CP&L

Carolina Power & Light Company

SERIAL: NLS-84-051

FEB 06 1984

Director of Nuclear Reactor Regulation
Attention: Mr. D. B. Vassallo, Chief
Operating Reactors Branch No. 2
Division of Licensing
United States Nuclear Regulatory Commission
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 & 50-324/LICENSE NOS. DPR-71 & DPR-62
ELECTRICAL DISTRIBUTION SYSTEM VOLTAGES

Dear Mr. Vassallo:

In a letter dated November 30, 1983 Carolina Power & Light Company (CP&L) committed to answer three remaining questions from your request for additional information dated September 1, 1983. These responses are included herein as Attachment 1. However, an error has been discovered in our previous submittal as discussed below. As part of this letter, CP&L would like to advise your office of this situation, provide our preliminary analysis of the error, and our schedule for resubmitting a revised analysis.

Because of anticipated load additions, CP&L initiated an engineering study to determine whether additional auxiliary capacity would require adding new transformers or whether existing equipment could handle the increased load. Preparation of data included a review of the transmission system characteristics. This review has uncovered an error in the data supplied to United Engineering & Constructors (UE&C) for the degraded grid voltage analysis. Specifically, it was determined that the worst case minimum grid voltage was actually lower than that orginally supplied to UE&C.

An assessment of the impact of this error has been completed. Although the circuit design will not meet the 2X LOCA scenario as defined in our original submittal, it has been concluded that the current plant design is capable of meeting worst case design scenarios required by current regulations.

Attachment 2 provides a more detailed discussion of this matter including impacts on the results of our previously submitted analysis. Attachment 3 details our evaluation of the regulatory requirements as they pertain to worst case design scenarios for the degraded voltage study.

411 Fayetteville Street • P. O. Box 1551 • Raleigh, N. C. 27602

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A new analyses to replace our earlier degraded voltage submittals will be transmitted to the NRC by August 31, 1984. Should you have any questions concerning this letter please do not hesitate to contact a member of our Licensing Staff.

Yours very truly,

S. K. Zimmerman
Manager
Nuclear Licensing Section

PPC/ccc (9432PPC)

cc: Mr. D. O. Myers (NRC-BSEP)
Mr. J. P. O'Reilly (NRC-RII)
Mr. M. Grotenhuis (NRC)

Attachment 1

Letter NLS-84-051

February 1, 1984

Answers to Request for Additional
Information Dated September 1, 1983
Question 7, 8, and 9

The following items are to clarify the referenced letter, enclosure 3.

Question 7

What was the grid voltage for both the test measurements and test anlaysis?

Response

The grid voltage was measured by Gould Brush 260 recorder, and the value was constant at 230 Kv during the site test. The same voltage was used as an input data for the test analysis.

Question 8

Account for the difference between the "study voltage" and the "test voltage" of Section 2. In some cases the difference is greater than 4%.

Response

The summary of results of Section 2.0 shows that most of the testing voltages closely approach the study voltages obtained from UE&C "Volt Program." The deviations between test and study voltages are within the *tolerance of the recording instrument, excepting the following two cases:

a) Bus 2E and 2F (Max: -3.68%) - CWP Start

The high % errors greater than instrument tolerance are mainly attributed to the frequent loading and unloading of the station service air compressors. These compressors fed from bus 2E and 2F caused the test voltage to vary and an accurate measuring was impractical.

b) MCC 2PB (Max: +3.51%) - SWP Start

Starting of SWP motor is represented by an estimated admittance as shown on study model Figure 4, Site Test Voltage Study Report, revision 2.

The study voltage (442 V) at MCC 2PB was calculated based on the estimated input data - motor admittance.

The site test voltage varied at the transient state when motor started, i.e., it dipped to 427 V and recovered to 473 V with no time delay (instantaneously).

The high % difference (+3.51%) concerned was calculated using the conservative input data (427 V - min); however, it will be improved to -1.7% when taking mean value ($450\ V = 427 + \frac{473 - 427}{2}$).

