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Docket No. 50-255

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Mr. David P. Hoffman Nuclear Licensing Administrator Consumers Power Company 212 West Michigan Avenue Jackson, Michigan 49201

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Dear Mr. Hoffman:

SUBJECT: SEP TOPIC VIII-2, DIESEL GENERATORS (PALISADES PLANT)

Enclosed is a copy of our revised, final evaluation of Topic VIII-2 for the Palisades Plant. This assessment has been changed from the draft that was forwarded by my September 15, 1980 letter because of modifications you have made to the diesel generator loading sequences.

This evaluation will be a basic input to the integrated safety assessment for your facility. This assessment may be revised in the future if your facility design is changed again or if NRC criteria relating to this subject is modified before the integrated assessment is completed.

Sincerely,

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

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Enclosure: As stated

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

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Docket No. 50-255 LS05-81-02-062

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# SEP TECHNICAL EVALUATION

TOPIC VIII-2 DIESEL GENERATORS

FINAL DRAFT

PALISADES

Docket No. 50-255

January 1981

F. G. Farmer

# CONTENTS

1.0	INTRODUCTION
2.0	CRITERIA
	2.1Diesel Generator Loading22.2Bypass of Protective Trips22.3Diesel Generator Testing3
3.0	DISCUSSION AND EVALUATION
	3.1 Diesel Generator Loading63.2 Bypass of Protective Trips73.3 Diesel Generator Testing7
4.0	SUMMARY
5.0	REFERENCES

#### SEP TECHNICAL EVALUATION

## TOPIC VIII-2 DIESEL GENERATORS

FINAL DRAFT

#### PALISADES

#### 1.0 INTRODUCTION

The objective of the review is to determine if the onsite AC generator for the Palisades 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 Plants and Fuel Reprocessing Plants," 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."

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Specifically, this review evaluates the loading of the dieselgenerator, 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 <u>Diesel Generator Loading</u>. 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:

 The automatically-connected loads on each dieselgenerator 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 <u>Bypass of Protective Trips</u>. 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 dieselgenerator trip would require specific coincident logic.

2.3 <u>Diesel Generator Testing</u>. 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-accidentloading 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 dieselgenerator 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 dieselgenerator 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 dieselgenerator unit to supply emergency power within the required time is not impaired during periodic testing under (3), below.

3

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

## 3.1 Diesel-Generator Loading

Discussion. The Palisades FSAR lists the worst-case loading for the diesel generators.<sup>1</sup> Diesel Generator 1-2 is slightly more heavily loaded than Diesel Generator 1-1 (2,714 Hp versus 2,640 Hp). As a result of recent containment spray modifications, the maximum step load change is 750 Hp (25% of capacity).

<u>Evaluation</u>. Palisades Technical Specifications require verification, by test, of diesel generator emergency load capability during each refueling outage.<sup>2</sup> Maximum loads of the diesel generators, at 90% motor efficiency, are 2,188 KW for DG 1-1 and 2,250 KW for DG 1-2. The continuous rating for each diesel generator is 2,500 KW at 0.8 Power Factor. Therefore, the total diesel generator loads (at 88% and 90% of capacity for DG 1-1 and DG 1-2, respectively) are within the requirements of Regulatory Guide 1.9.

# 3.2 Bypass of Protective Trips

<u>Discussion</u>. On May 16, 1977<sup>3</sup> and July 12, 1977,<sup>4</sup> CPCo provided a list of protective trips which render the diesel generators incapable of responding to an automatic emergency start signal.<sup>3,4</sup> Further conversation with CPCo determined that the diesel generators have protective trips which are not bypassed in accident conditions on high differential, overspeed and bearing oil pressure. None of these trips has redundant parameter sensors and coincident logic.

Evaluation. The diesel generator bearing oil pressure protective trip is neither bypassed during accident conditions nor provided with multiple parameter sensors and coincident logic. Therefore, the use of this diesel generat protective trip is not in agreement with current NRC staff guidelines as listed in BTP ICSB 17.

## 3.3 Diesel Generator Testing

<u>Discussion</u>. Palisades Technical Specifications, paragraph 4.7.1, require diesel-generator testing as follows:

- Each diesel generator shall be manually started each month and demonstrated to be ready for loading within 10 seconds. The signal initiated to start the diesel shall be varied from one test to another to verify all starting circuits are operable. The generator shall be synchronized from the control room, and loaded to 2400 + 100 kW.
- 2. A test shall be conducted during each refueling outage to demonstrate the overall automatic operation of the emergency power system. The test shall be initiated by a simulated simultaneous loss of normal and standby power sources and a simulated SIS signal. Proper operations shall be verified by bus load shedding and automatic starting of selected meters and equipment to establish that restoration with emergency power has been accomplished within 30 seconds.
- 3. Each diesel-generator shall be subjected to an inspection, in accordance with procedures prepared in conjunction with the manufacturer's recommendations for this class of standby service, at least once per 18 months during plant shutdown. The licensee shall utilize his best efforts to conduct additional major diesel-generator inspections and overhauls during shutdown periods. Diesel-generator electric loads shall not be increased beyond the continuous rating of 2500 kW.
- 4. The fuel transfer pumps shall be verified to be operable each month.

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

1. a. Acceptable

b. Acceptable

- c. Duration of specified
- d. Not addressed
- e. Not addressed
- f. Not addressed
- g. Covered under monthly test
- h. Not addressed .
- 2. Not addressed
- 3. a. Acceptable
  - b. Duration not specified
- 4. Not addressed.

The Technical Specifications do not meet current licensing criteria for diesel-generator testing.

#### 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. Final Safety Analysis Report, updated through Amendment 32, September 4, 1975, page 8-20b.
- 2. Technical Specifications for the Palisades Plant, April 16, 1976, paragraph 4.7.1.
- 3. Letter CPCo to NRC, dated May 16, 1977.
- 4. Letter CPCo to NRC, dated July 12, 1977.

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Telephone converse on CPCo (J. Kuemin) and EG&G (Tho, Inc. (F. Farmer), April 26, 1979.

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- 6. 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."
- 7. General Design Criterion III, "Design Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CRF Part 50, "Domestic Licensing of Production and Utilization Facilities."
- 8. "Standard Criteria for Class IE Power Systems and Nuclear Power Generating Stations", IEEE Std. 308, 1974, paragraph 5.2.4.
- 9. "Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Stations," IEEE Std. 387, 1977.
- 10. "Selection of Diesel Generator Set Capacity for Standby Power Supplies", Regulatory Guide 1.9.
- 11. "Periodic Testing of Diesel Generators Used as Onsite Power Systems at Nuclear Plants," Regulatory Guide 1.108.
- 12. "Diesel-Generator Reliability Qualification Testing," BTP ICSB2 (PSB).
- 13. "Diesel-Generator Protective Trip Circuit Bypasses," BTP ICSB17 (PSB).