Nuclear

GPU Nuclear
100 Interpace Parkway
Parsippany, New Jersey 07054
201 263-6500
TELEX 136-482
Writer's Direct Dial Number:

April 30, 1981

Director
Nuclear Reactor Regulations
U. S. Nuclear Regulatory Commission
Washington, D. C.

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Degraded Grid Voltage Study

Your letter dated October 24, 1980 requested additional information concerning the Oyster Creek Degraded Grid Voltage Study. The Attachment to this letter provides our response to your letter.

If you should have any further questions, please contact Mr. James Knubel (201) 299-2264.

Very truly yours,

Ivan R. Finfrock, Jr.
Vice President

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<u>Oyster Creek Degraded Grid Voltage Study</u>
<u>Response to October 24, 1980 Request</u>

1. In the Aug. 11, 1980 submittal, the computations of voltage values included the 230/34.5 KV transformers. The inclusion of these transformers provides more accurate results. Previously, in the Nov. 1, 1979 submittal, the 34.5 KV grid was assumed to be an infinite bus. This change plus the revised conditions at Oyster Creek, as indicated in the response to Item No. 2 in the Aug. 11, 1980 submittal, has resulted in the setpoint voltage of 3635 volts for the second level undervoltage relays at Oyster Creek. This setpoint corresponds to grid voltage levels of 214.8 KV for Switchgear bus 1C and 216.3 KV for Switchgear bus 1D under the very conservative set of assumptions used for this analysis.

These grid voltage values do not reflect the effects of the installed voltage regulators or the load tap changers on the 230/34.5 KV transformers which feed the start-up transformers. Taking the voltage regulators into account, the grid voltage would have to decay 10% below the above listed grid voltage values in order for bus 1C or bus 1D to trip.

2. The grid voltage range of 212.75 KV to 238 KV contained in the Nov. 1, 1979 submittal was predicted by grid stability analysis. Subsequent to the submittal of Nov. 1, 1979, another grid stability analysis was performed. This later grid stability analysis predicted a grid voltage range of 214.82 KV to 242 KV. The Aug. 11, 1980 submittal contained these later grid stability analysis results.

It is our position that the installed voltage regulators enhance grid voltage at Oyster Creek sufficiently (± 10%) such that compliance with GDC-17 is maintained. Also, the load tap changers on the 230/34.5 KV transformers provide added assurance that there will be no spurious trips from a good offsite power source.

3. A review of the nameplate information for these equipment items yields the following results.

a. Core Spray Booster Pump is rated at 440 volts. Therefore, -10% corresponds to 396 volts. As a result, the computed value of 399 volts is above the allowed minimum value of 396 volts at the setpoint of the second level undervoltage relays.

b. Fuel Pool Filter Pump is rated at 460 volts. Therefore, -10% corresponds to 414 volts. As a result, the computed value of 398 volts is below the allowed minimum value of 414 volts at the setpoint of the second level undervoltage relays.

It was also stated in the Aug. 11, 1980 submittal that the Fuel Pool Filter Pumps are not considered to be important to reactor shutdown or cooldown and are not required to be run continuously. Therefore, the pumps could be off for extended periods and run only when voltage conditions permit.

c. CRD Feed Pump is rated at 480 volts. Therefore, -10% corresponds to 432 volts. As a result, the computed value of 402 volts is below the allowed minimum value of 432 volts at the setpoint of the second level undervoltage relays.

Based on the above findings, Burns and Roe, Inc. was consulted to analyze the Fuel Pool Filter Pumps and the CRD Feed Pumps. The purpose of this analysis was to evaluate the motor thermal overcurrent protection for the CRD Feed Pumps and the Fuel Pool Filter Pumps in order to establish the following:

1. Whether the existing overcurrent protection is adequate to preclude overheating damage in the motor windings due to undervoltage at their terminals in the event of a degraded grid voltage condition, prior to tripping of the undervoltage relays.

2. If the existing overcurrent protection cannot meet these requirements, whether it is feasible to achieve the required protection by readjusting or replacing the existing overcurrent protective devices.

As a result of the Burns and Roe analysis, the existing overload heaters for the Fuel Pool filter pumps shall be replaced by lower rated heaters in order to comply with the National Electric Code requirements for overcurrent protection. Since the Fuel Pool Filter Pumps are not considered to be important to reactor shutdown or cooldown, no further corrective action on these motors is contemplated. If necessary, these pumps could be shut off for extended periods and run only when voltage conditions permit.

The recommendation for the CRD feed pumps is to replace either the motors or the motor windings with those rated at 440 volts. This statement is based on the fact that it is not feasible to protect these motors from undervoltage by means of changing the overcurrent trip devices.

However, the Burns and Roe analysis does not take credit for the voltage regulators which are installed on the 34.5 KV buses at Oyster Creek. These regulators will maintain the voltage between 4100 and 4210 volts on 4160 volt buses 1A and 1B under the maximum loading conditions and for the lowest expected 230 KV grid voltage value.

