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SUBJECT: Forwards response to 970430 NRC RAI re licensee 960711,5% thermal power uprate submittal.RAI primarily involves impact of uprating on balance of plant electrical sys.

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AEP
INDIANA
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June 18, 1997 AEP:NRC:1223D

Docket No.: 50-316

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Donald C. Cook Nuclear Plant Unit 2
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
REGARDING POWER UPRATE AND RELATED CHANGES

This letter and its attachment constitute a response to the April 30, 1997, NRC request for additional information concerning our July 11, 1996, 5% thermal power uprate submittal (AEP:NRC:1223). The request for additional information primarily involves the impact of the uprating on the balance of plant electrical system.

This letter is submitted pursuant to 10 CFR 50.30(b) and, as such, includes an oath statement.

Sincerely,

E E Fitzpatrick

E. E. Fitzpatrick
Vice President

SWORN AND SUBSCRIBED BEFORE ME
THIS 18th DAY OF June 1997
Linda L. Boelcke
Notary Public

My Commission Expires 1-21-2001

LINDA L BOELCKE
Notary Public, Berrien County, MI
My Commission Expires January 21, 2001

vlb

Attachment

c: A. A. Blind
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NRC Resident Inspector
J. R. Padgett

A001

250022

ATTACHMENT TO AEP:NRC:1223D

REQUEST FOR ADDITIONAL INFORMATION
REGARDING POWER UPRATE AND RELATED CHANGES RESPONSE

Question No. 1a

"Information provided in attachment 7 - Balance of the Plant Evaluation / Electrical Systems, indicates that the generator step-up transformer will require limiting reactive power operation during the winter months to meet power uprate conditions. It also indicates that this operation has been reviewed and is found to be acceptable. Please provide additional details on limiting reactive power requirements for the power uprate conditions."

Response to Question No. 1a

The unit 2 generator provides reactive mega volt amperes (MVAR) for voltage control on the system. As such, its present reactive capability of 675 MVAR is used in load flow studies and system operations planning. It is not possible to maintain this 675 MVAR capability during winter months because after the power uprating a potential overloading of the generator step-up transformer (1326 mega volt amperes on a transformer rated 1300 mega volt amperes) could occur. This would only be a concern during the winter because warmer lake water temperatures during the rest of the year prevent the generator from achieving its maximum capability. To avoid exceeding the transformer rating at full power output, the reactive capability will be kept to a maximum of 621 MVAR.

Question No. 1b

"Information provided in Attachment 7 - Balance of the Plant Evaluation / Electrical Systems indicates, as a result of the power uprate, the iso-phase bus temperature will increase slightly. The temperature increase will reduce the margin between the normal operating point and alarm point. Additional temperature monitoring will be required because of reduced margin. If warranted, based upon operating experience at the power-uprated condition, future bus duct cooling system will be pursued. Please provide additional information on the temperature monitoring, expected increase in iso-phase bus temperature, and future additional cooling."

Response to Question No. 1b

Because of the expected increase in air temperature, we will be monitoring the actual bus temperature to ensure the appropriate limits are maintained. Minor alterations will be made to the iso-phase to facilitate temperature surveys. In addition to the present temperature monitoring equipment and indication, a fresnel lens will be installed where a sight glass currently exists. This will allow us to use an infrared camera and analyze actual bus and bolted connection temperatures. Baseline data will be taken before the uprate, and we will also do performance testing after the uprate. This data will be used to reset the existing monitoring equipment and add additional cooling as necessary.

The bus duct system was reanalyzed and it was estimated that there will be a 3.3°C (6°F) increase in the maximum air temperature. This would result in temperatures below the maximum 80°C. This will be validated as part of the uprate to ascertain whether or not changes are required (e.g., alternate cooling water source with a lower operating temperature, fan changes, etc.).

Actual bus and duct temperature data cannot be gathered until the uprate is completed. If changes to the duct cooling are required,

reactive loading will be limited until the appropriate changes are made.

Question No. 1c

"Information provided in Attachment 7 - Balance of the Plant Evaluation / Electrical Systems indicates that the stator water coolers in the generator/exciter were identified as requiring replacement to support the power-uprated operation. A follow-up evaluation of the heat loads on these coolers determined one cooler could meet the expected demand, with the option of using the second unit as a standby unit if necessary. Please explain if it is still necessary to replace stator water coolers and what has changed in the stator to require only one cooler and not both."

