June 22, 1983

Docket No. 50-255
LS05-83-06-049

Mr. David J. VandeWalle
Nuclear Licensing Administrator
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Dear Mr. VandeWalle:

SUBJECT: PALISADES NUCLEAR POWER PLANT - IPSAR SECTIONS 4.9 AND 4.15, PIPE BREAK INSIDE CONTAINMENT AND REACTOR COOLANT PRESSURE BOUNDARY (RCPB) LEAKAGE DETECTION REQUIREMENTS

In the Integrated Plant Safety Assessment Report (IPSAR) for the Palisades Nuclear Power Plant, NUREG-0820, the subject items were identified as requiring "refined engineering analysis or continuation of ongoing evaluation."

Based upon review of your December 9, 1982 submittal, the staff concludes that IPSAR Section 4.9 is complete. It is the staff's position that you should propose corrective measures for the two break locations that affect multiple instrument lines and, in accordance with IPSAR Section 4.15.2, that you should propose Technical Specification changes concerning operability of leakage detection systems. You are requested to provide your proposed resolution for these issues within 90 days of receipt of this letter.

Sincerely,

Original signed by/

Thomas V. Wambach, Project Manager
Operating Reactors Branch #5
Division of Licensing

Enclosure:
Evaluation on IPSAR
Sections 4.9 and 4.15

cc w/enclosure:
See next page

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DATE	6/15/83	6/20/83	6/15/83	6/15/83	6/21/83	6/22/83	6/22/83

Mr. David J. VandeWalle

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PALISADES NUCLEAR POWER PLANT
IPSAR SECTIONS 4.9 AND 4.15
HIGH ENERGY LINE BREAKS INSIDE CONTAINMENT
AND RCPB LEAKAGE DETECTION REQUIREMENTS

I. INTRODUCTION

The final Integrated Plant Safety Analysis Report (IPSAR) for the Palisades Nuclear Plant (NUREG-0820) (Reference 1), issued in October 1982, documented in Section 4.9 the licensee's commitment to complete review of high energy pipe breaks inside containment using staff guidance transmitted with the staff safety evaluation of Topic III-5.A. This guidance included criteria for acceptable interactions as well as a method for resolution of break locations where remedial measures are impractical which consists of a fracture mechanics analysis that demonstrates that a given size flaw remains stable under postulated loads and that smaller flaws are detectable. Similarly, the evaluation of the leakage detection systems (IPSAR Section 4.15) concluded that the need for improved leak rate sensitivity should be determined concurrent with the resolution of pipe break effects. The staff safety evaluation on Topic III-5.A, Effects of High Energy Line Breaks Inside Containment was issued by letter dated December 4, 1981 (Reference 2). In this evaluation, the staff concluded that the criteria and methodology were generally acceptable; however, additional information on the criteria used to determine acceptability of target piping interactions (functionality) was requested. Also, over 200 break locations were unresolved. As discussed above, the licensee was to further evaluate these break locations.

II. EVALUATION

By letters dated August 16, 1982 (Reference 3) and December 9, 1982 (Reference 4), CPCo submitted additional analyses of high energy line breaks inside containment to resolve the above issues.

A. Target Piping Acceptability Criteria

In the topic safety evaluation (Reference 2), the staff requested additional justification for the acceptance criterion for target piping, since the "functional capability" of the impinged pipe had not been directly addressed by the licensee. The staff's specific concern is that some piping systems are required to deliver certain rated flow and should be designed to retain dimensional stability when stressed to the allowable limits associated with the emergency and faulted conditions; i.e., the functional capability of the piping is required to be demonstrated.

In response to the staff's concern, the licensee submitted Reference 4. The licensee stated that a three dimensional computer model of the pipe as a long cylindrical thin shell was used to conduct a non-linear elastic-plastic analysis. The analysis showed that the maximum flow area reduction experienced by the target pipe in the Palisades pipe break study was only

9%. Therefore, the functional capability of the target pipe is not significantly affected. Based on a review of the information in Reference 4, we have determined that the licensee's target pipe evaluation is acceptable.

