UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 22 1978

Docket No. 50-368

Mr. William Cavanaugh III
Executive Director of Generation
and Construction
Arkansas Power & Light Company
P. O. Box 551
Little Rock, Arkansas 72203

50-368
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Dear Mr. Cavanaugh:

SUBJECT: ARKANSAS NUCLEAR ONE; INCIDENT ON SEPTEMBER 16, 1978; AUTO TRANSFER OF AUXILIARY LOADS ON BOTH UNITS TO STARTUP TRANSFORMER NO. 2 WITH CONSEQUENT OVERLOAD; CONFORMANCE TO GDC-17

As you know, the incident at Arkansas Nuclear One (ANO) on September 16, 1978 involving both Unit 1 and Unit 2, brought into question the conformance of ANO to General Design Criteria 17 (GDC-17) regarding the offsite power system design of the station. We have reviewed the ANO design in light of this incident, and our review has been conducted in close coordination and consultation with cognizant Arkansas Power and Light Company personnel and the NRC staff. This letter summarizes our evaluation and conclusions with respect to the actions required by you regarding Startup Transformer No. 2 (ST2) to bring the ANO offsite power system into conformance with GDC-17.

It is clear from the description of the pertinent features of the ANO offsite power design (Enclosure to this letter) that under certain conditions Startup Transformer No. 2 (ST2), which is in the "delayed access" offsite power circuit* (for both units) required by GDC-17, will be automatically overloaded due to a failure in the autotransformer which is the common element in the immediate access offsite power circuit which is also required by GDC-17. More specifically, the automatic overload, i.e., disabling, of ST2 will result when a failure of the autotransformer circuit occurs concurrently with any of the following station conditions and events:

*The design feature of automatic load transfer to ST2 which is provided actually makes this a second immediate access circuit, thus exceeding GDC-17 requirements with regard to access capability; however, the resulting overload of ST2 violates the independence requirements of GDC-17.

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1. both units in either startup or shutdown mode,

2. trip of one unit while the other is in either the startup or shutdown mode, and

3. simultaneous trip of both units.

GDC-17 requires, in part, that "Electric power from the transmission network to the onsite electric distribution system be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions." Since in the ANO design a failure in the immediate access offsite power circuit results in failure of the delayed access circuit, we conclude that the ANO offsite power system design is not in conformance with GDC-17.

We have already indicated to you that we will require that Unit 2 be in compliance with General Design Criteria-17 prior to NRC authorization for Unit 2 operation in Mode 2 (Startup). Acceptable options for attaining conformance with GDC-17 include:

1. Replacement of Startup Transformer No. 2 with one capable of carrying the worst case combination of automatically transferred loads.

2. Defeat of all capability for automatic transfer of loads to Startup Transformer No. 2.

3. Defeat of capability for automatic transfer of selected loads such that Startup Transformer No. 2 will never experience an overload condition (including excess voltage drop resulting in unacceptable voltage at the safety buses) due to the worst case combination of the retained automatic load transfer capability.

Acceptable means of implementing Option 3 above include: (1) defeat of automatic load transfer in one unit while retaining it in the other, or (2) partial defeat of automatic load transfer in either or both units.

Also, procedural implementation of Option 2 or 3 utilizing existing switching capabilities (as opposed to a design change) would be acceptable. Such procedural implementation should include written procedures for (1) defeat of the required automatic switching capability, (2) manual load shedding and switching including manual loading required to make use of ST2 as the delayed access offsite power circuit for either or both units, and (3) logging of the status of automatic load switching at least once every two weeks and whenever a breaker alignment is changed.

Unrestricted operation of Unit 2 (and Unit 1 insofar as automatic load transfer to ST2 is concerned) will be permissible provided the procedural requirements are incorporated in your plant operating procedures. Also, the NRC Office of Inspection and Enforcement will verify the acceptability of your procedures prior to Mode 2 operation.

Finally, as stated to you in several discussions we require that you provide the worst case combination of loads which would be automatically transferred to ST2 and verify that the total loading is within the rated loading of ST2.

