Omaha Public Power District
1623 HARNEY ■ OMAHA, NEBRASKA 68102 ■ TELEPHONE 536-4000 AREA CODE 402

August 31, 1981

Mr. Robert A. Clark, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D.C. 20555

Reference: Docket No. 50-285

Dear Mr. Clark:

The Commission's letter dated May 13, 1981, requested additional information regarding the adequacy of Fort Calhoun Station's electrical distribution system voltages. The District's submittal dated July 2, 1981, provided responses to Questions A, B, and C of the Commission's letter, while responses to Questions D and E were to be provided at a later date. The District's response to Questions D and E is attached.

Sincerely,

for W. C. Jones
Division Manager
Production Operations

WCJ/KJM/TLP/RWS:jmm

Attachment

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036

A001 S 1/1

Attachment

Question (D)

What is the service factor for the 4160V, 4000V and the 460V safeguards motors?

Response

Enclosure 1 provides a complete listing of motor service factors (except for ventilation air fan motors VA-3A, VA-3B, VA-7C, and VA-7D) for the 4160V, 4000V, and 460V safeguards motors. Custom built, high efficiency motors such as VA-3A, VA-3B, VA-7C, and VA-7D are manufactured without motor service factors because they are designed and used for a specific function.

Question (E)

The NRC letter of August 8, 1979 requires a test be performed to verify your analytical results. The latest guidelines required that this test should be performed by:

(a) Loading the station distribution buses, including all Class 1E buses down to the 120/208V level, to at least 30%;

(b) Recording the existing grid and Class 1E bus voltages and bus loading down to the 120/208 volt level at steady state conditions and during the starting of both a large Class 1E and non-Class 1E motor (not concurrently);

(Note) To minimize the number of instrumented locations (recorders), during the motor starting transient tests, the bus voltages and loading need only be recorded on that string of buses which previously showed the lowest analyzed voltages.

(c) Using the analytical techniques and assumptions of the previous voltage analyses and the measured existing grid voltage and bus loading conditions recorded during conduct of test, calculate a new set of voltages for all Class 1E buses down to the 120/208 volt level.

(d) Compare the analytical derived voltage values against the test results.

With good correlation between the analytical results and test results, the test verification requirement will be met. That is, the validity of the mathematical model used in performance of the analysis will have been established. In general the test results should be within ± 3% of the analytical results; however, the difference between the two when subtracted from or added to should never provide values that would allow operation of the Class 1E equipment outside of rated voltage ranges.

Response

The District performed voltage measurement tests as part of an undervoltage study on the Fort Calhoun Station's electrical distribution system, including all Class 1E buses down to the 120/208V level, during December 1977. (Note: The District's July 2, 1981 submittal which stated that the electrical distribution system voltage test was conducted during 1978 was incorrect.) The voltage measurement tests involved electrically loading the Fort Calhoun Station's distribution buses, including all Class 1E buses down to the 120/208V level, to at least 30% of full load as required by the Commission's test guidelines. Steady state and motor starting transient test voltages were measured for the existing grid and Class 1E buses down to the 480V level. Steady state and motor starting voltage measurements were not recorded at the 120/208V level because all critical safety related electric motors at Fort Calhoun operate on 480V buses or higher.

