, if a fire occurs in any fire zone other than the SSF or west penetration room (SSF route to containment), the control and power source can be transferred from existing plant to SSF. For a fire in the SSF or the west penetration room, existing mitigating capability remains available via the east penetration room and the existing plant. For the specific valves referenced in 4D & e, the power has been removed from these valves; therefore, spurious operation cannot occur.

5. In order to make the SSF fully functional following a fire, and flooding:

   (a) Will cabling of an affected train have to be physically disconnected in order to utilize the SSF train (similar to McGuire)

   (b) Will breakers have to be physically realigned in order to utilize the SSF train, make the SSF operational (similar to McGuire), or to ensure proper system configuration (e.g., valve positioning) to assure safe hot shutdown conditions. If so, state the locations and access of such switchgear rooms.

Response

(a) Cabling will not be physically disconnected in order to utilize the SSF train.

(b) The only breakers which are required to be manually realigned in order to utilize the SSF are the incoming breakers to the SSF 600 Volt Motor Control Centers (1XSF, 2XSF, and 3XSF). These 3 motor control centers are normally fed by in plant power. During an SSF event, it would be necessary to go to these 3 MCC's and operate key interlocked breakers so as to open the normal plant feeder and close the SSF backed feeder. Normally, a fourth 600 volt motor control center (XSF) will be aligned to SSF backed power; however, this MCC does have an alternate feeder from the normal plant sources. If for any reason this MCC is aligned to in plant power at the start of an SSF event, it would also be necessary to manually realign this MCC to the SSF by utilizing key interlocked breakers in the MCC.

The 600V motor control center XSF is located in the SSF electrical equipment room (Rm SF102) at elevation 777 + 0. The 600V motor control centers 1XSF, 2XSF, and 3XSF are located in the SSF HVAC Room (Room SF120) at elevation 817 + 0. Access to the SSF Electrical Equipment room is via the outside door at elevation 797 and down stairwell (room SF110) or via the outside into the Diesel Generator Room (Room SF104). Access to the HVAC Room is via the outside door at elevation 797 and up the stairwell (Room SF110).

6. If cables for all atmospheric dump valves are located in the same fire area, it is conceivable, that hot shorts could cause all those valves to fail open. The licensee should discuss the worst-case effect of a fire on the atmospheric dump valves, and demonstrate that the SFF can maintain safe hot standby conditions in the event of such postulated damage.

Response

Oconee Units 1, 2, and 3 main steam headers have the following steam release devices and/or routes:

a) Manual atmospheric dump valves

b) Spring-type code relief valves

c) Steam bypass to condenser pneumatically operated fail-safe bypass valves

None of the above have power cabling associated with them and therefore would not be affected by an electrical failure due to a fire.

7. By letter dated January 25, 1982, the licensee provided responses regarding the absence of source range flux and steam generator pressure indication at the SSF with respect to Appendix R to 10 CFR 50 Safe Shutdown in the Event of Fire. It is the Staff's interpretation of Section III.L.2 of Appendix R that source range flux and steam generator pressure are control parameters/ process variables which require "direct readings" in order to assure the achievement of the performance goals for safe shutdown. Thus, the licensee is requested to provide a commitment, to provide direct readings for source range flux and steam generator pressure at the SSF or an alternate shutdown panel, electrically isolated from the control room.

Response

As stated in our letter of January 25, 1982, it is our opinion that source range flux or steam generator pressure instrumentation is not necessary to achieve and maintain hot shutdown. Source range neutron flux is only required where there is a potential for positive reactivity addition. The following are reasons we conclude that this instrumentation is not required.

a. Unit is to be held at hot shutdown

b. Control rods are inserted

c. RCS makeup and boration (2000 ppm) is with fuel pool water

Steam generator pressure is not a control parameter (i.e., the operator does not take action or attempt to control based on this information only).

Since steam generator level is the only control parameter necessary for hot shutdown during a standby shutdown event, it is the only parameter to be monitored in the SSF Control Room. The SSF Control Room operator has the capability of increasing or decreasing this level by manual control of the SSF Auxiliary Service Water System.

