ARKANSAS POWER & LIGHT COMPANY
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

October 30, 1981

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Director of Nuclear Reactor Regulation
ATTN: Mr. J. F. Stolz, Chief
Light Water Reactors Branch #1
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Degraded Grid Voltage
(File: 1510)

Gentlemen:

In your September 1, 1981, response to our letter of July 7, 1981, a requirement to do a degraded grid voltage test was reiterated. However, as stated in our July 7, 1981, letter and subsequent telephone conversations we have not been able to justify the expense of such a test on a safety or cost/benefit basis. Therefore, as discussed in our October 19, 1981, telecon we are restating and summarizing our position on the degraded grid voltage test requirement.

The General Electric computer code used in the ANO-1 analyses has been used at other nuclear facilities and was compared with the Bechtel "Voltanal" computer code and approved by the Bechtel Q.A. program. Therefore, assurance has been given that the General Electric computer code is accurate and appropriate for the degraded grid voltage analyses.

The inputs to the computer model were obtained from actual factory tests on the specific class of transformers used in the plant. Nameplate data was not the source of such information. All other inputs were conservative and have previously been described in our March 13, 1979 submittal (attached) to document the information given in the NRC Staff presentation of February 27, 1979. This information is quite detailed and should be reviewed to understand the magnitude of the conservatisms.

In summary, the physical protective hardware as currently installed and tested (in accordance with the Technical Specifications) will function at the proper time and voltage level to assure protection of safety

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equipment irrespective of computer voltage predictions. An actual plant degraded grid voltage test could result in the potential to identify areas of conservatism that could be eliminated. It would not, however, result in an improvement in plant safety. Therefore, the cost of the degraded grid voltage test can not be justified on the basis of an improvement in safety. Based on the above, AP&L does not plan to do additional testing beyond that currently required by our Technical Specifications.

Very truly yours,

David C Trimble

David C. Trimble
Manager, Licensing

DCT:MCS:sc

ARKANSAS POWER & LIGHT COMPANY
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

March 13, 1979

1-039-7
2-039-3

Director of Nuclear Reactor Regulation
ATTN: Mr. Robert W. Reid, Chief
Division of Operating Reactors
Branch #4
ATTN: Mr. John F. Stolz, Chief
Lightwater Reactory
Branch #1
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Arkansas Nuclear One-Units 1&2
Docket Nos. 50-313, 50-368
License Nos. DPR-51, NPF-6
GDC-17, Millstone
(File: 1510, 2-1510)

Gentlemen:

The following information is provided to document the information presented in our meeting with the Staff on February 27, 1979, and to answer questions that arose during the meeting.

Item 1. Show by calculational analysis the minimum voltage levels that would exist on each 4160V and 480V ESF bus if a LOCA were to occur, paying special attention to the voltage transients during the starting of each ESF load. State all assumptions, describe the calculational scheme, and evaluate the significance of the calculational results.

Item 2. Repeat Question #1 with the assumption that ST-1 is not available and all ANO-1 loads are automatically transferred to ST-2.

Item 3. Repeat Question #1 with the assumption that ST-3 is not available and all ANO-2 loads are automatically transferred to ST-2.

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Response: The initial conditions for the voltage studies are shown on Attachment 1. Conservatism incorporated in the analyses is shown on Attachment II. The calculational method is shown on Attachment III. The Acceptance Criteria for voltages at the safety busses is shown on Attachment IV. Attachment V shows the results of the analyses for ANO-1.

Upon a Full House Transfer of ANO-1 loads to Startup Transformer #2 (SU2) the resulting Steady State Loads would be as shown on the first line. If a postulated LOCA (generating an ES signal) were to occur before, during or after the transfer to SU2, the resultant transient voltages would be as shown on the T=5-20 second portion of the Attachment V. The T=S.S. line represents the steady state voltages comprised of house loads and safety loads. These voltages are within the acceptance criteria.

Attachment VI represents the results of the same analyses for ANO-2.

Item 4. Justify, in terms of human factors engineering concepts, the desire that NRC allow credit for manual operator actions to overcome the apparent design inadequacy of ST-2 to accommodate its function for the present configuration and the proposed configuration.

Response: General Design Criteria #17 states in part:

". . .an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety."

"Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits . . . one of these circuits shall be designed to be available within a few seconds following a loss of coolant accident. . ."

Our understanding of GDC-17 is that only one of the two required offsite circuits must be available by a "fast transfer" and that the second source is considered a delayed source (e.g. manual access). We further understand that the GDC is concerned only with safety loads.