Response to Question No. 1c

The stator water coolers are counterflow shell-in-tube heat exchangers providing cooling for the water circulating in the generator stator windings. There are two coolers, each sized to provide 4280 kW heat removal at rated conditions. The heat loads are the armature losses and core losses. At current conditions, the cooler load is approximately 4339 kW. The cooler load at the uprated condition of 3600 MWt is projected by the original equipment manufacturer to be 4684 kW.

The limiting factor for these coolers is the temperature of the stator cooling water, to and from the stator as a function of turbine auxiliary cooling water. We are within the recommended temperature limits at our current operating conditions and will be below the upper limits after we uprate to 3600 MWt with one cooler in operation. This is determined by extrapolating the current operating data for these coolers and using the historical turbine auxiliary cooling water temperatures and comparing to the uprated heat load. The result is an actual performance higher than the coolers' rating. The primary reason these coolers have been performing above rated conditions is that the rated stator cooling water flow for these coolers is 789 gpm and our flow diagram flow is 872 gpm. Actual flow measurements are in the range of 925 to 950 gpm.

Therefore, only one of the current design stator water coolers is required for operation at full load at either 3411 or 3600 MWt. This provides two 100% capacity coolers. If there is performance degradation in the these coolers, or if additional cooling is required, it is possible to operate both coolers at the same time. This is the normal mode of operation for unit 1, by design.

Question No. 2

"Provide impact of power uprate on the diesel generator load profile during loss of offsite power (LOSP) and LOSP with LOCA."

Response to Question No. 2

The equipment that will be experiencing increases in load as a result of the unit uprating is limited to the following balance of plant motors: hotwell pump, condensate booster pump, and heater drain pump. These components are not powered from the safety buses, nor are they operated during loss of offsite power (LOSP) or LOSP with loss of cooling accident (LOCA). Therefore, because the

diesel generator only supplies power to safety related equipment connected to the safety buses, the diesel generator load profile will not be impacted during LOSP, or LOSP with LOCA as a result of the unit uprating.

Question No. 3

"Indicate the impact of power uprate on grid stability and reliability."

Response to Question No. 3

We have reviewed the 65 MW increase of unit 2 on the transmission system and determined the impact is insignificant and beneficial in terms of stability and reliability.

Question No. 4

"Provide the impact of the load, voltage, and short circuit values for power uprate conditions at all levels of the station auxiliary electrical distribution system."

Response to Question No. 4

The equipment that will be experiencing increases in load as a result of the unit uprating is limited to the following balance of plant motors: hotwell pump, condensate booster pump and heater drain pump. These motors are designed with a continuous service factor rating of 1.15, which allows them to continuously operate with horsepowers up to 15% above nameplate at rated voltage and frequency.

The new demand (horsepower) required of these motors for the unit uprating equates to the following new demand service factors (new demand ÷ nameplate):

Motor	Qty	Nameplate (hp)	Old Demand (hp)	New Demand (hp)	New Service Factor
Hotwell Pump	2	1000	980	1010	1.01
Condensate Pump	2	1750	1640	1700	0.97
Heater Drain Pump	2	1250	1230	1252	1.002

Because all buses will be operating at their rated voltage and frequency, and all of the above motors are well within their service factor ratings (< 1.15), there will be insignificant impacts on these loads from the above increases in demand as a result of the unit uprating.

The uprating will have no impact on the voltage and short circuit values because generator, motor, and transformer MVA ratings, and transformer tap settings and impedances are not changing from their present values. The parameters used to calculate relay setpoints are not changing and are still valid for the uprate conditions.

These include generator, motor, and transformer MVA ratings, tap settings, and impedances.

Question No. 5

"Provide analysis results which demonstrate that there has been no reduction in margin due to power uprate between the trip setpoints for loss of voltage or degraded grid voltage protective scheme installed on safety buses and transient voltage on safety buses that are expected following a reactor trip due to LOCA."

Response to Question No. 5

The uprating involves an electrical demand increase of 224 hp, spread across six different motors and four different buses. The bus that has the potential to experience the most change is 2D, because it has a heater drain, hotwell, and condensate booster pump connected to it. This bus could experience an increase of 112 hp (15 amperes). Two 2000 MCM aluminum cables, per phase, connect TR -201CD to bus 2D over a distance of 67 feet. The voltage drop associated with a 15 amp increase over this cable configuration is less than 0.003%. Therefore, there is insignificant impact on the undervoltage protection (degraded grid and loss of voltage) margin during steady state operation.

Bus voltage, as affected by transient conditions (motor starts), is bounded by the effect of locked rotor current experienced during motor starts. Because locked rotor current is unaffected by motor loading, there is no impact on the undervoltage protection margin during transient conditions.

