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DENTON,H.R. Office of Nuclear Reactor Regulation

SUBJECT: Forwards addl info re util 791217 response to NRC 790808 ltr on adequacy of station electrical distribution sys voltges.

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May 28, 1980
AEP:NRC:00268B

Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74

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

Dear Mr. Denton:

The attachments to this letter provide additional information and responses to questions from your staff and their consultants concerning our response to the NRC generic letter of August 8, 1979 entitled "Adequacy of Station Electrical Distribution System Voltages" submitted on December 17, 1979 (AEP:NRC:00268). These matters were discussed with members of your staff and their consultants during recent telephone conversations.

The attached Technical Specifications requested by your staff will undergo the required reviews by our on-site and off-site review committees in the near future.

Very truly yours,

John E. Dolan
John E. Dolan
Vice President

cc: R. C. Callen
G. Charnoff
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ATTACHMENT 1

TO

AEP:NRC:00268B

This Attachment provides the responses to the questions received by telecopy on March 4, 1980, and during telephone conversations concerning the matter of the adequacy of station distribution system voltages.

Item 1:

The IMECo submittal fails to supply any voltage information on electrical systems below 600 volts. IMECo should determine the expected voltages and the subsequent effect on Class IE loads for all analyzed cases for the low voltage systems.

Response:

Electrical systems with voltages less than 600 volts at the Cook Plant are as follows:

A. 250 Volt Station Batteries

The voltage of the 250 volt station batteries is maintained at the required level by automatic battery chargers which maintain the required output voltage within 1% , with a range of input voltage of ± 10% from a nominal base of 575 volts. The station battery voltage is therefore independent of the station auxiliary voltage.

B. Motor Control Center Control Voltage

Each motor control center motor starter has a 600/240 volt control power transformer which supplies the control power necessary to energize the contactor coil. The secondary voltage of the transformer is a direct function of the 600 volt auxiliary bus. Each type and size of motor control center transformer/starter combination used at the Cook Plant was analyzed and in each case the starter would operate correctly for any case where the 600 volt bus voltage was at least 90% of the 575 volt base, except for certain size 3 and 4 starters. The circuits for these starters were revised to make them operable at 600 volt levels below 85% of the 575 volt base, as part of the reviews conducted as a result of the Millstone incident (grid degraded voltage issue).

C. Vital Instrumentation Buses

The 120 volt ac vital instrumentation buses are energized from inverters with regulated output transformers. The output voltage remains within the required tolerance for all ranges of 600 volt ac or 250 volt dc which result from the degraded grid conditions evaluated. The output voltage, therefore, is functionally independent of the offsite power source voltage.

D. 120/208 Volt Lighting and Miscellaneous Power

The lighting and miscellaneous power transformers are not used as primary sources for safety systems. The secondary voltage of these transformers follows the 600 volt primary voltage and the voltage range is adequate for the connected loads.

Item 2:

The NRC requested that all licensees review the electrical power systems to determine if there were any events or conditions which could result in the simultaneous or consequential loss of both required circuits to the offsite network to determine if any potential exists for violation of GDC-17. IMECo needs to supply the review.

Response:

The sources of offsite power to the safety buses are as follows:

A. During unit operation, the auxiliary buses receive their power from the normal auxiliary transformers which are connected to the unit generator.

B. The preferred offsite power source may be either the 345/34.5 kV Transformer 5 or the 34.5 kV tertiary winding of 765/345 kV Transformer 4. The power is supplied to the plant through two separate 34.5 kV circuits. One circuit supplies reserve auxiliary transformers 101AB (Unit 1) and 201AB (Unit 2). The other circuit supplies reserve auxiliary transformers 101CD (Unit 1) and 201CD (Unit 2).

C. The alternate offsite power source is the 69/4 kV transformer TR-12-EP supplied from the 69kV subtransmission system. The power is distributed to the safety trains of each unit through a circuit breaker at the 69/4 kV transformer bus, appropriate underground power distribution cables and a circuit breaker at each of the safety buses. The 69 kV system is separate from the Cook Plant high voltage switchyard.

The preferred offsite power source may be fed from either Transformer 4 or Transformer 5. In either case the source of power will be the 345 kV and/or the 765 kV transmission system. The power is supplied to the plant through two underground cables which share the same general underground route.

Each of the offsite power sources is separated from the other as much as possible. The failure or loss of one of the offsite power sources does not affect the operability of the other offsite power sources since there are no local power dependencies. This design meets GDC-17.