*Total instrument loop error (%)
= (PT error) x (RMS error) x (recorder error)
= 1.006 x 1.01 x 1/0035 = $\pm$ 2%

Question 9

Demonstrate that the test measurements and test analysis were for identical station electrical loading.

Response

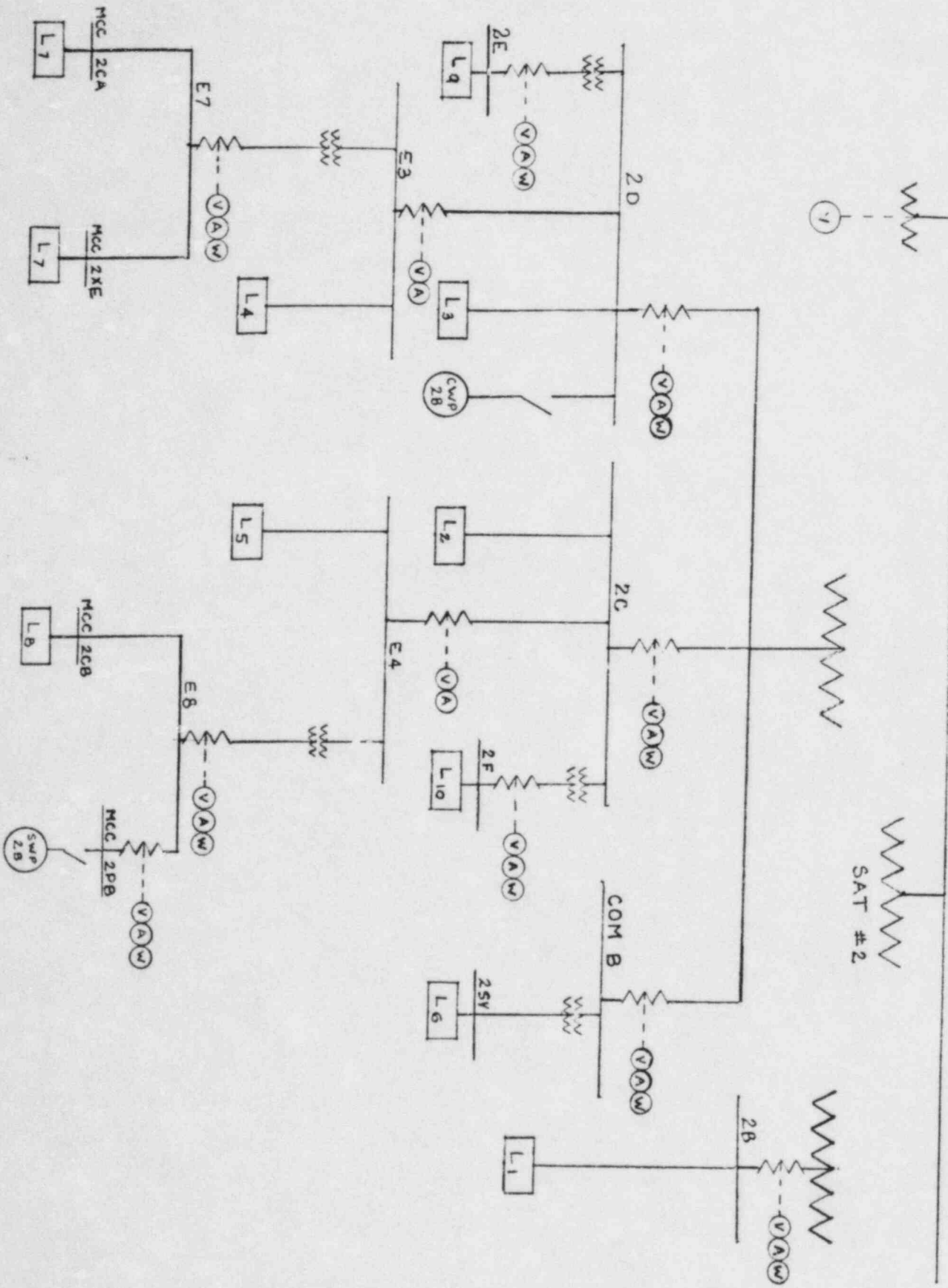
The BOP and emergency bus loads were fed from the startup transformer No. 2. At the time of the test, the power generator was 40% of the rated capacity of each unit and the following major loads were running:

