

SAFETY EVALUATION
FORT ST. VRAIN NUCLEAR GENERATING STATION
DOCKET NO. 50-267
ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

INTRODUCTION AND SUMMARY

Public Service Company of Colorado (PSC) was requested by NRC letter dated August 25, 1980 to review the electric power system at Fort St. Vrain. The review was to consist of:

- a) Determining analytically the capacity and capability of the offsite power system and onsite distribution system to automatically start as well as operate all required loads within their required voltage ratings in the event of 1) an anticipated transient, or 2) an accident (such as LOCA) without manual shedding of any electric loads.
- b) Determining if there are any events or conditions which could result in the simultaneous or consequential loss of both required circuits from the offsite network to the onsite electric distribution system and thus violating the requirements of GDC 17.

The August 25, 1980 letter included staff guidelines for performing the required voltage analysis and the licensee was further required to perform a test in order to verify the validity of the analytical results.

PSC responded by letters dated October 24, 1980, March 19, 1981, April 7, 1981, July 6, 1981, May 28, 1982 and June 7, 1982. A detailed review and technical

evaluation of the submittals was performed by EG&G under contract to the NRC, with general supervision by NRC staff. This work is reported by EG&G in Technical Evaluation Report (TER), "Adequacy of Station Electric Distribution System Voltages, Fort St. Vrain Nuclear Generating Station," dated July, 1982 (attached). We have reviewed this report and concur in the conclusions that the offsite power system and the onsite distribution system are capable of providing acceptable voltages for worst case station electric load and grid voltages.

EVALUATION CRITERIA

The criteria used by EG&G in this technical evaluation of the analysis includes GDC 5 ("Sharing of Structures, Systems, and Components"), GDC 13 ("Instrumentation and Control"), GDC 17 ("Electric Power Systems") of Appendix A to 10 CFR 50; IEEE Standard 308-1974 ("Class 1E Power Systems for Nuclear Power Generating Stations"), ANSI C84.1-1977 ("Voltage Ratings for Electric Power Systems and Equipment - 60 Hz"), and the staff positions and guidelines in NRC letter to PSC dated August 25, 1980.

ANALYSIS AND TEST FEATURES

PSC analyzed each offsite power source to the onsite distribution system under maximum and minimum load conditions with the offsite power sources at maximum and minimum anticipated voltages. The analysis indicates that the worst case Class 1E equipment voltages occur under the following conditions:

1. The maximum expected voltages occur when the 230 kv source is at its maximum anticipated value of 244 kv, the unit is shutdown, and the Class 1E buses are powered from the reserve auxiliary transformer.
2. The minimum steady state voltage occurs when the 230 kv source is at its minimum anticipated value of 226 kv, all loads required for plant startup are operating, and the Class 1E buses are powered from the reserve auxiliary transformer.
3. The worst case transient voltage occurs under condition 2 above when starting the 4500 hp non-Class 1E boiler feedpump 1B.

The analysis results show that the minimum transient voltage could result in equipment terminal voltages that are less than design rating. The licensee has performed analysis which shows that no 460 volt Class 1E motor will stall and no contactor drop out will occur during this short (≈ 5 second) transient. If the input voltage to the battery chargers should drop below their rating, the battery will assist the charger in this transient to maintain adequate system voltage.

The voltage analysis was verified by taking voltage and load measurements on the grid, 4160V and 480V buses and at the terminals of the largest 480 volt Class 1E motor. Additionally included in the tests were the transient voltage effects created by starting the largest non-Class 1E and Class 1E motors. A comparison showed measured voltages to be within 1.5% of the calculated voltages. In all cases the values were conservative and confirmed that the analysis was accurate.

DESIGN CHANGES

The licensee has proposed the following design changes:

1. Installation of new larger capacity 480 volt Class 1E buses.
2. Installation of new larger capacity 4160/480 volt transformers.

The above design changes will be accomplished in two phases. Two of the buses and transformers will be replaced during the plant's third refueling outage and the third bus and transformer will be replaced during the fourth refueling outage.

CONCLUSIONS

We have reviewed the EG&G technical evaluation report and concur in the findings that:

1. The licensee has provided a voltage analysis to demonstrate that the Class 1E equipment voltages will remain within acceptable operating limits for the postulated worst case conditions.
2. The voltage analysis was verified by tests and the close correlation between measured and calculated values showed the analysis to be accurate.
3. PSC's reaffirmation of compliance to GDC 17 is acceptable.

We therefore find the Fort St. Vrain Nuclear Generating Plant design to be acceptable with respect to the adequacy of station electric distribution system voltages subject to completion of the proposed modifications.

Attachment:
EGG Technical Evaluation Report