Question No. 6

"Provide information on environmental qualification for safety-related electrical equipment located in a harsh environment (containment, main steam valve room, and auxiliary building subject to high radiation due to post-LOCA recirculatory fluids) due to power uprate. Discuss in detail the safety-related electrical equipment, the continued environmental qualification, and the process for establishing qualification for increased temperature, pressure, humidity, and radiation levels for the power uprate."

Response to Question No. 6

6.1 Humidity

The uprate does not affect the humidity qualification as the required material is already qualified at 100% humidity.

6.2 Radiation

The increase in radiation due to recirculatory fluids is proportional to the power uprate. The existing environmental qualification (EQ) radiation parameters were established with margins above previous radiation levels. These radiation qualification values were then compared against the new radiation levels to determine if they envelope the uprated environmental conditions. A review of unit 2 EQ documentation indicated all devices have a qualified radiation level greater than uprated condition radiation

levels. Therefore, the current environmental radiation qualifications remain valid for the uprate conditions.

6.3 Temperature

The temperature increase for the uprate was evaluated by reviewing the existing high energy line break (HELB) analyses for possible changes. The review determined that the relevant HELB analyses performed since the original FSAR appendix O assumed uprated conditions, with one exception. This review found that a chemical volume control system letdown line break in the engineered safety features ventilation system shaft room (vestibule room 28) with the uprate conditions will result in an area temperature increase of less than 10°F above the previously calculated value. The current peak environmental condition resulting from the letdown line break in this area is a temperature of 122.4°F. A review was then made of EQ documentation to determine if the equipment could be qualified at this higher temperature. The EQ margins over earlier temperatures were sufficiently large that the new temperatures do not affect the EQ.

Question No. 7

"Verify and discuss if the assumptions used in station blackout coping analysis are valid for the power uprate conditions, particularly as they relate to heat-up analysis, equipment operability, battery capacity, etc."

Response to Question No. 7

The ability of Cook Nuclear Plant to cope with a station blackout (SBO) for four hours was assessed using NUMARC 87-00, with the results submitted in letters AEP:NRC:0537D, dated April 14, 1989, AEP:NRC:0537E, dated March 30, 1990, and AEP:NRC:0537G, dated December 4, 1991. Specifically, the following six issues had been reviewed at that time. A review of the effect of the unit 2 uprate on each of these issues is presented below.

7.1. Condensate Inventory For Decay Heat Removal (NUMARC 87-00, Section 7.2.1)

The purpose of this section is to ensure that there is adequate condensate inventory for decay heat removal during a station blackout (SBO) for the four hour coping duration required for Cook Nuclear Plant. With the current plant operating limits, a calculation had been performed which calculated that the condensate inventory required for removal of sensible heat and four hours of decay heat is approximately one half of the minimum condensate inventory required by technical specifications. For the power uprate, a new calculation was performed to determine the condensate inventory requirements assuming the more limiting RCS conditions. The new analysis resulted in a slight increase in the condensate inventory required for decay heat removal during a SBO, but still much less than the technical specification (T/S) requirement (94,640 gallons vs. 175,000 gallons) for the condensate storage tank (T/S 3.7.1.3).

7.2. Class 1E Battery(ies) Capacity (NUMARC 87-00, Section 7.2.2)

The purpose of this section is to ensure that each plant has adequate battery capacity to support decay heat removal during a SBO for the required coping period. No changes to the battery loads have been created by the power uprate. Therefore, the existing battery load profile is still applicable for the unit uprating.

7.3. Compressed Air (NUMARC 87-00, Section 7.2.3)

The purpose of this section is to ensure that air operated valves required for decay heat removal have sufficient reserve air or can be manually operated under SBO conditions for the specified duration (four hours). In response to the SBO rule, a review of the air operated valves used by the auxiliary feedwater system (i.e., those air operated valves on the condensate supply to the turbine driven auxiliary feedwater pumps (TDAFP), the discharge from the TDAFP, and the steam supply to the TDAFP), and for core heat dissipation (i.e., the steam generator power operated relief valves) had been conducted. That review concluded the air operated valves necessary to cope with a SBO for four hours will either be operated manually, or have sufficient backup sources (e.g., nitrogen) available. Valves requiring manual operation or backup sources for operation have been identified in plant procedures. For the auxiliary feedwater system, it was determined the failed position for air operated valves in this system did not impact system operation (i.e., no valve operation is required). However, the steam generator power operated relief valves (PORVs) will need to be cycled for core heat dissipation. The steam generator PORVs can be operated by either utilizing control air from the non-blacked out unit if it is available, the manual lineup of nitrogen bottles, or by manual operation (i.e., use of handwheels). Additional backup nitrogen bottles are available for use if needed. These conclusions will not be changed by the unit 2 uprate. In addition, implementation of the power uprate will not result in the need for additional air operated valve operation for decay heat removal following a SBO.