8. 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.

Response

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.

9. With regard to the licensee's response of June 19, 1978 to the Staff's May 18, 1978 request for additional information; are the responses to Questions 4 and 5 regarding design criteria of equipment and systems in the SSF intended to also address the requirements at the system interface (i.e., interfacing between SSF equipment and "In Plant" equipment).

Response

Please refer to our response on item 19 for clarification of this question.

10. With respect to the licensee's response (Reference 2) to Question 1 of Reference 1 concerning the design of Reactor Coolant Make-up System and Auxiliary Service Water System, the following areas require clarification.

   a. The Auxiliary Service Water Piping which penetrates the containment for each unit is incorrectly classified piping Class F as shown in Figure 4-1 of Reference 3. These lines should be classified piping Class B as addressed in Reference 2. Correct the appropriate figure and confirm that the system is designed in accordance with the appropriate classification.

Response

Our response to Question 1 refers to inservice inspection Quality Group B, not piping Class B. The SSF Auxiliary Service Water System makes use of the existing Duke Class F piping of the Emergency Feedwater System for its path to the steam generators. Since this existing penetration into the Reactor Building was used, existing piping was not upgraded from its original Class F classification. This is consistent with our SSF design commitment of not upgrading any existing systems. Therefore, the Class F piping found on Figure 4-1 of Reference 3 is correctly identified. However, the inservice inspection requirement for the Class F piping at this penetration is ASME Section XI for Quality Group B piping.

11. With respect to the licensee's response (Reference 4) to Question 2 of Reference 1 concerning the conformance with the NRC Standard Review Plans, the following areas require additional information to demonstrate that the licensee's methodologies comply with Standard Review Plans (SRP).

   a. The licensee's response to SRP Sections 3.7.3 II.2 through II.12 states that all requirements are satisfied. Expand the response to include a discussion describing how the licensee's methodologies comply with the SRP.

   b. The licensee's response to SRP Section 3.9.2 II.1 states that procedures are being established to verify thermal motion and vibration for compliance within acceptance criteria. Expand the response to include a description of the acceptance criteria which will be used.

   c. The licensee's response to SRP Section 3.9.3 II.3 states that all requirements are satisfied. Expand the response to include a discussion describing how the licensee's methodologies comply with the SRP.

Response

As discussed in our response to Question 1, conformance with the Standard Review Plan is not intended. Responses to questions regarding specific Standard Review Plan sections are provided below, but future questions relating to the compliance of licensee's methodologies with the Standard Review Plan are considered outside the licensing basis of Oconee Nuclear Station.

a. SRP Section 3.7.3 Seismic Subsystem Analysis

3.7.3.II.2 Determination of Number of Earthquake Cycles

Not applicable. Since there is no Class 1 piping associated with the SSF and detailed fatigue analysis is not used to qualify any of the Class 2 and 3 piping for the SSF, the number of earthquake cycles is not required.

3.7.3.II.3 Procedure for Analytical Modeling

All SSF piping is considered subsystems that are decoupled from the major structures based on a mass ratio:

$$Rm < .01$$

$$\text{where } Rm = \frac{\text{Total mass of subsystem}}{\text{Mass that supports the subsystem}}$$

An adequate number of mass points are included in the model to determine

the response of significant modes. As a minimum, the number of degrees of freedom is twice the number of modes below 30 cps.

The analysis is performed using three dimensional models.

3.7.3.II.4 Basis for Selection of Frequencies

SSF piping is generally supported such that the fundamental frequencies are less than 1/2 the dominant frequency of the support structure. In all cases, the calculated response is within Code allowables.

3.7.3.II.5 Use of Equivalent Static Load Method of Analysis

Not applicable. No static sesimic analysis is used for SSF ASME Code piping.

3.7.3.II.6 Three Components of Earthquake Motion

The response spectra method is used for seismic analysis to determine the structural response due to each of the three components of earthquake motion. The response due to each of three components of earthquake motion are combined by the square root of the sum of the squares method to obtain the total response.

