



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555
January 29, 1982

Docket No. 50-244
LS05-82-01-072

RG003865

P
Mr. John E. Maier, Vice President
Electric and Steam Production
Rochester Gas & Electric Corporation
89 East Avenue
Rochester, New York 14649

Dear Mr. Maier:

SUBJECT: SEP TOPIC VIII-1.A, POTENTIAL EQUIPMENT FAILURES ASSOCIATED
WITH DEGRADED GRID VOLTAGE

SEP Topic VIII-1.A is composed of two tasks. The first task was to evaluate the adequacy of protection against degraded grid voltages. This task has been completed and the staff Safety Evaluation Report (SER) and Technical Specification Changes were issued as Amendment 38 to your Operating License.

The second task was to evaluate the adequacy of the onsite power system voltages. The staff SER for this task is enclosed.

Because the staff has found that an adequate design exists, and has been verified by test, and because of Amendment 38, we conclude that Topic VIII-1.A has been completed satisfactorily.

Sincerely,

Dennis M. Crutchfield
Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure;
See next page

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Mr. John E. Maier

cc

Harry H. Voigt, Esquire
LeBoeuf, Lamb, Leiby and MacRae
1333 New Hampshire Avenue, N. W.
Suite 1100
Washington, D. C. 20036

Mr. Michael Slade
12 Trailwood Circle
Rochester, New York 14618

Ezra Bialik
Assistant Attorney General
Environmental Protection Bureau
NNew York State Department of Law
2 World Trade Center
New York, New York 10047

Resident Inspector
R. E. Ginna Plant
c/o U. S. NRC
1503 Lake Road
Ontario, New York 14519

Director, Bureau of Nuclear
Operations
State of New York Energy Office
Agency Building 2
Empire State Plaza
Albany, New York 12223

Rochester Public Library
115 South Avenue
Rochester, New York 14604

Supervisor of the Town
of Ontario
107 Ridge Road West
Ontario, New York 14519

Dr. Emmeth A. Luebke
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dr. Richard F. Cole
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

U. S. Environmental Protection Agency
Region II Office
ATTN: Regional Radiation Representative
26 Federal Plaza
New York, New York 10007

Herbert Grossman, Esq., Chairman
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

James P. O'Reilly, Regional Administrator
Nuclear Regulatory Commission, Region II
Office of Inspection and Enforcement
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

SAFETY EVALUATION
DOCKET NO. 50-244
ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

INTRODUCTION AND SUMMARY

Rochester Gas and Electric Corp. (RG&E) was requested by NRC letter dated August 8, 1979 to review the electric power system at R. E. Ginna Nuclear Power Station Unit 1. 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 8, 1979 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. RG&E responded by letters dated December 6, 1979, September 3, 1980, December 4, 1980 and September 30, 1981. A detailed review and technical evaluation of the submittals was performed by LLL under contract to the

NRC, with general supervision by NRC staff. This work is reported by LLL in Technical Evaluation Report (TER), "Adequacy of Station Electric Distribution System Voltages for the R. E. Ginna Nuclear Power Station Unit 1," dated November 5, 1981 (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 LLL 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 RG&E dated August 8, 1979.

ANALYSIS AND TEST FEATURES

Various analyses were performed using the station auxiliary transformer #12, over the normal expected operating voltage range of the two independent feeders to the transformer. The worst case analysis for minimum voltage indicated that the voltage at the equipment would be slightly below the equipment rated steady state voltage (88% versus 90%). Based on this, RG&E proposed changing their operating procedures

to maintain the voltage at the feeders to transformer #12 at a higher value. Subsequently, the results of the verification testing indicated that the analysis was conservative and the equipment voltages would be maintained essentially at their rated values (section 4.3 and 5.(4) of the enclosed LLL TER). Based on this, and the fact that in either case the second level undervoltage relays will protect the loads, we conclude that the proposed change to the operating procedures is not required.

CONCLUSIONS

We have reviewed the LLL Technical Evaluation and concur in the findings that:

- (1) Under worst case conditions, the Class 1E equipment will automatically start and continue to operate within their voltage design ratings.
- (2) The voltage at the Class 1E equipment will not exceed the upper design voltage rating under maximum offsite voltage and minimum plant loading conditions.
- (3) The analysis submitted was verified by test. The test data indicates that the analytical results are lower than actual-measured values; thus the model is conservative with acceptable percentage error differences.