1. Bus 2B - Reactor Recirculating Water Pumps 2A and 2B
2. Bus 2C - Circulating Water Pump 2C, Condensate Booster Pump 2A, Heater Drain Pump 2B, Condensate Pump 2A
3. Bus 2D - Circulating Water Pump 2D, Condensate Booster Pump 2C, Heater Drain Pump 2C, Condensate Pumps 2C, Chillers 2A
4. Bus E3 - Control Rod Drive Hydraulic Pump 2A, Nuclear Service Water Pump 2A, Conventional Service Water Pump 2A
5. Bus E4 - Nuclear Service Water Pumps 2B, Conventional Service Water Pumps 2B
6. Bus Common B - Turbine Building Cooling Tower Pumps 2A and 2B
7. Bus E7 - Reactor Building Closed Cooling Water Pumps 2A and 2C, Reactor Building Supply Fans 2A and 2C, Reactor Building Exhaust Fans 2A and 2C
8. Bus E8 - Reactor Building Exhaust Fans 2B
9. Bus 2E - Turbine Building Closed Cooling Water Pump 2A, Turbine Building Supply Fans 2C, Turbine Building Exhaust Fans 2A and 2C
10. Bus 2F - Turbine Building Closed Cooling Water Pumps 2C, Turbine Building Supply Fans 2B and 2D, Turbine Building Exhaust Fans 2B

The above station loads were measured at the same time (15:48 p.m., December 12, 1980) at various locations as shown on Sketch 1.

For test analysis, megawatts were taken directly from site test data and megavars were computed (see Appendix A of the study report) from megawatt, voltage, and current data with the exception of motor starting loads noted in Response 8.

SKETCH 1


230 KV
SAT #2
COM B
2A
2B
2C
2D
2E
2F
2SY
E3
E4
E7
E8
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
MCC 2CA
MCC 2XE
MCC 2CB
MCC 2PB
CWP 2B
SWP 2B
V
A
W

Attachment II

Letter NLS-84-051

February 1, 1984

Description of Problem

Description of Problem

As a result of a study conducted by CP&L's corporate engineering group (NELD) it has been determined that UE&C's voltage drop study was based on information provided by CP&L which showed that for a proposed 2X LOCA, the switchyard voltage would drop to no less than 0.96 pu. Using this 0.96 pu for the worst case for source voltage, UE&C's computer model and study concluded that BSEP was adequately designed to handle the 2X LOCA. However, the NELD study's preliminary results (based on existing current available transmission system data) showed that the switchyard voltage at BSEP could actually drop lower than the 0.96 pu in the 2X LOCA scenario.

Further review revealed that BSEP has no regulatory commitments for degraded grid voltage to meet the 2X LOCA accident scenario effects for off-site power. The evaluation of applicable regulatory requirements (see attachment 3) revealed that BSEP is actually required to demonstrate adequate grid voltage in the case of LOCA on one unit with a controlled shutdown of the other unit. In fact, however, the situation where one unit is already shutdown and a LOCA occurs on the operating unit is a more limiting case with respect to degraded voltage at BSEP. As such, NELD's preliminary study was based on this more conservative scenario. Results of this preliminary study indicate that BSEP is currently able to handle this more conservative scenario satisfactorily.

The comparison between the preliminary NELD voltage drop study and the UE&C voltage drop study also identified two less significant items.