3.7.3.II.7 Combination of Modal Response

The seismic response due to individual modes are combined to determine the total response using the 10% grouping method. Closely spaced modes are divided into groups that include all modes having frequencies between the frequency of the lowest mode in the group and a frequency 10% higher. The response for modes in each group are combined by absolute sum. Then the remaining modes and groups are combined by the square root of the sum of the squares.

3.7.3.II.8 Analytical Procedures for Piping Systems

Seismic analysis of category I pipe is performed using dynamic modal analysis techniques.

All modes with frequencies less than 30 cps are included in the analysis. The effects of higher frequency modes are included by static techniques using the spectral acceleration at 30 cps.

Other topics included in SRP 3.7.2.II.1 are either not applicable to subsystem analysis or addressed in other portions of SRP 3.7.3.

3.7.3.II.9 Multiply Supported Equipment and Components With Distinct Inputs

Piping supported from multiple levels or structures, is designed for an envelop of the response spectra for all supporting structures.

Maximum relative displacements of supports are reviewed and included in the analysis as a static load if significant.

3.7.3.II.10 Use of Consistent Vertical Static Factors

Not applicable. Constant Vertical Static Factors were not used. Vertical response was obtained from a dynamic modal analysis.

3.7.3.II.11 Torsional Effects of Eccentric Masses

All significant eccentric masses are modeled so that their effects are adequately included in the analysis.

3.7.3.II.12 Category I Buried Piping Systems and Tunnels

The SSF Auxiliary Service Water buried piping is seismically designed for stresses resulting from SSE and OBE events. The design and analysis are based on the current state-of-the-art as given in the following references:

1. Goodling, E. C. Jr., "Flexibility Analysis of Buried Pipe", ASME Conference Paper, Canada, ASME, 1978.
2. Igbal, M. A., and Goodling, E. C. Jr., "Seismic Design of Buried Piping", ASCE Speciality Conference on Structural Design of Nuclear Plant Facilities, Vol. 1-A, pp. 142-168, ASCE, 1975.

These papers reference the recommended procedures noted in SRP Section 3.7.3 for inertial effects and the effects of static resistance of

the surrounding soil.

The effects due to local soil settlements and soil arching are minimized by the use of a controlled backfill and accepted construction practices.

b. SRP Section 3.9.2, "Dynamic Testing and Analysis of Mechanical Components."

An "as-built" verification procedure is utilized to verify that piping, components and support/restraints have been erected within design tolerance.

Pump vibration is monitored during initial testing in accordance with IWP-3210 to verify vibrations are less than or equal to the maximum allowable per the specific vendor's requirements.

c. SRP Section 3.9.3 ASME Code Class 1, 2, and 3 Components, Component Supports and Core Support Structures

3.9.3.II.3 Design and Installation of Pressure Relief Devices

The loads from pressure relief valves with an open discharge are evaluated in accordance with Code Case 1569, "Design of Piping for Pressure Relief Valve Station", assuming multiple valves on the same pipe open in the most conservative sequence. A dynamic load factor of 2 is used to determine the transient loads unless a lower value is justified by analysis.

Relief valves discharging into a closed system or a system with long discharge piping are reviewed to identify any significant transient loadings. Any significant loading is analyzed using appropriate techniques to include the effects of changes in momentum due to fluid flow changes of direction and any potential water slugs. The piping will be adequately supported such that piping stresses associated with any transient loads satisfy applicable Code requirements.

12. The response "One RC Makeup Pump will be seismic and operability tested on a shaker table" lacks specificity regarding seismic qualification of pumps. What are the methods; procedures such as input, load combinations, codes and standards; and criteria to be used? Justify the selection of the methods, procedures, and criteria used.