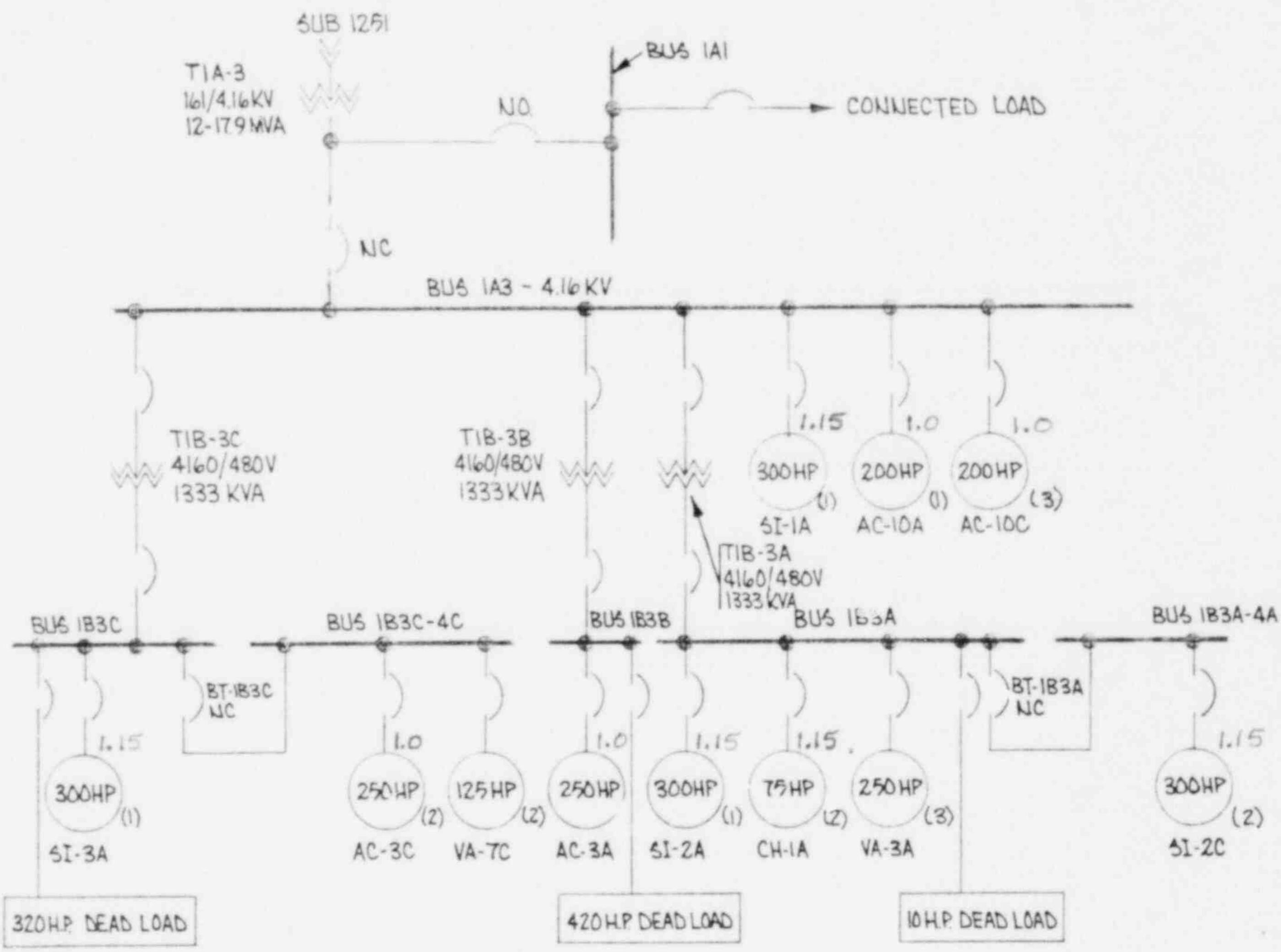
Based on the District's previous undervoltage analysis, bus 1B4B was determined to have the lowest analyzed voltage. Therefore, only transient voltage measurements on bus 1B4B were recorded. Two separate motor starting tests were conducted with Class 1E motors to provide voltage data. This test data was then compared to the analytically derived voltages for bus 1B4B. The first test involved starting the 300 HP containment spray pump SI-3B. The second test involved the concurrent starting of two motors, containment spray pump SI-3C and ventilation air fan motor VA-7D, with combined power requirements of 425 HP. The compared results of the voltage test measurements and of the analytically derived voltages at bus 1B4B for both transient tests are summarized in Enclosure 2. Voltage values above the 480V level were not analyzed as recording equipment measuring transient voltage changes on the distribution grid (161 KV) and bus 1A4 (4.16 KV) measured no detectable voltage drops when the motors were started.

Comparison of the test and analytically derived voltage values in Enclosure 2 revealed the test voltages to be higher than the calculated voltages. The calculated voltage of 429V for the motor starting analysis of SI-3B was found to be 3.8% lower than the measured test voltage of 446.2V. The calculated voltage of 421V for the concurrent motor starting analysis of SI-3C and VA-7D was found to be 3.5% lower than the measured test voltage of 436.5V. The District believes the resultant correlations of 3.5% and 3.8% are sufficient evidence to justify the validity of our analytical model and that no further testing is required. Selected variable values (e.g , motor locked rotor factors) used in the calculation of the analytically derived voltages were conservative and probably accounted for the differences. It is believed that the use of less conservative variable values would result in closer correlations between analytical and test results.

Please note the District did not perform a motor starting voltage analysis using a non-Class 1E motor as required by Commission guidelines. The District believes the concurrent starting of both SI-3C and VA-7D motors for the second transient test provided test results that were more pertinent in establishing the validity of the analytical results than would have been obtained from testing a single non-Class 1E motor.

GSE-B-2-2 FORM REVISION 01 DATE AUG 0 1 1975	PREPARED BY ____ CHECKED BY ____ APPROVED ____ REV ____ DATE ____	Motor Terminal Voltage Calculations SH 2 CONT ON SH 3
TASK NO ____		OMAHA PUBLIC POWER DISTRICT GENERATING STA ENG

1) One Line Diagram: (Refer to Fig. 8.4-1 FSAR)