- (4) Spurious trips will not occur for the voltages and plant operating conditions analyzed.

Review of the plants offsite power system for compliance with GDC 17 has already been performed under the systematic evaluation program (SEP).

UCID- 19116



TECHNICAL EVALUATION OF THE ADEQUACY OF
STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES
FOR THE R.E. GINNA NUCLEAR POWER STATION,
UNIT 1

James C. Selan

SELECTED ISSUES PROGRAM

(Docket No. 50-244)

November 5, 1981

Lawrence
Livermore
Laboratory

This is an informal report intended primarily for internal or limited external distribution. The opinions and conclusions stated are those of the author and may or may not be those of the Laboratory.

This work was supported by the United States Nuclear Regulatory Commission under a Memorandum of Understanding with the United States Department of Energy.

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ABSTRACT

This report documents the technical evaluation of the adequacy of the station electric distribution system voltages for the R.E. Ginna Nuclear Power Station, Unit 1. The evaluation is to determine if the onsite distribution system, in conjunction with the offsite power sources, has sufficient capacity to automatically start and operate all Class 1E loads within the equipment voltage ratings under certain conditions established by the Nuclear Regulatory Commission.

The analysis submitted demonstrates that acceptable voltages will be supplied to the Class 1E equipment under worst case conditions.

FOREWORD

This report is supplied as part of the Selected Electrical, Instrumentation, and Control Systems Issues Program being conducted for the U. S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Operating Reactors, by Lawrence Livermore National Laboratory.

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TECHNICAL EVALUATION OF THE
ADEQUACY OF STATION ELECTRIC
DISTRIBUTION SYSTEM VOLTAGES
FOR THE R.E. GINNA NUCLEAR POWER STATION
UNIT 1

(Docket No. 50-244)

James C. Selan

Lawrence Livermore National Laboratory, Nevada

1. INTRODUCTION

The Nuclear Regulatory Commission (NRC) by a letter dated August 8, 1979 [Ref. 1], expanded its generic review of the adequacy of the station electric distribution systems for all operating nuclear power facilities. This review is to determine if the onsite distribution system, in conjunction with the offsite power sources, has sufficient capacity and capability to automatically start and operate all required safety loads within the equipment voltage ratings. In addition, the NRC requested each licensee to follow suggested guidelines and to meet certain requirements in the analysis. These requirements are detailed in Section 5 of this report.

By letters dated December 6, 1979 [Ref. 2], September 3, 1980 [Ref. 3], December 4, 1980 [Ref. 4] and September 30, 1981 [Ref. 5], Rochester Gas and Electric Corporation (RG&E), the licensee, submitted their analysis and conclusion regarding the adequacy of the electrical distribution system's voltages at R.E. Ginna, Unit 1.

The purpose of this report is to evaluate the licensee's submittal with respect to the NRC criteria and present the reviewer's conclusion on the adequacy of the station electric distribution systems to maintain the voltage within the design ratings of the required Class 1E equipment for the worst case starting and load condition.

2. DESIGN BASIS CRITERIA

The design basis criteria that were applied in determining the adequacy of station electric distribution system voltages to start and operate all required safety loads within their required voltage ratings are as follows:



FIGURE 1 R. E. GINNA NUCLEAR POWER STATION ELECTRICAL ONE-LINE DIAGRAM

TABLE 1

R.E. GINNA UNIT 1
CLASS 1E EQUIPMENT VOLTAGE RATINGS AND
ANALYZED WORST CASE TERMINAL VOLTAGES
(in % of Equipment Nominal Voltage Rating)

Equipment	Nominal Voltage Rating (100 %)	Maximum		Minimum	
		Rated	Analyzed ^a	Rated	Analyzed ^a
			Steady State		Steady State Transient
Motors	460 ^b				
Start					
Operate		110	106.5	80 90	81 88.0
Starters ^c	—				
Pickup					
Dropout					
Operate					
Other ^d	—				
Equipment					

- a. The analyzed voltages are the extremes of the analysis provided by RG&E using the station auxiliary transformer and both circuit feeders (751 and 767).
- b. All Class 1E motors and six motor-operated valves (MOVs) are rated 460 volts. All other Class 1E MOVs are rated 440 volts and 480 volts and are not required to operate for long periods of time under low bus voltage conditions. Therefore, the 460-volt motors are the voltage limiting motors.
- c. R.E. Ginna Unit utilizes D.C. type contactors.
- d. Class 1E equipment below 480 volts is supplied from either regulated 480/125-volt transformers or uninterruptable power supplies.