Response

Seismic Qualification of the SSF RC Makeup Pumps consists of (see also 14.b.2):

1. Methods: One pump was performance tested, then shaker table tested, and performance tested after the shaker table test. This method was chosen in lieu of analytical seismic qualification.
2. Procedures: The pump was performance tested before and after the shaker table test to show operability before and after a seismic event. The seismic test utilized the Oconee Safe Shutdown Earthquake spectrum and showed the pump to have a natural frequency greater than 33 Hz. This seismically qualifies the pump per Duke Structural Design Requirements. The performance tests were per Hydraulic Institute Standards (see response to #13).
3. Criteria: The acceptance criteria consists of the pump meeting design output before and after a seismic event and the pump having a natural frequency greater than 33 Hz. The acceptance was based upon ASME III, Class 2, design and stress criteria, Duke Structural Design Requirements and Hydraulic Institute Standards which assures the design of the SSF RC Makeup System to be equal to the balance of plant design.

13. What are the specific tests that consitute performance tests for pumps?

Response

Pumps were performance tested a rated speed in accordance with Hydraulic Institute Standards, Thirteenth Edition. Performance curves, with measurements taken at no less than seven different flow points per curve, were required to determine total head, Net Positive Suction Head Requirement (NPSHR), Brake Horsepower Requirement (BHP_R), and pump efficiency. Vibration readout on the shaft was monitored and recorded in each case. This performance testing was documented with certified performance curves, data and test results for each pump.

14a. List all the mechanical and electrical equipment located in the SSF that is needed to safely shutdown the plant from the SSF.

14b. Discuss in detail the plan to seismically qualify mechanical and electrical equipment located in the SSF and those that tie into existing systems. This should include methods, procedures, load combinations, codes, standards and criteria to be used.

Response

Electrical equipment associated with the standby shutdown facility required for hot shutdown is as follows:

Control Console

MEC & IC Cabinets

Diesel Generator & Accessories

4160VAC Switchgear

600VAC Motor control centers

208VAC Motor control centers

120VAC/125 VDC Panelboards

600VAC Load Centers

Inverters

Battery Chargers

Voltage Regulators

Control Batteries/Racks

Environmental Chamber and Resistor Cabinet

4KV Aux. Serv. Pump Motor (2000HP)

Transformers 600/208 30KVA

Transformers 600/600 150KVA

Transformers 4160/600 1500KVA

Transformers 600/120 37.5KVA

SSF RC Makeup Pump Motor

D/G Service Water Pump/Motor (20HP)

SSF HVAC Serv Wtr Pmp Mtr

The mechanical equipment associated with the SSF that is needed to bring the unit/units to hot shutdown from the SSF are listed below:

SSF Auxiliary Service Water System

*SSF Auxiliary Service Water Pump

Manual/EMO Valves associated with this system
(Located inside and outside the SSF)

SSF RC Makeup System

SSF RC Makeup Strainer

SSF RC Makeup Accumulator

SSF RC Makeup Pump

SSF RC Makeup Pulsation Dampener

SSF RC Makeup Filter

EMO valves associated with this system

SSF Diesel Engine and Auxiliaries

*SSF Service Water Strainer

*Diesel Engine Service Water Pump

*HVAC Service Water Pump

*HVAC Strainer

*HVAC Condenser

*Diesel Engine Fuel Oil Transfer Pump

*SSF Fuel Oil Transfer Filter

*Fuel Oil Strainer

*Manual valves associated with this system

*Equipment located in SSF

Item 14.b.1 Seismic Qualification of SSF Electrical Equipment:

Seismic Qualification Criteria

Electrical equipment associated with the Standby Shutdown System necessary to achieve hot shutdown is designed to perform its intended function during and following a Safe Shutdown Earthquake (SSE). This criteria is consistent with the criteria applied in the design of the Oconee Nuclear Station as stated in the FSAR Section Section 3.10 entitled "Seismic Qualification of Safety Related Instrumentation and Electrical Equipment."