Based on this, we believe our current manual access to SU2 is allowed by the GDC. We further state that since SU2 will provide adequate power, with no unacceptable voltages, while supply both ANO-1 and ANO-2 full safety loads simultaneously, that the transformer design is not inadequate.

Item 5. An interlock between ANO-1, and ANO-2, and ST-2 has been proposed.
(a) Can the operation/maloperation/failure of any part of the interlock (including each sensor) cause both ANO-1 and ANO-2 loads to be applied to ST-2?

(b) Can the operation/maloperation/failure of any part of the interlock (including each sensor) prevent the manual loading of ANO-1 or ANO-2 ESF loads onto ST-2?

Response: Attachment VII shows our conceptual design for the interlocking mechanism. The interlock only affect the automatic portion of the system. Manual overide is always available. The specific answer to each of the above items is "no."

Item 6. What is the equivalent undervoltage setpoint at the 4160V buses coordinated with your proposed setpoint at a value of 92% of rated voltage on the 480V buses?

Response: With no load on the 480V bus, the voltage on the 4160V bus necessary to maintain 92% of 460V on the 480V bus, is 91.69% of 4000V. As the load is increased on the 480V, the voltage on the 4160V bus must increase to maintain 92% of 460V on the 480V bus. This is shown on Attachment IX.

Item 7. Describe how the proposed undervoltage sensor on the 480V buses will detect all faults on the station service transformer, the 480V ESF systems, and unacceptable voltage degradation on the 4160V ESF systems.

Response: As shown on Attachment VIII, 92% of 460V is the minimum acceptable for continuous operation of the 480V system. The 4160V bus must be at or above 91.69% of 4000 V to assure acceptable voltage at the 480V busses. 91.69% of 4000 V is above the minimum required for the 4160V system. Therefore, for any fault upstream of the 480V system, degraded voltage would first be evidenced on the 480V system. Placing the undervoltage relay on the 480V system therefore provides direct protection at the point at which an undervoltage would first occur if an undervoltage condition was to occur.

Item 8. Provide the results of your analyses which supports your letter of October 25, 1978, for ANO-1.

Response: Attachment X shows those results. All the voltages (S.S. and transient) are acceptable.

Item 9. Can Startup Transformer #2 provide adequate power with acceptable voltages for a shutdown of one unit concurrent with a postulated LOCA on the other unit?

Response: The actual loads necessary to safely shut down ANO-1 or 2 are a subset of the total safety loads. SU2 will provide full safety loads for both units simultaneously. Therefore, the response to the question is "yes."

Item 10: Is the rating assumed, for Startup Transformer #2, in the analysis the FOA rating and if so justify?

Response: The thermal ratings assumed in the analyses are FOA ratings. Power for transformer cooling is available from both units, one source from ANO-1 and the other from ANO-2. The transfer from one source to the other is automatic on loss of voltage of either source. Only one source is needed at any time.

Item 11: Do your plant operating procedures provide adequate information to prevent accidental manual overloading of startup transformer #2?

Response: Our current procedures address manual loading of the startup transformers under certain conditions. We are currently reviewing those procedures for their adequacy and will revise them as appropriate should our review determine they are inadequate.

Very truly yours,

for Donald A. Rueter

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Attachments

INITIAL CONDITIONS FOR VOLTAGE STUDY

1. AUTO TRANSFORMER IS OUT

2. TIE BETWEEN 500 KV AND 161 KV SYSTEMS IS OUT

3. 161 KV SYSTEM IS INTACT

4. MILLSTONE MODIFICATIONS ON ANO-1 ARE COMPLETE

5. FAST TRANSFER TO ST 1/ST 3 IS NOT SUCCESSFUL

6. MINIMUM VOLTAGE ON 161 KV SYSTEM OF 1 P.U.

7. MINIMUM ACCEPTABLE VOLTAGE AT MOTOR TERMINALS

    RUNNING - 90% (MOTOR BASE)

    STARTING - 80% (MOTOR BASE)