(1) - 1st Group of Sequence Starting Motors

(2) - 2nd Group of Sequence Starting Motors

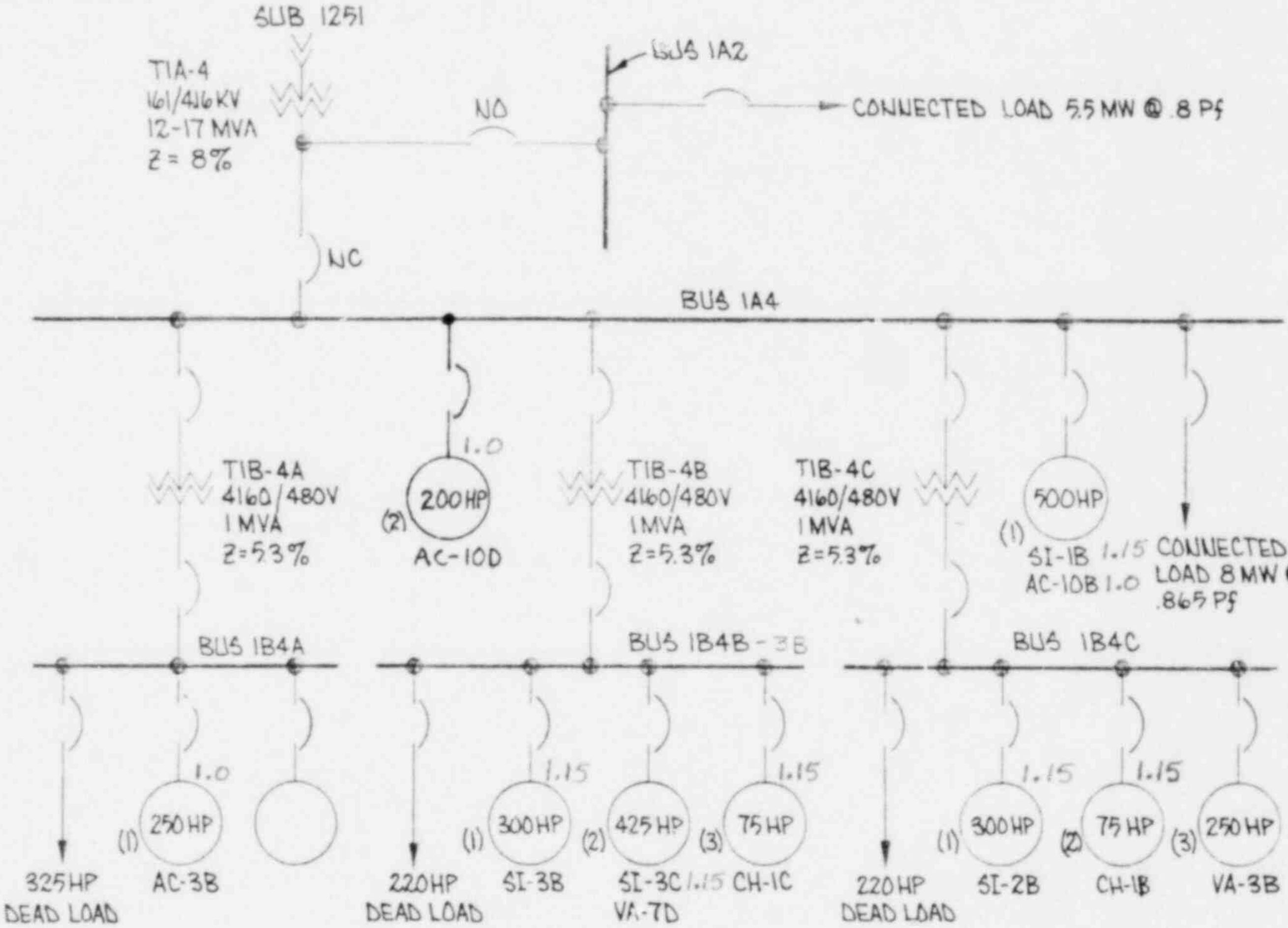
(3) - 3rd Group of Sequence Starting Motors

Service Factors in green, (See Question D).
(The VA motors do not have a manufacturer specified service factor)

Enclosure 1

GSE-B-2-2 FORM REVISION 01 DATE AUG 0 1 1975	PREPARED BY ____ CHECKED BY ____ APPROVED ____	Motor Terminal Voltage Calculations SH 2 CONT ON SH 3
TASK NO FC-77-40	REV ____ DATE ____	OMAHA PUBLIC POWER DISTRICT GENERATING STA ENG

1) One Line Diagram: (Refer to Fig. 8.4-1 FSAR)



(1) - 1st Group of Sequence Starting Motors

(2) - 2nd Group of Sequence Starting Motors

(3) - 3rd Group of Sequence Starting Motors

Service Factors in green.

Enclosure 2

Test and Analytically Derived Voltages at
Bus 1B4B During Class 1E Motor Starting
Transient Tests

	Motor Group Started	Test Voltage	Calculated Voltage
1)	Containment Spray Pump SI-3B	446.2V	429V
2)	Containment Spray Pump SI-3C and Ventilation Air Cooling Unit VA-7D	436.5V	421V