

TECHNICAL EVALUATION REPORT

ECCS REPORTS (F-47)

TMI ACTION PLAN REQUIREMENTS

CONSUMERS POWER COMPANY
PALISADES PLANT

NRC DOCKET NO. 50-255

FRC PROJECT C5506

FRC ASSIGNMENT 7

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FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Operating Reactors) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

Mr. G. J. Overbeck, Mr. F. W. Vosbury, and Mr. B. W. Ludington contributed to the technical preparation of this report through a subcontract with WESTEC Services, Inc.

1. INTRODUCTION

1.1 PURPOSE OF REVIEW

This technical evaluation report (TER) documents an independent review of the outages of the emergency core cooling (ECC) systems at Consumers Power Company's (CPC) Palisades Plant. The purpose of this evaluation is to determine if the Licensee has submitted a report that is complete and satisfies the requirements of TMI Action Item II.K.3.17, "Report on Outages of Emergency Core-Cooling Systems Licensee Report and Proposed Technical Specification Changes."

1.2 GENERIC BACKGROUND

Following the Three Mile Island Unit 2 accident, the Bulletins and Orders Task Force reviewed nuclear steam supply system (NSSS) vendors' small break loss-of-coolant accident (LOCA) analyses to ensure that an adequate basis existed for developing guidelines for small break LOCA emergency procedures. During these reviews, a concern developed about the assumption of the worst single failure. Typically, the small break LOCA analysis for boiling water reactors (BWRs) assumed a loss of the high pressure coolant injection (HPCI) system as the worst single failure. However, the technical specifications permitted plant operation for substantial periods with the HPCI system out of service with no limit on the accumulated outage time. There is concern not only about the HPCI system, but also about all ECC systems for which substantial outages might occur within the limits of the present technical specification. Therefore, to ensure that the small break LOCA analyses are consistent with the actual plant response, the Bulletin and Orders Task Force recommended in NUREG-0626 [1], "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in GE-Designed Operating Plants and Near-Term Operating License Applications," that licensees of General Electric (GE)-designed NSSSs do the following:

"Submit a report detailing outage dates and lengths of the outages for all ECC systems. The report should also include the cause of the outage (e.g., controller failure or spurious isolation). The outage data for ECC components should include all outages for the last five years of

3. TECHNICAL EVALUATION

3.1 REVIEW OF COMPLETENESS OF THE LICENSEE'S REPORT

The ECC systems at CPC's Palisades Plant consist of the following four separate systems:

- o safety injection (SI) tank
- o high pressure safety injection (HPSI)
- o low pressure safety injection (LPSI)
- o refueling water storage tank (RWST).

In Reference 4, CPC also included systems and components that support the ~~ECC systems in carrying out their design functions under various accident~~ conditions. The support systems are:

- o design basis accident (DBA) sequencer
- o standby diesel generators
- o containment sump
- o engineered safeguards.

For each ECC system outage event, CPC provided the outage dates, the duration, and the cause, plus sufficient description to discern the corrective action taken. Maintenance and surveillance testing activities were included in the ECC system outage data. The results of CPC's review were provided for the period from January 1, 1976 to December 31, 1980 for the Palisades plant.

Based on the preceding discussion, it has been established that CPC has submitted a report which fulfills the requirements of review criterion 1 without exception.

3.2 COMPARISON OF ECC SYSTEM OUTAGES WITH THOSE OF OTHER PLANTS

The outages of ECC systems can be categorized as (1) unplanned outages due to equipment failure or (2) planned outages due to surveillance testing or preventive maintenance. Unplanned outages are reportable as Licensee Event

unavailability is a function of planned and unplanned outages of essential support systems as well as planned and unplanned outages of primary ECC system components. In accordance with the clarification discussed in Section 2, only the effects of outages associated with primary ECC system components and emergency diesel generators are considered in this review. The inclusion of all outage events assumed to be true ECC system outages tends to overestimate the unavailability, while the exclusion of support system outages tends to underestimate the unavailability of ECC systems and components. Only a detailed analysis of each ECC system for each plant could improve the confidence in the calculated result. Such an analysis is beyond the intended scope of this report.

