



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

July 29, 1980

MEMORANDUM FOR: Dennis M. Crutchfield, Chief
Operating Reactors Branch #5, DL

FROM: Dennis M. Crutchfield, Acting Chief
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SUBJECT: OYSTER CREEK - SEP TOPIC VIII-2

The enclosed draft technical evaluation of SEP Topic VIII-2 has been reviewed and found acceptable by the SEP staff. Accordingly, we request that the enclosed document be forwarded to the licensee for comment.

In that regard, please inform the licensee that we will consider any comments supplied prior to October 6, 1980, for use in a final report.

The evaluation points out some deviations from current licensing criteria which we plan to consider further during the integrated assessment.

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SEP TECHNICAL EVALUATION

TOPIC VIII-2
DIESEL GENERATORS

OYSTER CREEK

Docket No. 50-219

June 1980

June 24, 1980

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SEP TECHNICAL EVALUATION

TOPIC VIII-2 DIESEL GENERATORS

OYSTER CREEK

1.0 INTRODUCTION

The objective of the review is to determine if the onsite AC generator for the Oyster Creek Nuclear Station has sufficient capacity and capability to supply the required automatic safety loads during anticipated occurrences and/or in the event of postulated accidents after loss of offsite power. The requirement that the onsite electric power supplies have capacity and capability to complete the required safety functions is contained in General Design Criterion 17.

Criterion III, "Design Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plant^s and Fuel Reprocessing Plant," to 10 CFR Part 50 includes a requirement that measures be provided for verifying or checking the adequacy of design by design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program.

Regulatory Guides, IEEE Standards, and Branch Technical Positions which provide a basis acceptable to the NRC staff for compliance with GDC17 and Criterion III include: Regulatory Guide 1.9, "Selection of Diesel Generator Set Capacity for Standby Power Supplies;" Regulatory Guide 1.108, "Periodic Testing of Diesel Generators Used as Onsite Power Systems at Nuclear Power Plants"; IEEE Standard 387-1977, "Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Stations;" BTP ICSB2, "Diesel-Generator Reliability Qualification Testing"; and BTP ICSB17, "Diesel Generator Protective Trip Circuit Bypasses."

Specifically, this review evaluates the loading of the diesel-generator, bypasses of protective trips during accident conditions and periodic testing. The SEP reviews for Topics III-1 and III-12 will evaluate the diesel-generator qualification.

2.0 CRITERIA

2.1 Diesel Generator Loading. Regulatory Guide 1.9, "Selection of Diesel-Generator Set Capacity for Standby Power Supplies," provides the basis acceptable to the NRC staff for loading diesel-generator units. The following criterion is used in this report to determine compliance with current licensing requirements:

- (1) The automatically-connected loads on each diesel-generator unit should not exceed the 2000-hour rating. (Loads must be conservatively estimated utilizing the nameplate ratings of motors and transformers with motor efficiencies of 90% or less. When available, actual measured loads can be used.)

2.2 Bypass of Protective Trips. Branch Technical Position (BTP) ICSB 17, "Diesel-Generator Protective Trip Circuit Bypasses," specifies that:

- (1) The design of standby diesel generator systems should retain only the engine overspeed and the generator differential trips and bypass all other trips under an accident condition
- (2) If other trips, in addition to the engine overspeed and generator differential, are retained for accident conditions, an acceptable design should provide two or more independent measurements of each of these trip parameters. Trip logic should be such that diesel-generator trip would require specific coincident logic.

2.3 Diesel Generator Testing. Regulatory Guide 1.108, "Periodic Testing Of Diesel Generator Units Used as Onsite Electrical Power Systems at Nuclear Power Plants", states that:

- (1) Testing of diesel-generator units, at least once every 18 months, should:
 - (a) Demonstrate proper startup operation by simulating loss of all ac voltage and demonstrate that the diesel generator unit can start automatically and attain the required voltage and frequency within acceptable limits and time.
 - (b) Demonstrate proper operation for design-accident-loading sequence to design-load requirements and verify that voltage and frequency are maintained within required limits.
 - (c) Demonstrate full-load-carrying capability for an interval of not less than 24 hours, of which 22 hours should be at a load equivalent to the continuous rating of the diesel generator and 2 hours at a load equivalent to the 2-hour rating of the diesel generator. Verify that voltage and frequency requirements are maintained. The test should also verify that the cooling system functions within design limits.
 - (d) Demonstrate proper operation during diesel-generator load shedding, including a test of the loss of the largest single load and of complete loss of load, and verify that the voltage requirements are met and that the overspeed limits are not exceeded.