Methods and Procedures for Seismically Qualifying Electrical Equipment

The seismic qualification of electrical equipment is demonstrated by testing, analysis, or a combination of these methods. When testing is performed, the input excitation normally employed is random, multifrequency biaxial similar to that described in IEEE 344-1975. In the event other input excitations are employed, they are selected in accordance with the requirements of IEEE 344-1971. Satisfactory operation of the electrical equipment is verified both during and after testing. When testing is not practical, qualification is by analysis.

When seismic qualification of electrical equipment is verified by testing, the test response spectrum (TRS) envelopes the required response spectrum (RRS) for all frequencies from 1 to 33 HZ. All equipment that is tested is verified to be operational during and after the test.

When seismic qualification of electrical equipment is by analysis, all stresses in critical members are verified to be less than the applicable allowable stresses. Seismically sensitive components located in the analyzed equipment are seismically qualified by testing for the localized motion at the component mounting location.

Results of Seismic Test and Analyses

The results of seismic tests and analyses for this electrical equipment are provided in the individual seismic qualification reports.

(14.b.2): Our mechanical equipment specifications for the equipment listed in 14.a.2 above incorporate "Structural Design Requirements", which specifies seismic design criteria to be used and describes allowable methods (analysis or test, or a combination thereof) and formats for qualification consistent with Oconee FSAR Sections 3.7 and 3.9. Also, this mechanical equipment was certified to be operable before and after a design basis accident which includes normal operating effects, i.e. piping loads, dead weight loads, thermal expansion, pressure, and support reactions, plus full Safe Shutdown Earthquake (SSE) effects. The load combinations and pressure boundary codes are described by the attached table taken from the "Structural Design Requirements".

In addition to the above, the Auxiliary Service Water Pump was certified to be operable <u>during</u> a design basis accident.

SUPPORTING INFORMATION FOR RESPONSE
TO QUESTION 14b-2
DESIGN CRITERIA - LOAD CONDITIONS AND STRESS CRITERIA

Equipment Designation	Design Criteria[1]	Loading Conditions	Stress Criteria[4]	
			Pressure Boundary	Supports
Safety Class 2 (Duke Class B)	ASME III, Class 2 + Duke Structural Design Requirements	Normal Operation	ASME III, Class 2, Level A Service Limits	ASME III, Class 2, Sub-Level A Service Limits
		Normal Operation + OBE[2]	ASME III, Class 2, Level B Service Limits	ASME III, Class 2, Sub-Level B Service Limits
		Normal Operation +SSE[3]	ASME III, Class 2, Level D Service Limits	ASME III, Class 2, Sub-Level D Service Limits
Safety Class 3 (Duke Class C)	ASME III, Class 3 +Duke Structural Design Requirements	Same as for Safety Class 2	Same as above for Safety Class 2, Levels A, B, D Service Limits	Same as above for Safet Levels A, B, D Service

1. Applicable code addenda is most recent addenda in effect at the purchase order date for the equipment.

2. Applies to Level B Service Conditions as defined in ASME Code (Section III).

3. Applies to Level D Service Condition as defined in ASME Code (Section III).

4. Stress criteria are stated for areas of structure governed by ASME Code. For areas not governed by ASME Cod AISC criteria governs as follows:

Condition	Allowable Stress
Normal Operation	0.6 fy*
Normal Operation + OBE	0.6 fy
Normal Operation + SSE	0.8 fy

*fy = yield stress at applicable temperature (psi)

15. Describe the type of displays provided for measured parameters used for the SSF. Are any parameters recorded, such as primary system temperature from which trending information may be obtained to confirm natural circulation?

16. Provide a list of the instrument tag item numbers for those instruments listed in Sections 3.2.3 and 4.2.3 of the FDR to permit their identification in the figures and P&I drawings requested in A 1 and 2 above. Provide the range of each measured parameter.

