Docket Nos.: 50-498
and 50-499

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Dear Mr. Goldberg:

Subject: South Texas Project, Units 1 and 2 - Request for Additional Information - Power Systems (Mechanical)

The NRC staff has determined that additional information is required for the safety review of the South Texas Project operating license application as enclosed. The questions cover the mechanical aspects of review conducted by the Power Systems Branch and have been numbered 430.74 through 430.105.

The staff is available to discuss these questions and provide any needed clarification. We suggest a meeting to discuss the technical issues raised by the questions at your earliest convenience. Please contact the Project Manager (Mr. N. P. Kadambi at (301) 492-7272) if you have any questions.

Sincerely,

ORIGINAL SIGNED BY

George W. Knighton, Chief
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Division of Licensing

Enclosure:
As stated

cc: See next page

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ENCLOSURE

SUPPLEMENTAL REQUEST FOR ADDITIONAL INFORMATION
SOUTH TEXAS PROJECT
UNITS 1 AND 2 (50-498/499)
POWER SYSTEMS BRANCH
(MECHANICAL SECTION)

430.74 (8.3) Operating experience at two nuclear power plants has shown that during periodic surveillance testing of a standby diesel generator, initiation of an emergency start signal (LOCA or LOOP) resulted in the diesel failing to start and perform its function due to depletion of the starting air supply from repeated activation of the starting relay. This event occurred as the result of inadequate procedures and from a hang-up in engine starting and control circuit logic failing to address a built-in time delay relay to assure the engine comes to a complete stop before attempting a restart. During the period that the relay was timing out fuel to the engine was blocked while the starting air was uninhibited. This condition with repeated start attempts depleted starting air and rendered the diesel generator unavailable until the air system could be repressurized.

Review procedures and control system logic to assure this event will not occur at your plant. Provide a detail discussion of how your system design, supplemented by procedures, precludes and occurrence of this event. Should the diesel generator starting and control circuit logic, and procecures require changes, provide a description of the proposed modifications. (Refer to Request 430.96 for control air requirements) (SRP 8.3.1, Part II & III)

430.75 (9.5.2) The description of the intraplant and interplant (plant to offsite) communication systems is inadequate. Provide a detailed description for each communication system listed in Section 9.5.2.2 of the FSAR. The detailed description shall include an identification and description of each system's power source, a description of each system's components (headsets, handsets, switchboards, amplifiers, consoles, handheld radios, etc.), location of major component (power sources, consoles, etc.) and interfaces between the various systems (SRP 9.5.2, Parts II & III)

430.76 (9.5.2) In Section 9.5.2.2.3 of the FSAR you state that inservice inspection tests, preventative maintenance, and operability checks are performed periodically to prove the availability of the communication systems. Provide the frequency for these tests. (SRP 9.5.2, Part II and III)

430.77 (9.5.2) Section 9.5.2 of the FSAR describes the intraplant communication system at South Texas which is composed of five subsystems. They are the Public Address (PA), Telephone, Fuel Loading Communications, Maintenance Communication, and Two-Way Radio Systems. A number of areas in the plant are served by one or more of these systems. All

these systems are classified non-Class 1E. The PA and telephone systems are powered from Class 1E AC power system and the power sources for the other systems are undefined. Assuming a failure, non-availability, due to loss of power, or inability to use a system due to its interference with control instrumentation or equipment such as the radio system, of any or all of these systems following a seismic event, it is possible that portions of the plant may be without adequate communications for an extended period of time during the design basis event. This is unacceptable. It is a requirement that adequate communications be provided at all vital, hazardous, and safety related areas needed for the safe shutdown of the reactor and the evacuation of personnel in the event of a design basis event. Confirm this service is provided or modify your design to provide the necessary communication for postulated conditions above or justify the present design. (SRP 9.5.2, Parts I & II)

430.78 (9.5.3) Expand the lighting section of the FSAR to include a discussion of how lighting will be provided for those areas listed in requests 040.10 and 040.11 and illuminated by the DC emergency lighting system only, in the event of a sustained loss of offsite ac power (in excess of 8 hours and up to 7 days), or provide the rationale why lighting is not required in these areas. Include in your discussion what, if any, other areas would require lighting during a sustained loss of ac power, and how it would be provided. (SRP 9.5.3, Parts I & II)