- (e) Demonstrate functional capability at full-load temperature conditions by rerunning the test phase outlined in (a) and (b), immediately following (c), above.
 - (f) Demonstrate the ability to synchronize the diesel generator unit with offsite power while the unit is connected to the emergency load, transfer this load to the offsite power, isolate the diesel-generator unit, and restore it to standby status.
 - (g) Demonstrate that the engine will perform properly if switching from one fuel-oil supply system to another is a part of the normal operating procedure to satisfy the 7-day storage requirement.
 - (h) Demonstrate that the capability of the diesel-generator unit to supply emergency power within the required time is not impaired during periodic testing under (3), below.
- (2) Testing of redundant diesel-generator units during normal plant operation should be performed independently (nonconcurrently) to minimize common failure modes resulting from undetected interdependences among diesel-generator units. However, during reliability demonstration of diesel-generator units during plant preoperational testing and testing subsequent to any plant modification where diesel-generator unit interdependence may have been affected or every 10 years (during a plant shutdown), whichever is the shorter, a test should be conducted in which redundant units are started simultaneously to help identify certain common failure modes undetected in single diesel-generator unit tests.

(3) Periodic testing of diesel-generator units during normal plant operation should:

(a) Demonstrate proper startup and verify that the required voltage and frequency are automatically attained within acceptable limits and time. This test should also verify that the components of the diesel-generator unit required for automatic startup are operable.

(b) Demonstrate full-load-carrying capability (continuous rating) for an interval of not less than one hour. The test should also verify that the cooling system functions within design limits. This test could be accomplished by synchronizing the generator with the offsite power and assuming a load at the maximum practical rate.

(4) The interval for periodic testing under (3), above (on a per diesel-generator unit basis) should be no more than 31 days and should depend on demonstrated performance. If more than one failure has occurred in the last 100 tests (on a per nuclear unit basis), the test interval should be shortened in accordance with the following schedule:

(a) If the number of failures in the last 100 valid tests is one or zero, the test interval should be not more than 31 days.

(b) If the number of failures in the last 100 valid tests is two, the test interval should be not more than 14 days.

- (c) If the number of failures in the last 100 valid tests is three, the test interval should be not more than 7 days.
- (d) If the number of failures in the last 100 valid tests is four or more, the test interval should be not more than 3 days.

3.0 DISCUSSION AND EVALUATION

Since both diesel generator's worst-case loads, protective trips, and trip bypasses are identical, a review of one serves as a review of both.

3.1 Diesel-Generator Loading

Discussion. On January 23, 1979, JCP&L provided a list of loads automatically connected to the diesel generators in the event of a LOCA concurrent with a loss of offsite power.¹ Further discussion with the licensee² corrected two typo-graphical errors in data entries, determined an unstated assumption, and verified that the "Rated Condition" entries are, in fact, measured values for large motors. The worst-case load on a diesel generator occurs in the event of a LOCA concurrent with a loss of offsite power and failure of the other diesel generator. The maximum step load change is 748 KW (30% of capacity) which occurs when the generator is initially loaded.

Evaluation. Oyster Creek Technical Specifications require testing of load sequencing timers, but not of the capability of the generators to actually assume emergency loads during each refueling outage.³ The maximum automatically connected load to either generator is 2,504 KW. The diesel generators are rated at 2,500 KW base load, 2,750 KW continuous peak load, and 3,025 KW overload capacity for two hours in any 24-hour period. Therefore, the total automatically connected diesel generator load (at 91% of continuous capacity) is within the ~~requirements~~ ^{criteria} of Regulatory Guide 1.9.