Burns and Roe has also analyzed the Oyster Creek system assuming a voltage of 4100 volts on the 4160 volt buses and found that the lowest expected terminal voltage for the CRD feed pumps is 458 volts. This value is acceptable since it is above the 90% value of 432 volts. Therefore, the CRD feed pumps are adequately protected from thermal damage by the voltage regulators whenever the plant's electrical systems are connected to the start-up transformers.

When the plant's electrical systems are connected to the auxiliary transformer, credit cannot be taken for the voltage regulators. However, for this scenario, the plant is in operation and under normal off-peak conditions the 230 KV grid voltage is maintained at 1.026 per unit or about 236 KV. This compares favorably with the Burns and Roe analysis which lists 233.9 KV as being required to maintain 432 volts at the terminals of CRD feed pump 8B. During normal peak load conditions 1.035 per unit is maintained on the 230 KV grid. This results in voltages which are higher than those for the off-peak load condition. Therefore, under both normal peak and normal off-peak load conditions, the CRD feed pumps are not subjected to thermal damage.

However, there are some unusual conditions which may exist on the system which may cause problems for the CRD feed pumps. For example, a recent stability analysis of the Oyster Creek 230 KV bus reveals that the lowest expected voltage with Oyster Creek's generating unit on line would be 100.8% during worst operating conditions. These conditions consist of the assumption that Sayreville No. 4 is the only Southern Area generator on the line and that the Windsor-Lawrence 230 KV tie line is out of service. This condition corresponds to a grid voltage level of 231.84 KV which is less than the 233.9 KV value represented in the Burns and Roe analysis as being the minimum required to maintain 432 volts at the CRD feed pump's motor terminals. At this grid level of 231.84 KV, a voltage reading of 428 volts is found at the CRD feed pump's motor terminals.

It should also be noted that the probability of having only the Sayreville No. 4 generator on line at any time is about 2x10 . Therefore, this unusual occurrence is highly improbable. Also, the difference between the actual 428 volts and the required 432 volts is minimal (less than 1%) and should be offset by all the conservative assumptions used in the voltage analysis.

4. The computer calculated percent of full load used for field verification was 83% for Switchgear bus 1C and 97% for Switchgear bus 1D. All other buses were at 100% calculated full load.

At the time of the test, when the voltage readings were taken the following bus percent loadings were in effect. The test was performed on July 23, 1980 while the plant was operating.

a. 4160 V. Swgr. 1A: 70% computer = 100%
b. 4160 V. Swgr. 1B: 100% computer = 100%
c. 4160 V. Swgr. 1C: 71% computer = 83%
d. 4160 V. Swgr. 1D: 71% computer = 97%
e. 480 V. USS 1A2: 39% computer = 100%
f. 480 V. USS 1B2: 50% computer = 100%
g. 480 V. USS 1A3: 100% computer = 100%
h. 480 V. USS 1B3: 100% computer = 100%

5. As shown on the Attachment II of the Aug. 11, 1980 submittal, assumptions 1 & 2, the minimum voltage on the primary side of the control transformers which will guarantee all starters will pick up is 403 V. The setpoint for the undervoltage relays were selected to coincide with a minimum of 403 V at the MCC buses. Thus, the voltages at the MCC buses ensure the proper operation of all starters.

6. Table 5, of the Aug. 11, 1980 submittal, does not include MCC verification for the following reasons.

First, for analytical purposes, all the loads fed from a MCC connected to a Unit Substation or directly connected to a Unit Substation, are considered to be fed from the same bus. The justification for this assumption is that the feeders between the Unit Substations and the MCC's are relatively short and therefore their impedances are negligible. The impedances of the current limiting reactors, which some MCC's have, is lumped with the impedance of the entire associated Unit Substation. As a result, the values given in Table 2 of the Aug. 11, 1980 submittal for the Unit Substation are also the analytical voltages of the associated MCC's.

Second, as far as field verification of the analytical voltages is concerned, the voltages at the MCC's will be very close to those measured at the Unit Substations, since the MCC feeder cable impedances are negigible. In addition, the voltage drop across any reactor will be small because the loads on the MCC's are relatively small.

Table 5, of the Aug. 11, 1980 submittal, does not include worst-case motor terminal voltage verification for the following reasons.

The procedure for measuring the voltage at the individual motor terminals was so cumbersome that it was concluded that the amount of effort required did not justify the single result to be obtained (i.e. one voltage reading). The other voltage readings represented the verification of the site distribution system analysis at the three voltage levels 4160V., 480 V. and 120 V.

In addition, the analysis which was performed for Oyster Creek Nuclear Generating Station is the same computer program analysis which was submitted for Three Mile Island, Unit No. 2. It was also performed by the same engineering consultants. As a result, considering the test results which were obtained at Oyster Creek and the fact that the same analysis has been performed for other plants, it is our position that the validity of the analysis results has been adequately verified.