430.79 (9.5.3) Sections 8.3.1 and 9.5.3 of the FSAR do not indicate how during accident and transient conditions the essential ac lighting system is connected to the emergency diesel generator bus. Identify whether the connection is manual or automatic. (SRP 9.5.3, Parts I & II)

430.80 (9.5.3) Provide a discussion on the protective measures taken to assure a functionally operable lighting system, including considerations given to component failures, loss of ac power, and the severing of lighting cables as a result of a accident or fire. (SRP 9.5.3, Parts I & II)

430.81 (9.5.3) RSP Section 9.5.3 of the FSAR describes the emergency lighting system which is composed of four subsystems. They are the 125 V dc, essential ac, 90 minute battery lighting, and 8 hour battery lighting systems. A number of areas in the plant are served by one or more of these systems. All these systems are classified non-Class 1E and receive power from the following sources: non-Class 1E station batteries for the dc lighting, the Class 1E emergency diesel generator for a few select areas of the plant and the non-Class 1E emergency diesel generator for the balance of the ac lighting. Assuming a failure or nonavailability of any or all of these systems following a seismic event, it is possible that portions of the plant particularly the control room may be without sufficient lighting or without lighting for an extended period of time during this design basis event. This is unacceptable. It is a requirement that adequate lighting be provided to all vital, hazardous, and safety related areas needed for the safe shutdown of the reactor and the evacuation of personnel in the event of any design bases accident. Conform this service is provided or

modify your design to provide this necessary lighting. (SRP 9.5.3, Parts I and II)

430.82 (9.5.3) You state in Sections 9.5.3.1 and 9.5.3.3 of the FSAR that illumination levels provided in the various areas of the plant either conform to or exceed that required in the Illumination Engineering Society (IES) Handbook. This statement is too general particularly for emergency lighting. Based on the guidelines in the IES Handbook (pages 2-11 and 2-45), the staff has determined that the plant emergency lighting for access and egress should be considered safety lighting for high hazards requiring visual detection and that a minimum of 10 foot candles at the work station is required to adequately control, monitor and/or maintain safety related equipment during accident and transient conditions and a minimum of 2 to 5 foot candles in the corridors which provide access to and egress from these areas. For those safety related areas listed in requests 040.10 and 040.11 and illuminated by the dc lighting systems only verify that the minimum of 10 foot candles at the work station being met. Also verify that the 10 foot candle minimum at the work station is being met in those safety related areas illuminated by the ac emergency system. Verify that the access and egress corridors are illuminated by a minimum of 2 to 5 foot candles. Confirm that the design provides the above or modify your design as necessary. (SRP 9.5.3, Parts I & II)

430.83 (9.5.3) Section 9.5.3 of the FSAR does not describe the inservice inspection tests. Prevention maintenance and operability checks that will be performed periodically to prove the availability of the emergency lighting systems. Provide this information. (SRP 9.5.2 Part II & III)

430.84 (9.5.4) (9.5.5) (9.5.6) (9.5.7) (9.5.8) In Section 9.5.3 of the FSAR you state that the South Texas design includes a nonsafety related emergency diesel generator that supplies power to various nonsafety related systems including portions of the emergency lighting lighting and possibly the communications during accident conditions. Emergency lighting and communication systems are necessary and vital to the operation and safe shutdown of the plant during all accident and transient conditions and, therefore, are required to be powered from an acceptable power source. In the event of a design basis earthquake, this nonsafety related power source is not considered available and results in loss of power to these vital systems. This does not meet the criteria and is, therefore, not acceptable. The applicant must show that adequate emergency lighting and communication systems are available for plant shutdown under any design basis accident condition. Confirm that these services are provided or revise your design accordingly. (SRP 9.5.2 and 9.5.3 Parts II & III)

430.85 (9.5.4) In the FSAR you state the primary fire protection system for the diesel generator fuel oil storage rooms is a foam-water sprinkler system. The foam-water sprinkler is a nonsafety related system, and is not qualified for seismic events. The system is seismically supported. Show that spurious actuation or inadvertent manual actuation of the

foam-water sprinkler fire protection system will not affect diesel generator availability and operability. (SRP 9.5.4, Part III)