3.2 Bypass of Protective Trips

Discussion. On June 9, 1977, JCP&L provided a list of protective trips which render the diesel generators incapable of reponding to an automatic emergency start signal.⁴ The protective trips which are not bypassed are phase sequency^e voltage, undervoltage, leading VARs, reverse overspeed, and differential. None of them have redundant parameter sensors and coincident logic.²

Evaluation. The diesel generator phase sequence voltage, undervoltage, and leading VARs protective trips are neither bypassed during accident conditions nor provided with multiple parameter sensors and coincident logic. Therefore, the use of these diesel generator protective trips during accident conditions is not in agreement with current NRC staff guidelines as listed in BTP ICSB 17.

3.3 Diesel Generator Testing

Discussion. Oyster Creek Technical Specifications, paragraph 4.7.A, require diesel-generator testing as follows:

- (1) Each diesel generator shall be started and loaded to not less than 20% rated power every two weeks.
- (2) The two diesel generators shall be automatically actuated and functionally tested during each refueling outage. This shall include testing of the diesel generator load sequence timers listed in Table 3.1.1.
- (3) Each diesel generator shall be given a thorough^h inspection at least annually.¹
- (4) The diesel generators' fuel supply shall be checked following the above tests.

- (5) The diesel generators' starting batteries shall be tested and monitored the same as the station batteries, Specification 4.7.B.

Evaluation. Diesel-generator testing defined in the plant Technical Specifications address the criteria listed in paragraph 2.3 to the following extent:

- (1)
 - (a) No limits are specified for voltage, frequency, or time
 - (b) No limits are specified for voltage or frequency; actual loading of generator not required
 - (c) No limits are specified for voltage, frequency, or duration
 - (d) Not addressed
 - (e) Not addressed
 - (f) Not addressed
 - (g) Not addressed
 - (h) Not addressed
- (2) Not addressed
- (3)
 - (a) No limits specified for voltage, frequency, or time; automatic-start components are not addressed
 - (b) Load is specified as not less than 20%; duration is not specified.
- (4) Test interval is two weeks; variable interval is not addressed.

The Technical Specifications do not meet current licensing criteria for diesel-generator testing. Diesel-generator failure data will be extracted by NRC from Licensee Event Reports and will be considered in the final evaluation of testing adequacy.

4.0 SUMMARY

Automatic diesel generator loading is in compliance with current licensing criteria. The bypass of diesel generator protective trips is not in agreement with current NRC staff guidelines. Diesel-generator testing, as specified by plant Technical Specifications, does not meet current licensing criteria. The review of qualification of the diesel generators will be completed with SEP Topics III-1, Seismic Qualification, and III-12, Environmental Qualification.

5.0 REFERENCES

1. Letter JCP&L to NRC, dated January 23, 1979.
2. Telephone conversation, JCP&L (S. Merchant) and EG&G Idaho, Inc. (F. Farmer), April 26, 1979.
3. Technical Specifications and Bases for the Oyster Creek Nuclear Power Plant, paragraph 4.7.A.2.
4. Letter JCP&L to NRC, dated June 9, 1977.
5. General Design Criterion 17, "Electric Power System," of Appendix A, "General Design Criteria of Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."
6. General Design Criterion III, "Design Control," Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

7. "Standard Criteria for Class IE Power Systems and Nuclear Power Generating Stations," IEEE Std. 308, 1974, paragraph 5.2.4.
8. "Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Stations," IEEE Std. 387, 1977.
9. "Selection of Diesel Generator Set Capacity for Standby Power Supplies," Regulatory Guide 1.9.
10. "Periodic Testing of Diesel Generators Used as Onsite Power Systems at Nuclear Plant," Regulatory Guide 1.108.
11. "Diesel-Generator Reliability Qualification Testing," BTP ICS² (PSB).
12. "Diesel-Generator Protective Trip Circuit Bypasses," BPT ICSB17 (PSB).