We request your immediate reply to our concerns as stated above and respond prior to your scheduled date for Mode 2 (Startup) operation.

Please call us if you have any questions regarding these matters.

Sincerely,

John F. Stolz

John F. Stolz, Chief
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Enclosure:
Description of the Offsite
Power System

cc: See page 4

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ENCLOSURE

Description of the Offsite Power System
Design for Arkansas Nuclear One
Units 1 and 2

The following design features of the Arkansas Nuclear One (ANO) station are pertinent to the evaluation of the design for conformance to GDC-17, in light of the incident which occurred on September 16, 1978.

1) Each of the two units has a dedicated unit auxiliary transformer (UAT) and a dedicated startup transformer (ST) each of which can supply all a-c power to all the unit auxiliaries, both safety and non-safety. The UAT's are supplied from their respective unit generator; the two ST's are both supplied through a single auto-transformer which also interconnects the 500 KV and 161 KV sections of the station switchyard.

2) A backup startup transformer, Startup Transformer No. 2 (ST2), is provided which can serve both units. This transformer is supplied directly from the 161 KV section of the switchyard. However, it does not have the capacity for carrying the full auxiliary loads of both units.

3) On unit trip, all the unit auxiliary loads will be transferred automatically from its UAT to its ST. This will occur in both units, independently.

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4) When unit auxiliary loads are being carried by the respective ST and this source of power is lost for any reason, all the unit auxiliary loads will be transferred automatically to the backup ST 2. This also will occur in both units, independently.

5) When both units are being supplied by their respective ST's and the common source of power to the ST's (the autotransformer) is lost, then the auxiliary loads of both units will be automatically transferred to ST2. This will overload ST2 (exceed MVA rating) and also produce excess voltage drop resulting in a degraded voltage condition at the buses (safety and non-safety) of both units.

6) With the existing design, the overloading of ST2 will result automatically on failure of the autotransformer circuit feeding the two dedicated startup trasnformers, when the failure occurs concurrently with the following conditions or events:

   a) both units in either the startup or shutdown modes of operation,

   b) trip of one unit while the other is in either the startup or shutdown mode of operation, and