7.4. Effects of Loss of Ventilation (NUMARC 87-00, Section 7.2.4)

The purpose of this section is to determine the average steady state temperature in dominant areas containing equipment necessary to achieve and maintain safe shutdown during a SBO. NUMARC 87-00 was followed to identify the SBO dominant areas of concern for Cook Nuclear Plant. These areas were identified as the turbine driven auxiliary pump rooms, the control room instrumentation distribution (CRID) inverter rooms, the control rooms and inside containment.

In March 1990, SBO heat-up conditions in containment were verified to be enveloped by LOCA/HELB criteria for the equipment required to function during a SBO. A conservative calculation was performed at that time to obtain a containment temperature profile during a four hour SBO. A subsequent evaluation focused on the lower containment, as it contains instrumentation required to function during a SBO. The EQ characteristics of the SBO instruments, e.g., steam

generator and pressurizer level transmitters, were reviewed against the resultant temperatures. The SBO temperature was calculated to be considerably lower than the instrument EQ temperature profiles and the calculated LOCA/HELB conditions. A new calculation of conditions that could affect EQ have been performed at 3600 MW for inside containment. Based on evaluation of the uprate conditions, it has been concluded the uprate SBO conditions will remain within the bounds of the uprate containment LOCA/HELB analysis.

To determine the impact of the uprating on the turbine driven auxiliary feedwater pump rooms, the existing SBO loss of ventilation calculation for the turbine driven auxiliary feed pump rooms was reviewed. This review researched the steam temperature value used in performing the calculation to determine if there would be an impact on the results based on the uprating. The previous calculations were performed using the maximum design temperature of 556°F, which corresponds to a saturation pressure of 1085 psig, the maximum setpoint for the steam generator safety valves. Because the steam generator safety valve setpoints will not change, it has been concluded that the existing SBO loss of ventilation analysis for the turbine driven auxiliary feedwater pump rooms remains valid.

To determine the impact of the uprating on the CRID inverter rooms and control rooms, the existing SBO loss of ventilation calculations for those rooms were reviewed. The existing calculations for the CRID inverter rooms and control rooms used design basis temperatures of the auxiliary building and the surrounding environment, as well as heat transfer and heat generated by equipment in the area under analysis. Based on evaluation of the uprate conditions, the design basis temperatures for the areas under review will not be affected by the uprate. Furthermore, the uprate conditions will not result in an increase to the equipment heat loads for the areas under review. Therefore, it is concluded the CRID inverter room and control room temperatures will not change, and the existing SBO loss of ventilation analyses for those rooms remain valid.

7.5. Containment Isolation (NUMARC 87-00, Section 7.2.5)

The purpose of this section is to ensure that the appropriate containment isolation can be provided during a SBO. Appropriate containment isolation is defined as the capability for valve position indication and closure of certain containment isolation valves. In response to the SBO rule, in order to ensure that containment integrity can be provided under SBO conditions, it was verified that the containment isolation valves that must be capable of being closed or that must be operated (cycled) under SBO conditions can be positioned (with indication) independent of the preferred and blacked-out unit's class 1E power supplies. For the unit 2 uprate, it was verified that the operation of those required containment isolation valves is not impacted by the subject power uprating.

7.6. Reactor Coolant System (RCS) Inventory (NUMARC 87-00, Section 2.5)

The purpose of this section is to ensure the volume of liquid in the RCS is sufficient to maintain reactor core coverage throughout the four hour coping period. As outlined in section 2.5 of NUMARC 87-00, this determination includes losses of RCS inventory due to a) normal system leakage; b) RCS letdown; and, c) reactor coolant pump seal leakage. In addition, shrinkage of the reactor coolant resulting from steam generator cooldown is also considered. Using these assumptions, a calculation was performed in 1989 that verified the core remained covered following a SBO. The leakage terms identified above have not been changed as a result of the power uprate. The only change resulting from the power uprate that affects the 1989 calculation is the initial average reactor coolant temperature. The slightly higher average temperature in the RCS for the uprated condition (581.3°F versus 573.8°F) results in a slightly lower initial RCS liquid mass. As such, a new calculation was performed for unit 2. The new calculation confirmed that, even with the uprated conditions, the unit 2 core will remain covered.