8. INTERLOCKS INSTALLED TO KEEP BOTH UNITS FROM ACCESSING

    ST 2 AUTOMATICALLY

CONSERVATISM

1. ASSUMED AUTO TRANSFORMER REMOVED

2. RATED H.P. VICE OPERATING H.P.

3. USED HIGHER THAN MEASURED LOADS ON 480 V. SYSTEM

4. USED ARITHMETIC SUM VICE VECTORIAL SUM FOR 480 V. SYSTEM.

VOLTAGE CALCULATIONS

COMPUTER ANALYSIS

BECHTEL PROGRAM FOR DATA CONVERSION AND COMPILATION

BECHTEL, GE, AND PHIL. ELEC. CO. POWER FLOW PROGRAM FOR
PROBLEM SOLUTION

RESULTS ANALYZED, EVALUATED AND QAD

MINIMUM ACCEPTABLE VOLTAGES

ON BUSSES

SYSTEM	MOTOR BASE	RUNNING LOAD	STARTING LOAD
6.9 KV BUS	6.6 KV	0.91 P.U.	0.82 P.U.
4.16 KV BUS	4.0 KV	0.91 P.U.	0.82 P.U.
430 V BUS	460 V	0.92 P.U.	0.86 P.U.

BUS VOLTAGES (MOTOR BASE)

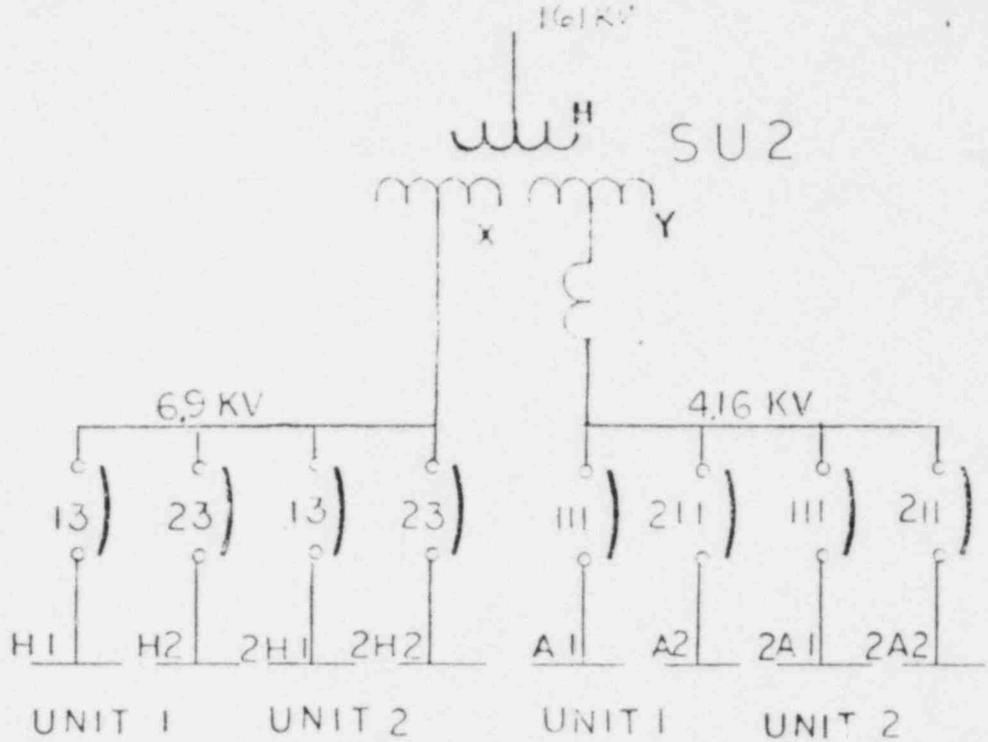
ANO - 1

	6900 V	4160 V	4160 V	480 V	480 V
FULL HOUSE - S.S. (NO ES)	1.032	1.006	1.006	1.009	1.009
ES					
T = 5	1.028	0.977	0.977	0.877	0.919
T = 10	1.028	0.978	0.978	0.917	0.930
T = 15	1.031	1.000	1.000	0.941	0.954
T = 20	1.029	0.9828	0.9828	0.927	0.940
T = S.S.	1.031	1.000	1.000	0.945	0.962