Item 3:

In Attachment No. 5 cases C1 through C3, IMECo has analyzed the Class IE System voltages when supplied by the Alternate Offsite Power Sources. The analysis considered the 69 kV transformer TR-12-EP supplying only one safety train in each unit. What interlocks or administrative procedures (as included in the Technical Specifications) prevent this source from supplying the same loads as the other sources?

If there are no interlocks or Technical Specification (LCO) restrictions to prevent the 69 kV transformer from supplying two trains on each of the two units and other operating loads, then the analysis for the 69 kV transformer should include all these loads.

Response:

An administrative procedure is being prepared and will be implemented by July 1, 1980 which will allow the operator of each Unit to connect one of the safety trains to the alternate power source without restrictions. The second safety train of the Unit may be connected and loaded only after verifying that the other Unit is not using the alternate power source and notifying the other Unit operator that both trains are in use.

A suggested Technical Specification as requested by members of your Staff is attached (see Attachment 3). We submit this proposed Technical Specication prior to the off-site and on-site committees review in order to keep on schedule the review of this matter.

ATTACHMENT 2

to

AEP:NRC:00268B

This Attachment responds to questions received from your staff and their consultants during telephone conversations held on March 3 and 7, 1980.

Item 1

Provide a description and the results of the test performed in accordance with your December 17, 1979 submittal (AEP:NRC:00268).

Response:

On 12/19/79 and 12/20/79 during a startup of Unit 2, while Unit 1 was at power, voltage, current and phase angle readings were made at the preferred offsite power substation bus, the alternate offsite power substation bus, and at the Unit 2 auxiliary buses. The measured values for current and voltages were employed as input data on the power distribution model previously used to compute the bus voltage levels at the auxiliary buses (submitted under AEP:NRC:00268). Specifically, the 345 kV bus measured voltage and current were used as the input in our power distribution model and the voltages at the 34.5 kV, 4 kV and 600 V auxiliary buses were computed. The difference between the measured and the calculated bus voltages is equal to the errors resulting from the simplifications of the model.

Likewise the measured 4 kV bus voltage was used as input on the model and the 600 V bus voltage was calculated. The difference between the measured and the calculated 600 V bus voltage is equal to the error resulting from the simplifications of the model.

Tables 1 and 2 present the measured and calculated bus voltages and the percentage error between the two. Table 1 presents the results obtained when the Preferred Offsite Power Source (Transformer #5) is used. Table 2 presents the results obtained when the Alternate Offsite Power Source is used.

TABLE 1

Verification for Reserve (TR5) Feed

Bus	Measured	Calculated	Error (%)
345 kV	355 kV	355 kV (input)	--
34.5	34.6 kV	34.6 kV	˜0
"AB"	3999 V	4064 V	-1.6
"CD"	3999 V	4064 V	-1.6
21A	574 V	582 V	-1.4
21B	563 V	574 V	-2.0
21C	564 V	575 V	-2.0
21D	572 V	581 V	-1.6

Reverification of 4 kV/600 volt model using a measured value of 3999 V on the 4 kV buses is as follows:

Bus	Measured	Calculated	Error (%)
21A	574 V	573 V	0.2
21B	563 V	565 V	-0.4
21C	564 V	566 V	-0.4
21D	572 V	571 V	0.2

TABLE 2

Verification for Emergency Feed (TR-12-EP)

Bus	Measured	Calculated	Error (%)
69 kV	70.56 kV	--	--
4 kV	4502 V	4546 V	-.98
21A	650 V	648 V	.31
21B	642 V	643 V	-.16

By studying the bus voltage profiles presented in Attachment No. 5 to AEP:NRC:00268, one sees that diminishing the steady state low voltage values by 1.6 percent in the worst case does not result in 4 kV bus voltages below 90%. This, however, would only result in an under-voltage alarm to annunciate in the control room which alerts the operator of an impending low voltage condition. The 600 volt equipment will operate satisfactorily at this voltage due to conservative design and the 1.15 service factor for the motors.

Attachment No. 1 to AEP:NRC:00268 had given the maximum expected value of grid voltage to be 1.07 p.u. (369 kV) at the 345 kV bus and 1.04 p.u. at the 765 kV bus. On December 25, 1979, a higher 345 kV voltage (370 kV) resulted at Cook Plant when unusually light loads were experienced in the system. In light of this recent experience a new grid load flow study was carried out using the same outage assumptions previously made to obtain a high voltage level of 369 kV. This time a calculated value of 372.4 kV was obtained for the high voltage level case. We input this higher voltage level for the 345 kV bus in our power distribution model and obtained a 4 kV bus voltage of 1.093 p.u. up from the previous 1.09 (worst high voltage case A1 in our previous submittal when feeding the auxiliaries through the Normal Auxiliary Source). When inputting this new high voltage through the Preferred Offsite Power Source (Transformer No. 4), a 4 kV bus voltage of 1.085 p.u. is obtained up from the previous 1.074 (worst high voltage case B1 in our previous submittal). Thus, the auxiliary bus voltage levels obtained from this very unusual operating condition were still within the acceptable range.