430.86 (9.5.4) In Section 9.5.4.3 of the FSAR you state that the emergency flood protected fill connection for the fuel oil storage tanks is located on the DG building roof. It is also stated that "a hose could then be routed to the roof via an existing hose reel for tank filling when the flood level has receded. Provide the following:

a. State whether the "existing hose reel" is located inside or outside the DG building. Describe any other uses (fire protection, etc.) associated with this hose and hose reel.

b. Assuming the emergency fill connection must be used to refill the fuel oil storage tanks, describe how fuel oil will be delivered to the site during flood conditions and the procedures that will be used in refilling the storage tanks during flood conditions and non-flood conditions. The procedures should include fuel hose routing and fire watches.

(SRP 9.5.4, Parts I, II & III)

430.87 (9.5.4) Section 9.5.4.2 of the FSAR states that "a nitrogen inerting system for each tank compartment" is being provided. This statement is too general to evaluate this system. Provide a more detailed description of the nitrogen inerting system. The description should include seismic classification, piping quality group classification, a failure modes and effects analysis, and procedures to be used during emergency refill operations (if different from normal refill operations) with the system in operation and in the failed mode. (SRP 9.5.4, Parts I, II & III)

430.88 (9.5.5) Section 9.5.5 indicates that the function of the diesel generator cooling water system is to dissipate the heat transferred through the: 1) engine water jacket, 2) lube oil cooler; 3) engine air water coolers, 4) fuel oil cooler, and 5) governor lube oil cooler. Provide the design margin (excess heat removal capacity) included in the design of major components and subsystems. (SRP 9.5.5, Parts II & III)

430.89 (9.5.5) Provide the results of a failure mode and effects analysis to show that failure of a piping connection between subsystems (engine water jacket, lube oil cooler, governor lube oil cooler, ECWS, and engine air intercooler) will not degrade engine performance or cause the failure of more than one diesel generator. (SRP 9.5.5, Parts II & III)

430.90 (9.5.5) Indicate the measures to preclude long-term corrosion and organic fouling in the diesel engine cooling water system that would degrade system cooling performance, and the compatibility of any corrosion inhibitors or antifreeze compounds used with the materials of the system. Indicate if the water chemistry is in conformance with the engine manufacturers recommendations. (SRP 9.5.5, Parts I & III)

430.91 (9.5.5) Recent licensee event reports have shown that tube leaks are being experienced in the heat exchangers of diesel engine jacket cooling water systems with resultant engine failure to start on demand. Provide a discussion of the means used to detect tube leakage and the corrective measures that will be taken. Include jacket water leakage into the lube oil system (standby mode), lube oil leakage in to the jacket water (operating mode), jacket water leakage into the engine air intake and governor systems (operating or standby mode). Provide the permissible inleakage or outleakage in each of the above conditions which can be tolerated without degraded engine performance or causing engine failure. The discussion should also include the effects of jacket water/service water systems leakage. (SRP 9.5.5, Parts II & III)

430.92 (9.5.5) Operating experience indicates that diesel engines have failed to start on demand due to water spraying on locally mounted electronic/electrical components in the diesel engine starting system. Describe what measures have been incorporated in the diesel engine electrical starting system to protect such electronic/electrical components from such potential environment. (SRP 9.5.5, Parts II & III)

430.93 (9.5.5) Proper operation of the standby diesel generator during accident and transient conditions requires that heat removal capability is restored before the diesel engine exceeds its operating design temperature limits. In Section 9.5.5.2 of the FSAR you state that the essential cooling water system (ECWS) will begin operation within a specific time lapse from initial DG startup, but you do not state the time period between engine start and ECWS startup. Provide the following :

a. The time interval between the diesel engine start and the opening of any ECWS/DG inlet valve or ECWS water pump restart (assuming loss of offsite power) whichever is longer.

b. Results of an analysis which shows that cooling will be restored to the diesel engine before it overheats.