Response

The follwoing is a listing of the type of displays for SSF measured parameters available on the control panel, including the device tag # and measured range:

A - Flow, Temperature, Level, Pressure Parameters

Measured Parameter	Device Tag #	Display Device	Measured Range
SSF Unit Related Alarms		Beta Annunc. Panel	N/A
SSF Unit Related Valve/ Pump Status		Status Lights	N/A
SSF RC Makeup Pump Suction Temp	(RD-174)	W VX-252 Receiver Gauge	60-300°F
SSF RC Makeup Pump Disch. Press	(PT-227)	W VX-252 Receiver Gauge	0-2500 PSIG
SSF RC Makeup Pump Suct. Press	(PT-223)	W VX-252 Receiver Gauge	0-35 PSIG
SSF RC Makeup Pump Disch. Flow	(FT-157)	W VX-252 Receiver Gauge	0-30 GPM
Pressurizer Pressure	(PT-224)	W VX-252 Receiver Gauge	0-2500 PSIG
Pressurizer Level	(LT-72)	W VX-252 Receiver Gauge	0-400 INCHES
RC Loop A Hot Leg Temp	(RC84A)	W VX-252 Receiver Gauge	60-650°F
RC Loop A Cold Leg Temp	(RC5B & RC6A)	W VX-252 Receiver Gauge	60-650°F)
RC Loop A Pressure	(PT-225)	W VX-252 Receiver Gauge	0-2500 PSIG
RC Loop B Hot Leg Temp	(RC85A)	W VX-252 Receiver Gauge	60-650°F
RC Loop B Cold Leg Temp	(RC7B & RC8A)	W VX-252 Receiver Gauge	60-650°F

Measured Parameter	Device Tag #	Display Device	Measured Range
RC Loop B Pressure *	(PT-226)	W VX-252 Receiver Gauge	0-2500 PSIG
Steam Generator Level * 1A	(LT-66)	W VX-252 Receiver Gauge	0-388 INCHES
Steam Generator Level * 1B	(LT-67)	W VX-252 Receiver Gauge	0-388 INCHES
Incore Thermocouple * Indication		Westronic Recorder **	0-900°F
D/G Serv Wtr Pmp Disch Flow	(FT-73)	W VX-252 Receiver Gauge	0-750 GPM
Aux Serv Wtr Pmp Test Disch. Flow	(FT-71)	W VX-252 Receiver Gauge	0-2400 GPM
Aux Ser Wtr Pmp Suct. Press	(PG-435)	***	0-60 PSIG
Aux Ser Wtr Pmp Disch. Press	(PG-430)	***	0-2000 PSIG
Aux Serv Wtr Unit Disch. Press	(PG-434)	***	0-2000 PSIG
Aux Serv Wtr Pmp Suct. Temp	(TH102)	***	20-120°F
HVAC Serv Wtr Pump Disch. Flow	(FT-72)	***	0-75 GPM

* All three units measured parameters are identical

** Recorded parameters are from 5 incore thermcouples

*** There parameters are displayed locally at instruments only

B - Power System Parameters

Measured Parameters*	Device Tag #	Display Device	Measured Range
D/G & Switchgear Related Alarms		Beta Annunc. Panel	N/A
D/G Monitored Parameters		Westronics Recorder **	N/A
D/G Power Factor		W VX-252 Receiver Gauge	0.5-1.0-0.5
D/G VARS		W VX-252 Receiver Gauge	5 MVAR-0-5 MVAR
D/G Watts		W VX-252 Receiver Gauge	0-5000 KW

Measured Parameters*	Device Tag #	Display Device	Measured Range
Frequency		W VX-252 Receiver Gauge	55-65 HZ
Amps/Generator		W VX-252 Receiver Gauge	0-800 AMPS
Generator Voltage		W VX-252 Receiver Gauge	0-5000 VOLTS
OTSI BUSS Volts		W VX-252 Receiver Gauge	0-5000 VOLTS
Line Amps (OTSI Inc. Feed from B2T)		W VX-252 Receiver Gauge	0-800 AMPS
Motor Amps (Aux. Serv. Wtr Pump)		W VX-252 Receiver Gauge	0-300 AMPS
OTSI Watts (Inc. Feed from B2T)		W VX-252 Receiver Gauge	5 MW - 0 - 5 MW
INC BUSS (B2T) Volts		W VX-252 Receiver Gauge	0-5000 VOLTS
Load Ctr Transf OXSF Primary Amps		W VX-252 Receiver Gauge	0-300 AMPS

** Recorded parameters are D/G Engine 1 & Engine 2 Cylinder Exhaust temperature

17. Describe the means by which steam generator pressure is controlled for shutdown from the SSF. If the steam generator safety valves are the sole means of pressure control, provide the basis that valves are capable of operation for three and one-half days at the required duty cycle. Are other means of controlling steam generator pressure anticipated and available to assure shutdown without damage control measures?