Item 2:

Provide the results of your analyses for the 69 kV alternate offsite power source at the voltage tap setting listed in Attachment 7 of your December 17, 1979 (AEP:NRC:00268) submittal.

Response:

Our submittal of December 17, 1979 (AEP:NRC:00268) transmitted the results of the voltage study required by the generic August 8, 1979 letter of Mr. Gammill. In Attachment 7 of that study the need to change voltage taps of the alternate offsite power source transformer (TR-12-EP) was identified and the change from the 67 kV to the 68.8 kV level was specified.

Your recent phone call requested the analysis of the offsite power source bus voltages with the revised taps. This information was transmitted in our December 17, 1979 submittal (AEP:NRC:00268) as part of its Attachment 5. The summary sheet for the 69 kV offsite power lists for each case C1, C2 and C3 the resulting voltages for the 70.6, 68.8 and 67.0 kV transformer taps. The voltages calculated for the 68.8 kV transformer tap are more closely in agreement with desired voltage levels than those resulting from the 67 kV voltage tap. A copy of the summary sheet previously submitted for the 69 kV power source is attached for your convenience as Table 3.

Item 3:

Provide additional information in support of your Technical Specification change request to revise the grid degraded voltage level and the loss of bus voltage level submitted in your AEP:NRC:00313 letter.

Response

A request to revise Table 3.3-4 of the Technical Specifications of both Units was previously submitted via our AEP:NRC:00313 submittal. Items 6.a of Unit 1 and 8.a of Unit 2 were revised to show loss of bus voltage level to occur at 3196 ± 18 volts with a 2 second time delay, and items 6.b of Unit 1 and 8.b of Unit 2 were revised to show grid degraded voltage level at 3596 ± 18 volts with a 2 minute time delay.

The above voltages represent the 80% and 90% voltage levels for loss of voltage and for grid degraded voltage respectively. In each case, the actual voltage value may be 0.55 percent below the nominal value if the maximum negative tolerance is used. This represents an acceptable practice because we firmly believe that the voltage level setpoints should be kept as low as possible to prevent unnecessary and unwanted automatic disconnecting of the safety systems from an acceptable and reliable source of auxiliary power and to prevent unnecessary challenges to the safety system of the Units (diesel generators).

The values selected for the proposed Technical Specifications were based on acceptable voltage levels for continuous operation of the motors considering the conservative application of the motors, the 1.15 service factor present in all of the safety grade motors, and the manufacturers recommended range of voltage for acceptable operation.

The values selected represent the best possible settings for a system the analysis of which has demonstrated adequate performance under the worst anticipated grid conditions.

Item 4:

Provide the Technical Specification revisions to Technical Specification 4.8.1.1.2 referenced on page 4 of your July 22, 1977 letter concerning the grid degraded voltage issue.

Response:

The revisions to Technical Specification 4.8.1.1.2 (both units) that are in accordance with our July 22, 1977 letter (page 4) are attached (see Attachment 4). For Unit 1 page 3/4 8-3 has an added requirement, No. b.3.c, as per our previously mentioned letter. Similarly, for Unit 2 page 3/4 8-3a has the added requirement No. 8.c (the former 8.c becomes 8.d). These revised Technical Specifications address your concerns and are consistent with our existing requirements for Units 1 and 2.

Again we submit these proposed Technical Specifications in an effort to continue your review of this matter, pending review by our off-site and on-site Safety Review Committees.

69 kV Offsite Power*

BUS	MACHINE BASE	HIGH VOLTAGE CASE #C1			LOW VOLTAGE STEADY STATE CASE #C2			LOW VOLTAGE MOTOR START CASE #C3		
		70.6/4.36	68.8/4.36	67/4.36	70.6/4.36	68.8/4.36	67/4.36	70.6/4.36	68.8/4.36	67/4.36
T11A T11B T11C T11D	4kV	1.09	1.11	1.14	.97	1.00	1.02	.94	.96	.99
11A 21A	575V	1.07	1.10	1.13	.95	.98	1.00	.92	.94	.97
11B 21B	575V	1.07	1.10	1.13	.95	.97	1.00	.92	.94	.96

* 69kV/4kV transformer is presently on the 67kV/4.36kV tap

This Table was previously submitted in Attachment 5 to our letter No. AEP:NRC:00268.

TABLE 3