(SRP 9.5.5, Part II & III)

430.94 (9.5.4) Diesel generators in many cases utilize air pressure or air flow devices to control diesel generator operation and/or emergency trip functions such as air operated overspeed trips. The air for these controls is normally supplied from the emergency diesel generator air starting system. Provide the following:

a) Expand your FSAR to discuss any diesel engine control functions supplied by the air starting system or any air system. The discussion should include the mode of operation for the control function (air pressure and/or flow), a failure modes and effects analysis, and the necessary P&ID's to evaluate the system.

b) Since air systems are not completely air tight, there is a potential for slight leakage from the system. The air starting system uses a nonseismic air compressor to maintain air pressure in the seismic Category I air receivers during the standby condition. In case of an accident, a seismic event, and/or loop, the air in the air receivers is used to start the diesel engine. After the engine is started, the air starting system becomes nonessential to diesel generator operation unless the air system supplies air to the engine controls. In this case the controls must rely on the air stored in the air receivers, since the air compressor may not be available to maintain system pressure and/or flow. If your air starting system is used to control engine operation, with the compressor not available, show that a sufficient quantity of air will remain in the air receivers, following a diesel engine start, to control engine operations for a minimum of seven days assuming a reasonable leakage rate. If the air starting system is not used for engine control describe the air control system provided and provide assurance that it can perform for a period of seven days or longer. (SRP 9.5.6, Part III)

430.95 (9.5.6) Expand your FSAR to discuss the procedures that will be followed to ensure the air dryers are working properly and the frequency of checking/testing. (SRP 9.5.6, Parts II & III)

430.96 (9.5.6) You state in Section 9.5.6.2 of the FSAR that "Each independent starting system if designed to be capable of starting the engine five times from an initial pressure of 275 psig without recharging the starting air tanks. Some information has been provided on system pressure alarms, compressor cut-in and cut-out. Provide additional information as follows:

a) Expand Section 9.5.6 of your FSAR to clarify the statement regarding the capability of the air start system of five consecutive start attempts without recharging the air receivers. A successful diesel generator start is defined as the ability of the air start system to crank the diesel engine to the manufacturer's recommended RPM, to enable the generator to reach voltage and frequency and begin load sequencing in 10 seconds or less. With the receiver at the low pressure alarm setting and without recharging provide a tabulation of receiver pressure and diesel engine starting times for each of the five consecutive starts. In addition describe the sequence of events when an emergency start signal exists. State whether the diesel engine cranks until all compressed air is exhausted, or cranking stops after a preset time to conserve the diesel starting air supply. Describe the electrical features of this system in Section 8.0 of the FSAR (in the appropriate subsection).

b) Provide the pressures at which the following alarms actuate: low pressure alarm, and high pressure alarm.
(SRP 9.5.6, Part II)

430.97 (9.5.7) You state in Section 9.5.7 of the FSAR that the lube oil to lubricate the engine is stored in the engine lube oil sump tank. During diesel engine operation a certain amount of lube oil is consumed as part of the combustion process. Since the diesel generator may be required to operate for a minimum seven days during a loss of offsite power or accident condition, sufficient lube oil should be stored in the sump and/or site to preclude diesel generator unavailability due to lack of lube oil. Provide the following:

a) Provide the normal lube oil usage rate for each diesel engine under full load conditions, the lube oil usage rates which would be considered excessive, and the sump capacity.

b) Show with the lube oil in the sump at the minimum recommended level (low level alarm setting) that the diesel engine can operate without refilling the lube oil sump for a minimum of seven days at full rated load. If the sump tank capacity is insufficient for this condition, show that adequate lube oil will be stored onsite for each engine to assure seven days of operation at rated load.

c) If the lube oil consumption rate becomes excessive, discuss the provisions for determining when to overhaul the engine. The discussion should include the procedures used and the quality of operator training provided to enable determination of excessive L.O. consumption rate. (Refer to requests 430.28 and 430. 100 for additional requirements on procedures and training).

(SRP 9.5.7, Parts II & III)

430.98 (9.5.7) In Section 9.5.4 you state that diesel fuel oil is available from local distribution sources, but you have not discussed the availability of the lube oil. Identify the sources where diesel quality lube oil will be available and the distances required to be travelled from the source(s) to the plant. Also discuss how the lube oil will be delivered onsite under extremely unfavorable environmental conditions. (SRP 9.5.7, Parts II & III)

430.99 (9.5.7) Assume an unlikely event has occurred requiring operation of a diesel generator for a prolonged period that would require replenishment of lube oil without interrupting operation of the diesel generator. Provide the following:

a) What provisions will be made in the design of the lube oil system to add lube oil to the sump. These provisions shall include procedures or instructions available to the operator on the proper addition of lube oil to the diesel generator as follows:

