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DENTON,H.R. Office of Nuclear Reactor Regulation

SUBJECT: Forwards response to NRC 791212 questions & 800111 telcon re degraded grid voltage.

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January 31, 1980

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. R. W. Reid, Chief
Operating Reactors Branch No. 4

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

Dear Sir:

As requested by members of the Staff involved in a January 11, 1980 teleconference on degraded grid voltages, please find attached Duke Power Company's response to several questions which were informally provided to Duke on December 12, 1979 or brought up in the teleconference.

Very truly yours,

William O. Parker, Jr

RLG:scs

Attachment

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OCONEE NUCLEAR STATION

NRC Request for Information
Degraded Grid Voltage

1. What is the maximum and minimum allowable variation from your second level undervoltage setpoint? (Reference DPC letters July 21 and October 7, 1977).

   Response
   The undervoltage relays used in this particular application have a tolerance of ± 3% of setpoint.

   Additionally, in our January 11, 1980 telecon with the NRC, the voltage recovery time at the 4 KV level following the transfer of all normally running loads to the startup transformer and the starting of all required ES loads was requested. The dynamic simulation of the distribution system indicates that the 4 KV voltage level recovers to its steady-state condition in less than three seconds following the load transfer and starting requirements stated above. This voltage recovery time is representative of that seen by the undervoltage relays.

2. Do you have documentation to support your statement that the 600 and 208 VAC motor contactors will hold-in with the MCC voltages at 72 and 71% respectively?

   Response
   Duke Power Company has manufacturer's test documentation that shows that motor contactors of the types used in safety-related applications at Oconee will hold-in at voltages of 72% of nominal 600 V and 71% of nominal 208 V.

3. Do you have documentation to show that all of the safety related motor contactors (starters) will pick up and hold in under the worst case voltages?

   Response
   Duke Power Company has manufacturer's test documentation that shows that contactors of the types used in safety-related applications at Oconee will pick-up under the worst-case voltages predicted by our analysis. The capability for contactor hold-in is addressed in the response to Question 2.

4. Will the TOL's and/or other protection devices for the MOV's sustain the expected locked-rotor current for 5 to 6 seconds without interrupting the circuit?

   Response
   Thermal overload devices and molded-case circuit breakers used in safety-related MOV circuits are capable of withstanding the expected locked-rotor current for six seconds without interrupting the circuit.

5. Will all instrument and control equipment connected to the analyzed buses withstand the worst case voltages without degradation and/or loss of their required function? (Blowing fuses, etc.)

Response

Safety-related and non safety-related instrumentation which is used in plant protection and/or which is important in operating the plant and monitoring plant status is powered from battery-backed sources as shown in FSAR Figure 8-5. These battery-backed sources are not affected by degraded grid voltage.

Additionally, motor control center control power fusing has been tested at and below the worst-case voltages identified in our analysis. No interrupting action occurred during repetitious application of the postulated degraded voltage levels.

6. How will your periodic power system test verify the system analysis? When has the latest test been performed and does it verify the analysis results?

Response

The analytical methods used in the distribution system analysis will be verified by a comparison between measured voltage conditions at the station and calculated results of the test conditions. It is expected that the necessary analysis and comparison will be completed by March 15, 1980.

7. Do you have manufacturers documentation to show that the RBCU fan motor will start with the MCC voltage at 70 or 72%?

Response

The manufacturer of the RBCU fan motors has provided speed-torque curves for these motors which are based on actual performance test data. To show that the RBCU fan motor will start with its associated MCC voltage dipping to 72%, the speed-torque curve for the motor was extrapolated to 70% of nominal voltage. The motor speed-torque curve at 70% nominal voltage in conjunction with the motor load curve shows that the RBCU fan motor will start and accelerate to approximately 99% of rated speed. It is important to note that this analysis takes no credit for voltage recovery as the motor is accelerating.

The dynamic simulation of the distribution system indicates that the RBCU fan motor will start with the MCC voltage dipping to 72% of nominal and accelerate to rated speed in approximately five seconds. This reduced voltage start will not result in any degradation or loss of life to the motor since the motor is capable of withstanding rated locked-rotor current for 10 seconds.

8. In the January 11, 1980 telecon between Duke and NRC, the NRC asked that Duke respond to Item 3 of their Guidelines for Voltage Drop Calculations.

   3. All actions the electric power system is designed to automatically initiate should be assumed to occur as designed (e.g., automatic bulk or sequential loading or automatic transfers of bulk loads from one transformer to another). Included should be consideration of starting of large non-safety loads (e.g., condensate pumps).