Response

Steam generator pressure is controlled by the spring-type code relief valves which relieve to the atmosphere off the main steam header of each steam generator. These valves are expected, based on their operating history, to perform as designed and to maintain the steam generator within an acceptable pressure range for standby shutdown operation.

As a backup to the above, only one steam generator and its associated relief valves are needed to maintain the necessary secondary side heat sink requirements. If a problem occurs, this steam generator can be isolated and the remaining steam generator would be available.

18. Describe any features provided for periodic testing to assure that the SSF system would be available if required. What measures would be taken to assure that instrumentation and controls are operable and what frequency would instruments be calibrated?

Response

Provisions have been made for periodic testing of the SSF RC Makeup System and the SSF Auxiliary Service Water System as described in the Final Design Report (FDR) in Sections 3.2.4 and 4.2.2, respectively. Provided below is a detailed description of each system's test path:

SSF RC Makeup System Test Path: (Reference Figure 3.1 enclosed)

Suction is taken from the spent fuel pool through valve SSF-SF-82 into the suction side of the SSF RC Makeup Pump. The discharge of the pump passes through flow element FT 157 and then through the test path via valve SSF-HP-405. The flow then returns back to the spent fuel pool.

SSF Auxiliary Service Water System Test Path: (Reference Figure 4.1 enclosed)

Suction is taken from the embedded CCW line through valve SSF-CCW-266 into the suction side of the SSF ASW pump. The discharge of the pump passes through valve SSF-CCW-267 located in the test line. The test flow then passes through flow element FT 71 and then back into the CCW line.

Instrumentation and Controls:

Procedures addressing operability and calibration will be developed utilizing technical requirements based on appropriate standards and practices and will be put into format consistent with existing station procedures as described in Chapter 13 of the FSAR.

19. 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.

Response

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 consequences more severe than those analyzed in the FSAR.

B. Design Details Requested

1. Full size drawing for the following figures included in the final design report (FDR) (Duke letter of March 28, 1980)

   a. Figure 3-1
   b. Figure 4-1
   c. Figure 5-1 through 5-4
   d. Figure 6-1

Response

Drawings are enclosed. Please note that items a, b, and d represent the design concept presented in the FDR and reflect the evolution of design details.

2. P&I Drawing for instrumentation identified in Sections 3.2.3 and 4.2.3 of which are not shown on drawings noted in 1 above.

Response

P&I drawings were previously submitted as Figures 3-1 and 4-1 in the FDR. The only instrumentation that is not identified on Figure 3-1 or 4-1 (enclosed) are the following:

Reactor Coolant System Pressure: (PT 225, PT 226)

Reactor Coolant System Temperature: (RD-85A, -84A, -8A, -7B, -6A, -5B)

Pressurizer Water Level: (LT 72)

These instrumentation items are located on Figure 3-2 which was not included in the FDR but is enclosed in this response.

3. Electrical Schematics for following:

   a. Make up pump and valves listed in Section 3.2.2.3 of FDR.
   b. Pressurizer heater controls used in SSF design.
   c. Auxiliary service water pump and valves listed in Section 4.2.2.2 of FDR.
   d. HVAC and diesel engine service water pumps.
   e. Sump pumps
   f. Ventilation and Air Conditioning Systems

4. Layout drawing of SSF control panel.

Response

Current drawing and design details are on file in our offices. As has been the case in similar reviews, we recommend a visit to our office where all pertinent information and resources are available.