1. How and where lube oil can be added while the equipment is in operation.

2. Particular assurance that the wrong kind of oil is not inadvertently added to the lubricating oil system, and

3. That the expected rise in level occurs and is verified for each unit of the lube oil added.

b) Verification that these operating procedures or instructions will be posted locally in the diesel generator rooms.

c) Verification that personnel responsible for the operation and maintenance of the diesel are trained in the use of these procedures. Verification of the ability of the personnel on the use of the procedures shall be demonstrated during preoperational tests and during operator requalification.

d) Verification that the color coded, or otherwise marked, lines associated with the diesel-generator are correctly identified and that the line or point for adding lube oil (when the engine is on standby or in operation) has been clearly identified.
(SRP 9.5.7, Parts II & III)

430.100 (9.5.7) In Section 9.5.7.2 of the FSAR you state that to ensure quality lube oil is present in the lube oil system and that it is within manufacturer's specifications, the lube oil will be sampled at regular intervals. Specify the sampling intervals. (SRP 9.5.7, Part II)

430.101 (9.5.7) In Figure 9.5.8-1 of the FSAR a crankcase breather system is shown. Provide a more detailed description of the system including operating modes, and power sources. If this system is necessary during normal operation of the diesel engine (prevention of crankcase explosion) we require that the mechanical portions of this system be designed to Seismic Category I ASME Section III Class 3 (Quality Group C) requirements and the electrical systems (if any) to Class 1E requirements. The portion of the system extending outside the diesel generator building shall be tornado missile protected. Describe any other systems or devices used to preclude or mitigate the consequences of a crankcase explosion. (SRP 9.5.7, Part II)

430.102 (8.3.1) (9.5.6) (9.5.7) (9.5.8) Diesel generators for nuclear power plants should be capable of operating at maximum rated output under various service conditions. No load and light load operations, the diesel generator may not be capable of operating for extended periods of time under extreme service conditions or weather disturbances without serious degradation of the engine performance. This could result in the inability of the diesel engine to accept full load or fail to perform on demand. Provide the following:

a) The environmental service conditions for which your diesel generator is designed to deliver rated load including the following:

Service Conditions

(a) ambient air intake temperature range-°F

(b) humidity, max-%

b) Assurance that the diesel generator can provide full rated load under the following weather disturbances:

(1) A tornado pressure transient causing an atmospheric pressure reduction of 3 psi in 1.5 seconds followed by a rise to normal pressure in 1.5 seconds.

(2) A low pressure storm such as a hurricane resulting in ambient pressure of not less than 26 inches Hg for a minimum duration of two (2) hours followed by a pressure of no less than 26 to 27 inches Hg for an extended period of time (approximately 12 hours).

c) In light of recent weather conditions (subzero temperatures), discuss the effects low ambient temperature will have on engine standby and operation and effect on its output particularly at no load and light load operation. Will air preheating be required to maintain engine performance? Provide curve or table which shows, performance verses ambient temperature for your diesel generator at normal rated load, light load, and no load conditions. Also provide assurance that the engine jacket water and lube oil preheat systems have the capacity to maintain the diesel engine at manufacturer's recommended standby temperatures with minimum expected ambient conditions. If the engine jacket water and lube oil preheat systems' capacity is not sufficient to do the above, discuss how this equipment will be maintained at ready standby status with minimum ambient temperature.

d) Provide the manufacturer's design data for ambient pressure vs engine derating.

e) Discuss the effects of any other service and weather conditions will have on engine operation and output, i.e., dust storm, air restriction, etc.

(SRP 8.3.1, Parts II & III; SRP 9.5.5, Part III; SRP 9.5.7, Parts II & III; and SRP 9.5.8, Parts II & III)

430.103 (9.5.8) Recent events have shown that not all aspects in the design of the DG combustion air intake and exhaust system have been taken into account resulting in the pressure losses through the system exceeding manufacturer's limitations. Verify that the pressure losses through your system do not exceed manufacturer's recommendations taking into consideration pipe losses, and pressure drops associated with the filters, silencers, and intake and exhaust structure openings. (SRP 9.5.8, Part III)