The planned and unplanned (forced) outage times for the four ECC systems (SI tank, HPSI, LPSI, and RWST) and for the standby diesel generators were identified from the outage information in Reference 4 and are shown in number of days and as percentage of plant operating time per year in Table 1 for the Palisades plant. Outages that occurred during nonoperational periods were eliminated as were those caused by failures or test and maintenance of support systems. Data on plant operating conditions were obtained from the annual reports, "Nuclear Power Plant Operating Experience" [9-12], and from monthly reports, "Licensed Operating Reactors Status Summary Reports" [13]. The remaining outages were segregated into planned and unplanned outages based on CPC's description of the causes. The outage periods for each category were calculated by summing the individual outage durations.

Observed outage times of various ECC systems at the Palisades plant were compared with those of other PWRs. Based on this comparison, it was concluded that the historical unavailability of the SI tank, RWST, LPSI, and HPSI systems has been consistent with the performance of those systems throughout the industry. The unavailability was less than the industrial mean for the SI tank, RWST, and LPSI system and less than about one standard deviation above the industrial mean for the HPSI system, assuming that the underlying unavailability is distributed lognormally. The outage times were also consistent with existing technical specifications. The outages of the standby diesel generators were not included in this comparison.

Table 1. Planned and Unplanned (Forced) Outage Times for Palisades Plant*

Year	Days of Plant Operation	SI Tank		HPSI		LPSI		RWST		Diesel Generator	
		Outage in Days Forced	Outage in Days Planned								
1976	202.04	0.0	0.0	0.0	0.67 (0.33%)	1.12 (0.55%)	0.61 (0.30%)	0.0	0.0	2.38 (1.18%)	5.36 (2.65%)
1977	333.67	0.06 (0.02%)	0.0	7.15 (2.14%)	2.22 (0.67%)	0.0	0.08 0.02%	0.0	0.0	5.61 (1.68%)	7.49 (2.24%)
1978	181.18	0.0	0.0	0.0	1.11 (0.61%)	0.0	0.23 (0.13%)	0.0	0.0	3.13 (1.73%)	4.84 2.67%
1979	218.54	0.20 (0.09%)	0.09 (0.04%)	0.0	1.55 (0.71%)	0.0	0.16 (0.07%)	0.0	0.0	3.46 (1.58%)	13.11 (6.00%)
1980	201.13	0.0	0.0	0.0	0.08 (0.04%)	0.0	0.28 (0.14%)	0.0	0.0	10.21 (5.08%)	4.54 (2.26%)
Total	1136.56	0.26 (0.02%)	0.09 (0.01%)	7.15 (0.63%)	5.63 (0.50%)	1.12 (0.10%)	1.36 (0.11%)	0.0	0.0	24.79 2.18%	35.34 (3.11%)

* Numbers in parentheses indicate system outage time as a percentage of total plant operating time.

3.3 REVIEW OF PROPOSED CHANGES TO IMPROVE THE AVAILABILITY OF ECC EQUIPMENT

In Reference 4, CPC did not propose any changes to improve the availability of ECC systems and components.

4. CONCLUSIONS

Consumers Power Company (CPC) has submitted a report for the Palisades plant that contains (1) outage dates and durations, (2) causes of the outages, (3) emergency core cooling (ECC) systems or components involved in the outages, and (4) corrective actions taken. It is concluded that CPC has fulfilled the requirements of NUREG-0737, Item II.K.3.17. In addition, the historical unavailability of the SI tank, RWST, LPSI, and HPSI systems has been consistent with the performance of those systems throughout the industry. The observed unavailability was less than the industrial mean for the SI tank, RWST, and LPSI system and less than about one standard deviation above the industrial mean for the HPSI system. The outage times were also consistent with existing technical specifications.

5. REFERENCES

1. NUREG-0626
"Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in GE-Designed Operating Plants and Near-Term Operating License Applications"
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"Nuclear Power Plant Operating Experience 1978"
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12. NUREG/CR-1496
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13. NUREG-0020
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