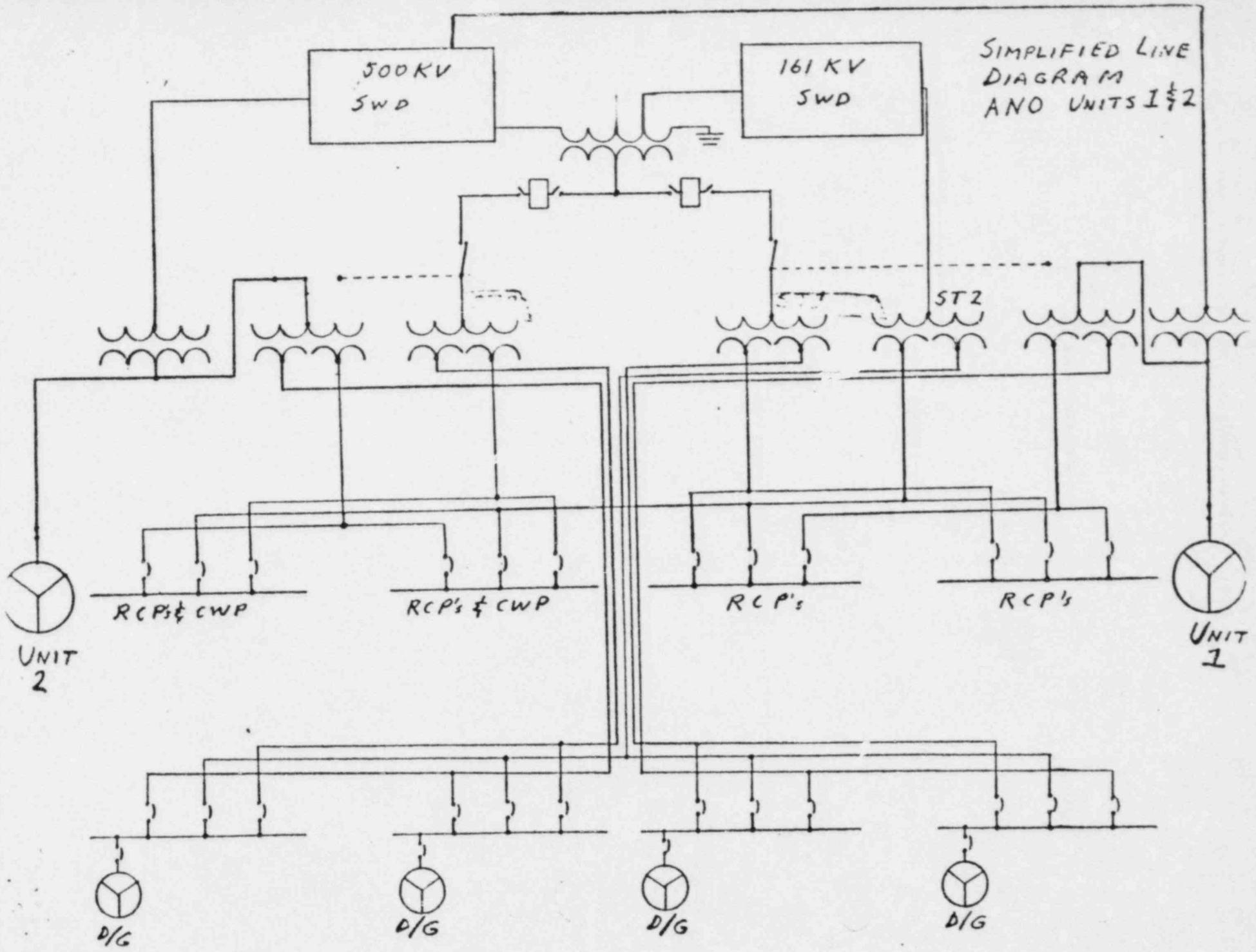
   c) simultaneous trip of both units.

7) The Millstone fix for degraded grid voltage conditions which includes a second level of undervoltage trip (at approximately 92% of nominal) was installed in Unit 2; this fix is scheduled for installation in Unit 1 at the next refueling outage. It should be noted that the Millstone fix is intended to protect the onsite safety related distribution systems from a degraded grid voltage condition not against degraded voltage due to overload of a startup transformer (although it is also effective in this regard). Therefore, the Millstone fix is necessary in order to meet the GDC-17 requirements for independence between the offsite and onsite power systems. However, the Millstone fix is not considered pertinent to the evaluation of the offsite system design for conformance to the GDC-17 requirement for independence between the two required offsite power circuits. In this case, the design feature in question is the automatic overloading of one of the required offsite power circuits to both units on failure of the other offsite circuit.

It is noted that item 6(b) above covers the incident which occurred at ANO on September 16, 1978. Specifically, this incident was

initiated by a spurious trip of Unit 1 while Unit 2 was in the startup mode. This resulted in automatic transfer of the Unit 1 auxiliary loads from its UT to its ST. Since Unit 2 was already on its ST, this transfer loaded the autotransformer with the full auxiliary loads of both units, resulting in trip of an autotransformer overcurrent relay (which had not been adjusted for two unit operation) and consequent opening of the circuit breakers feeding the two ST's. Loss of the ST's automatically transferred the auxiliary loads of both units to ST2 exceeding its MVA rating and producing a degraded voltage at the auxiliary buses (safety and non-safety) of both units. The overcurrent protective relaying for the autotransformer has since been corrected to preclude recurrence of this type of failure.

The above description does not address those aspects of the September 16, 1978 incident or plant design which are not pertinent to the evaluation of the offsite power system for conformance to GDC-17.


SIMPLIFIED LINE DIAGRAM AND UNITS 1 & 2
500 KV SWD
161 KV SWD
ST1
ST2
RCP's & CWP
RCP's & CWP
RCP's
RCP's
UNIT 2
UNIT 1
D/G
D/G
D/G
D/G