   Response
   Position 3 of the NRC Guidelines for Voltage Drop Calculations states that the voltage analysis should consider the starting of a large non safety-related motor at a time following the transfer of all normally running loads to the startup transformer and the starting of all required ES loads (i.e., after steady-state conditions have been established on the power distribution system).

   An analysis has been performed considering the starting and running of a 2000 HP Condensate Booster Pump under the conditions described above. The analysis shows that the non safety-related pump will start and that its starting has no adverse effects on the already running loads. Figures 1 and 2 provide the voltage profiles for starting and running the Condensate Booster Pump in addition to the previously analyzed loads.

9. In the January 11, 1980 telecon between Duke and NRC, the NRC asked that Duke respond to Item 2 of their Guidelines for Voltage Drop Calculations.

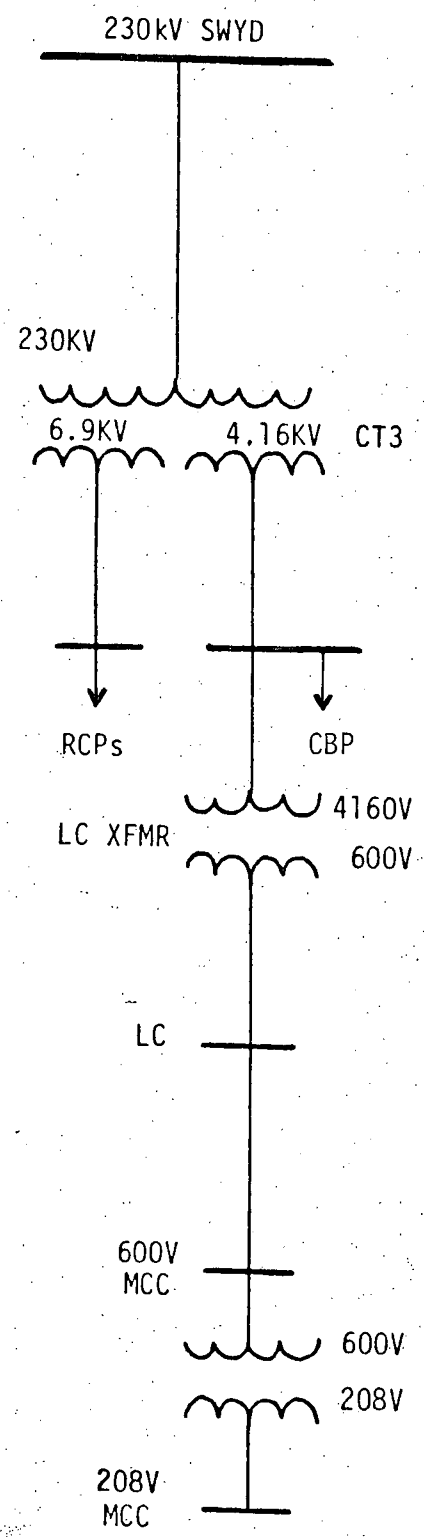
   2. For multi-unit stations a separate analysis should be performed for each unit assuming (1) an accident in the unit being analyzed and simultaneous shutdown of all other units at that station; or (2) an anticipated transient in the unit being analyzed (e.g., unit trip) and simultaneous shutdown of all other units at that station, whichever presents the largest load demand situation.

   Response
   The power system configuration described in Item 2 of the NRC's Guidelines for Voltage Drop calculations is presently being analyzed. The results of our analysis are expected to be available by March 1, 1980.

10. In the January 11, 1980 telecon between Duke and NRC, the NRC requested that Duke verify that the overvoltage cases presented in Duke's November 15, 1976 response are still applicable.

   Response
   A review of the overvoltage cases presented in our November 15, 1976 response indicates that the voltage profiles are still applicable.