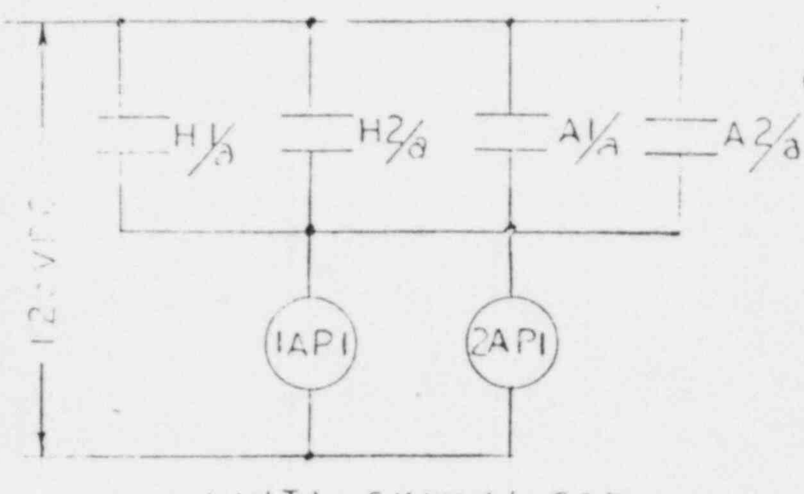
BUS VOLTAGES (MOTOR BASE)

ANO - 2

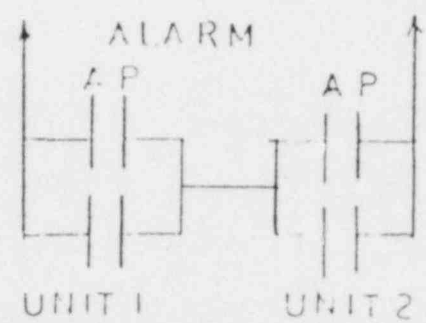
	6900 V	4160 V	4160 V	480 V	480 V
FULL HOUSE - S.S. (NO ES)	0.972	0.965	0.965	0.926	0.926
ES					
T = 0	0.998	1.011	1.011	0.929	0.929
T = 10	0.992	0.951	0.951	0.918	0.918
T = 15	0.993	0.959	0.956	0.928	0.926
T = 25	0.992	0.953	0.953	0.908	0.908
T = 50	0.996	0.993	0.993	0.904	0.904
T = 70	0.996	0.998	0.995	0.934	0.906
T = 80	0.996	1.000	1.000	0.959	0.937
T = 90	0.993	0.948	0.981	0.897	0.929
T = S.S.	0.996	1.00	1.003	0.958	0.957



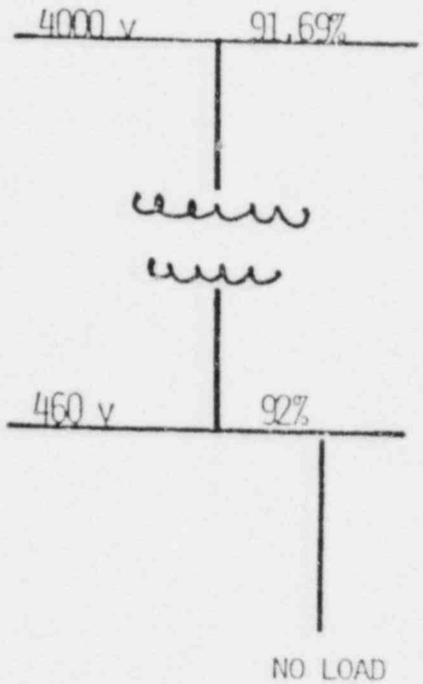
1AP1, 2AP1 N.O. CONTACTS IN SERIES WITH CLOSE AUTOMATIC TRANSFER LEG OF EACH BREAKER IN UNIT TWO.