First, since the UE&C study, larger Circulating Water Intake Pump (CWIP) induction motors have been installed. As such , the running loads and starting currents were not a part of the UE&C study. In addition, the starting of a fourth CWIP with three already running was not analyzed in the NELD study. The NELD study did not include the starting of a fourth pump since our National Pollutant Discharge Elimination System (NPDES) permit normally limits circulating water flow to two pumps in the winter and three pumps in the summer. There are, however, provisions in the permit which do permit occasional starting of a fourth pump under certain conditions. Since definite operator action is required to start the fourth pump, CP&L believes the potential for a fourth pump start during a LOCA is extremely remote. Additionally, the NELD study assumes the existance of the large loads of the radwaste crystallizer heaters which have not been installed. With these conservatisms, NELD's study shows that the starting of a third CWIP (with two already running) is acceptable from a degraded voltage standpoint. In summary, the low probability of an operator taking action to start a fourth CWIP during a LOCA, the margin added by the assumption of additional electrical loads that do not exist, and the satisfactory results of the starting of a third CWIP provide reasonable assurance that BSEP will satisfactorily meet the NRC's published guidelines for degraded grid voltage.

Second, an updated 208/120 voltage study was not included in the NELD's preliminary study. A review of the UE&C study showed that there were no problems with the 208/120 systems under their 2X LOCA scenario. The 480 VAC bus voltages were compared between the UE&C and NELD studies. The NELD study 480 VAC results were higher than the UE&C 480 VAC results. Consequently,

the 208/120 VAC bus degraded voltage effects are judged to be acceptable. Additionally, the 208/120 VAC analysis will be included in the final NELD voltage drop study.

The necessary modification to the NELD computer model to address the identified discrepancies are in progress. Final revisions to and reviews of the BSEP degraded voltage studies are currently scheduled for July 1984 with final submittal to NRC scheduled for August 31, 1984.

Attachment III

Letter NLS-84-051

February 1, 1984

Regulatory Requirements

Attachment 3

With regard to the regulatory design requirement for 2X LOCA or 1X LOCA plus shutdown of the other unit, the following comments are pertinent.

1) General Design Criteria 5, in Appendix A of 10 CFR 50, states in part that systems important to safety shall not be shared unless such sharing "will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining unit". (Emphasis added)

2) Regulatory Guide 1.81, Revision 1, January 1975, Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants, states in part: "The staff has determined that, because of the low probability of a major reactor accident, a suitable design basis for multi-unit nuclear power plants is the assumption that an accident occurs in only one of the units at a time, with all other remaining units proceeding to an orderly shutdown and a maintained cooldown condition". (Emphasis added)

3) IEEE Standard 308-1971, paragraph 8.1.1, states in part, "A multi-unit station may share preferred power supply capacity between units. In such a case, as a minimum the total preferred capacity be sufficient to operate the engineering safety features for a design basis accident on one unit and those systems required for concurrent safe shutdown on the remaining units." (Emphasis Added)

4) Section 8 of the BSEP FSAR, (original) Electrical Power System, states that the "plant electrical distribution system has been designed in accordance with the guidelines as outlined in IEEE Standard 308-1971 . . . ".

5) Section 8.7.5 of the original BSEP FSAR, states that the switchyard is designed to supply power for "a unit in a design basis accident condition while supplying the auxiliary power requirements for shutdown of the other unit". This basis requirement is restated for other portions of the electrical system in paragraph 8.10.5.2.

Using generally accepted terms, controlled orderly shutdown implies time is permitted to take necessary compensating actions on the transmission grid prior to unloading the generation and rod insertion, etc. Additionally, unanticipated tripping of generators and plant scrams are generally referred to as "trips" and "scrams". Based on the above, it may be concluded that 1) there is no design or regulatory requirement for the 2X LOCA, or LOCA on one unit with a simultaneously uncontrolled loss of output for the second unit and that 2) the regulatory design basis of the plant is a design basis accident (LOCA) on one plant with a controlled, orderly shutdown of the remaining unit.