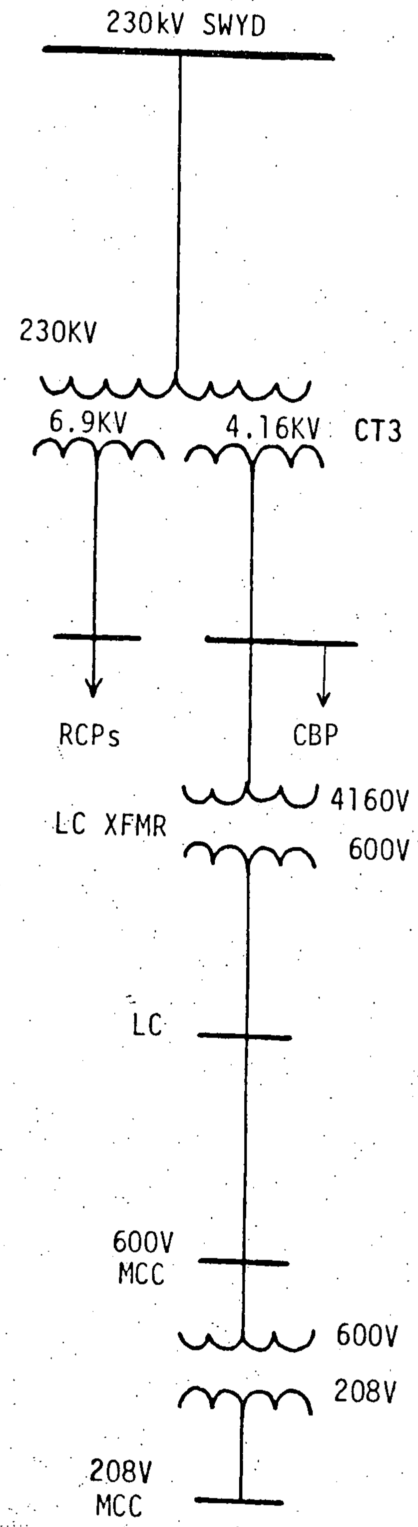
<u>Figure 1</u>




| LOCATION | BUS NAME | PER UNIT VOLTAGE NOMINAL BASE | VOLTAGE | PER UNIT VOLTAGE MOTOR BASE |
|---|---|---|---|---|
| SWYD | 230KV SWYD | 0.9435 | 217 KV | NA |
| 6.9KV SWGR | 3TA | 0.9279 | 6.40 KV | 0.970 |
| | 3TB | 0.9278 | 6.40 KV | 0.970 |
| 4.16KV SWGR | 3TC | 0.8618 | 3585 V | 0.896 |
| | 3TD | 0.8613 | 3583 V | 0.896 |
| | 3TE | 0.8610 | 3582 V | 0.895 |
| 600V LC | 3X8 | 0.8559 | 514 V | 0.893 |
| | 3X9 | 0.8544 | 513 V | 0.892 |
| | 3X10 | 0.8381 | 503 V | 0.875 |
| 600V MCC | 3XS1 | 0.8558 | 514 V | 0.893 |
| | 3XS2 | 0.8540 | 512 V | 0.891 |
| | 3XS3 | 0.8347 | 501 V | 0.871 |
| 208V MCC | 3XS1 | 0.8558 | 178 V | 0.890 |
| | 3XS2 | 0.8540 | 178 V | 0.888 |
| | 3XS3 | 0.8347 | 174 V | 0.868 |

VOLTAGES UPON STARTING CONDENSATE BOOSTER PUMPS AFTER STEADY STATE RE-ESTABLISHED

Figure 2




| LOCATION | BUS NAME | PER UNIT VOLTAGE NOMINAL BASE | VOLTAGE | PER UNIT VOLTAGE MOTOR BASE |
|---|---|---|---|---|
| SWYD | 230KV SWYD | 0.9435 | 217 KV | NA |
| 6.9KV SWGR | 3TA | 0.9371 | 6.47 KV | 0.980 |
| | 3TB | 0.9371 | 6.47 KV | 0.980 |
| 4.16KV SWGR | 3TC | 0.9040 | 3761 V | 0.940 |
| | 3TD | 0.9037 | 3759 V | 0.940 |
| | 3TE | 0.9036 | 3759 V | 0.940 |
| 600V LC | 3X8 | 0.8984 | 539 V | 0.937 |
| | 3X9 | 0.8971 | 538 V | 0.936 |
| | 3X10 | 0.8818 | 529 V | 0.920 |
| 600V MCC | 3XS1 | 0.8982 | 539 V | 0.937 |
| | 3XS2 | 0.8967 | 538 V | 0.936 |
| | 3XS3 | 0.8785 | 527 V | 0.917 |
| 208V MCC | 3XS1 | 0.8982 | 187 V | 0.934 |
| | 3XS2 | 0.8967 | 187 V | 0.933 |
| | 3XS3 | 0.8785 | 183 V | 0.914 |

VOLTAGES AFTER CONDENSATE BOOSTER PUMPS ARE RUNNING