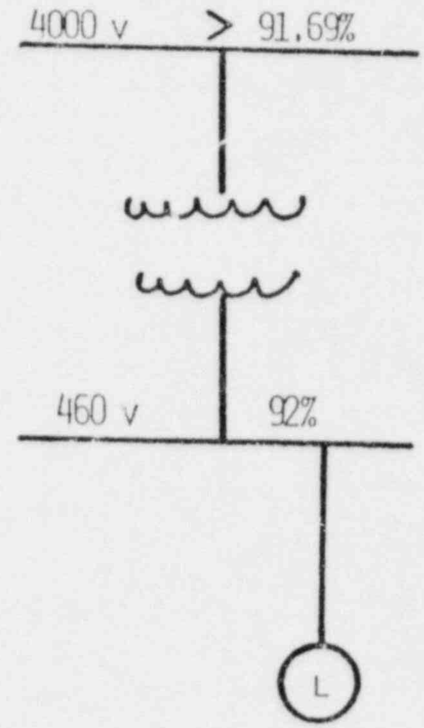


UNIT 1 - SIMILAR FOR 2



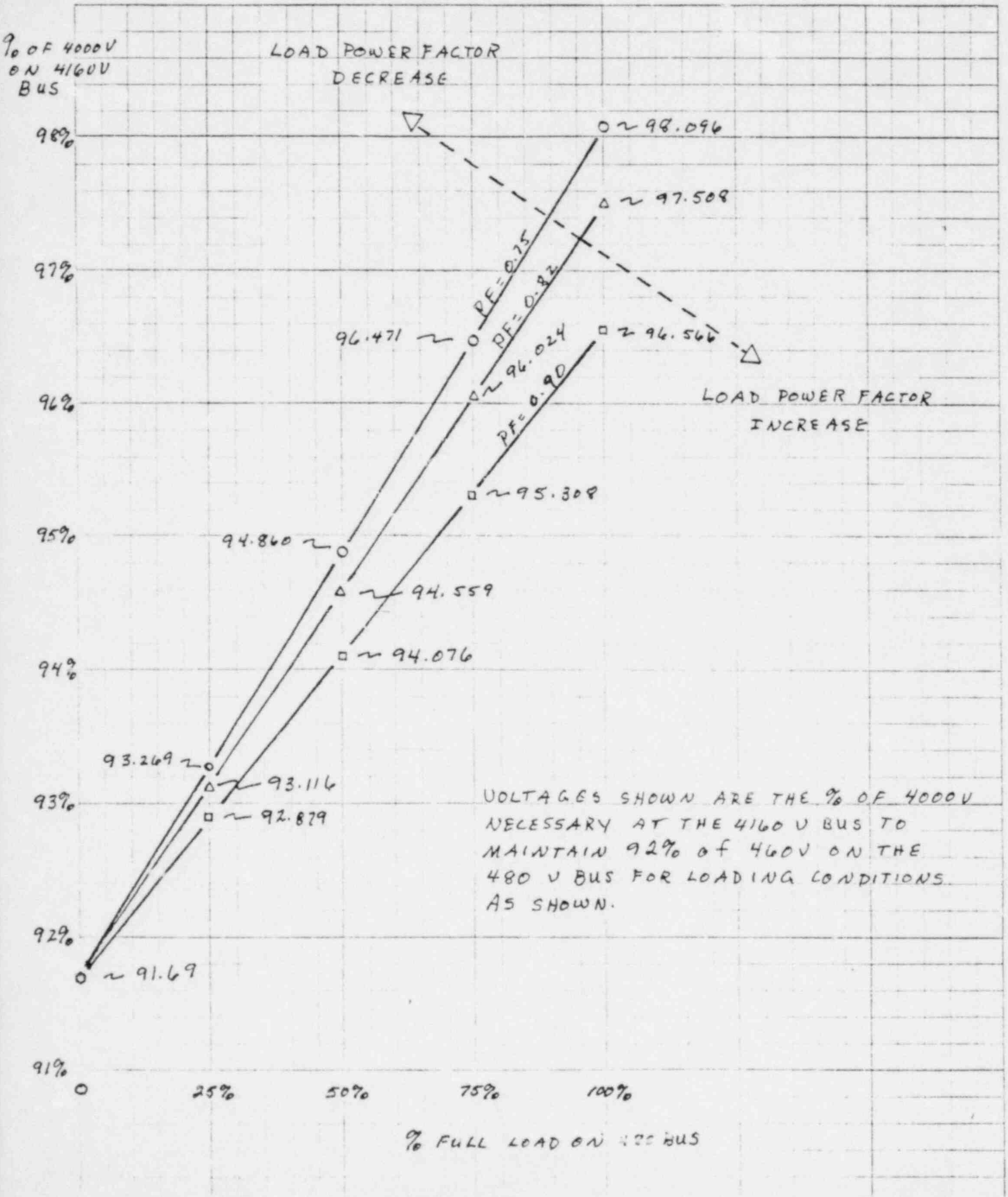
ATTACHMENT VIII





ATTACHMENT IX

Arkansas Power & Light
Generation & Construction



ATTACHMENT X

ANO-1

FULL HOUSE TRANSFER
FOLLOWED BY ES SIGNAL

TIME (SEC)	VOLTAGES ON BUSSES					
	6900	4160ES	4160 NON-ES	480ES	480ES	480 NON-ES
T=0(S.S.)	1.0298	0.9963	0.9963	0.9159	0.9404	0.9350
T=5	1.0328	0.9732	0.9732	0.8745	0.9168	0.9099
T=10	1.0327	0.9742	0.9742	0.9138	0.9262	0.9110
T=20	1.0320	0.9790	0.9790	0.9231	0.9356	0.9161
T=S.S.	1.0300	0.9940	0.9940	0.9385	0.9555	0.9323