RG&E has shown by analysis and test verification data that the offsite source has sufficient capacity and capability to automatically start and continuously operate the Class 1E equipment within the voltage ratings under worst case conditions.

- (2) With the maximum expected offsite grid voltage and minimum load condition, each offsite source and distribution system connection must be capable of continuously operating the required Class 1E equipment without exceeding the equipment's voltage ratings.

The analysis shows that the Class 1E equipment's voltage rating is not exceeded for minimum load and maximum expected offsite grid voltages.

- (3) The analysis must show that there will be no spurious separation of the offsite power source to the Class 1E buses by the voltage protection relays when the grid is within the normal expected limits and the loading conditions established by the NRC are being met.

RG&E has shown, by analysis and test verification data, that there will be no spurious separation from the offsite source.

- (4) Test results are required to verify the voltage analyses calculations submitted.

RG&E verified, by test, the voltage analysis results submitted. The test results produced percentage differences which indicated the calculated values to be lower than the actual measured values, thus indicating the model to be conservative. The percentage differences of the test results indicated that the proposed operating grid limits could be reduced to include the normal lower limit and that the 117 kV level is acceptable for plant startup voltages.

- (5) Review the plant's electrical power systems to determine if any events or conditions could result in the simultaneous loss of both offsite circuits to the onsite distribution system (compliance with GDC 17).

A review of the plant's electrical distribution systems has determined that the present design of the offsite transmission network consists of a single circuit to the onsite distribution system, which does not meet the current requirements of GDC 17. This discrepancy was reviewed by the system evaluation program (SEP) to determine if any changes or modifications would be required. The SEP concluded that since the station has 8 hours of backup battery capability for supplying power to the auxiliary feedwater system and that 6 to 8 hours is required to enable backfeeding, no modifications were required.

6. CONCLUSIONS

Based on the information submitted by Rochester Gas and Electric Corporation for the R. E. Ginna Nuclear Power Station, Unit 1, it is concluded that:

- (1) Under worst case conditions, the Class 1E equipment will automatically start and continue to operate within their voltage design ratings.
- (2) The voltage at the Class 1E equipment will not exceed the upper design voltage rating under maximum offsite voltage and minimum plant loading conditions.
- (3) The analysis submitted was verified by test. The test data indicates that the analytical results are lower than actual measured values; thus the model is conservative with acceptable percentage error differences.
- (4) Spurious trips will not occur for the voltages and plant operating conditions analyzed.

Accordingly, I recommend that the NRC accept the voltage analysis submitted by the licensee which demonstrates that acceptable voltage will be supplied to the Class 1E equipment under the worst case conditions analyzed.

REFERENCES

1. NRC letter (W. Gammill) to all Power Reactor Licensees, dated August 8, 1979.
2. RG&E letter (L. D. White, Jr.) to NRC (D. L. Ziemann), dated December 6, 1979.
3. RG&E letter (L. D. White, Jr.) to NRC (D. M. Crutchfield), dated September 3, 1980.
4. RG&E letter (L. D. White, Jr.) to NRC (D. M. Crutchfield), dated December 4, 1980.
5. RG&E letter (L. D. White, Jr.) to NRC (D. M. Crutchfield), dated September 30, 1981.
6. Code of Federal Regulations, Title 10, Part 50 (10 CFR 50), General Design Criterion B and 17 of Appendix A for Nuclear Power Plants.
7. ANSI C84.1977, "Voltage Rating for Electric Power Systems and Equipment."
8. IEEE Std. 308-1974, "Criteria for Class 1E Power Systems for Nuclear Generating Stations."