B. Disposition of Unresolved Breaks

The break locations that were unresolved after the preliminary review (in 1981) with conservative screening criteria were reevaluated in more detail.

The number of unresolved break locations were reduced to 139 after locations were moved to welds and structural discontinuities only instead of at any point in the system. The mechanistic approach was used on some lines to eliminate 42 locations. Detailed structural evaluation of interactions with the reactor cavity wall, containment liner, penetrations, and concrete embedment eliminated 18 locations (24 interactions).

The assessment of effects on safe shutdown capability and consideration of the jet zone of influence (from break locations that were moved) reduced the unresolved locations to 14. Twelve of the remaining locations were then considered with the staff guidance for resolution of break locations where remedial measures are impractical (transmitted with the staff topic evaluation in Reference 2). The other two locations are still unresolved (see Section C.3).

C. Results

1. Break Locations

The licensee used both the mechanistic and the simplified mechanistic approaches (see definitions in Reference 5) to reduce the number of break locations to consider. Based on review of the licensee's submittal (Reference 4), the staff concludes that the licensee has adequately identified the most likely break locations inside containment and that the methodology for selection is acceptable.

2. Structural Evaluations

The licensee's structural analyses were not reviewed by the staff in any detail; however, they will be considered in conjunction with review of code, load and load combination changes (see IPSAR Section 4.12).

3. Effects of Safe Shutdown Capability

The staff examined the target reevaluations presented in Appendix C of Reference 4, concerning the plant capability to attain safe shutdown following a postulated pipe break.

The approach used by the licensee was to examine each unresolved interaction between a postulated break and a safety-related target to determine whether a safe shutdown could still be performed. The single failure criterion was used. For example, for a non-LOCA break, some degradation of safety injection capability would be acceptable. For some secondary system break locations, the containment wall may be impacted. However, the possible radiological consequences of such a scenario would be a small fraction of 10 CFR Part 100 guidelines. Some small line breaks could fail other small lines; these cases were considered acceptable if the break area was enveloped by existing safety analysis, the ensuring break is in the same loop of the RCS and damage to in-core instrumentation lines is prevented.

Two breaks (one in the charging line, one in the letdown line) were identified which could damage instrument lines for steam generator pressure and level for both steam generators as well as the pressurizer pressure and level instrument lines. The staff finds this loss of monitoring instruments unacceptable and concludes that corrective measures are required.

Pipe whip from one break location in the three-inch pressurizer spray line could strike a cable tray containing power cables to one of the two hydrogen recombiners. A postulated single failure could result in no recombiners being available.

The licensee performed a preliminary leak before break fracture mechanics analysis (see below) which showed a stable 90° crack with a leak rate of approximately 0.1 gpm. A leak rate of this magnitude is probably too small to be readily detectable by present in-plant leak detection equipment. However, the leak would be detected in the daily calculation of the primary coolant inventory. Based upon the preliminary deterministic fracture mechanics analysis, the licensee believes that the possibility of the 3-inch pressurizer spray line break resulting in a pipe whip is unlikely and, therefore, that the need to modify the plant to add whip restraints or a barrier to protect the target cable tray is unwarranted. Furthermore, a modification to add local leak detection to monitor one weld is also not warranted. The weld associated with the break location is presently examined to ASME Section XI Class 1 requirements and is scheduled for inspection during the 1985 refueling outage.

Following a small break LOCA of the 3-inch pressurizer spray line, the hydrogen recombiner is not needed until a 2% hydrogen volume concentration is reached in containment. For comparative purposes, calculations performed for the Palisades containment show a 2% volume percent of hydrogen volume concentration is not reached until 100 hours have elapsed following a design basis accident (DBA). Plant operating procedure OMP-22 requires a hydrogen recombiner to be energized by the time hydrogen concentration has reached 2%. If at that time the recombiner is found to be inoperative, due to cable severance, there would be adequate time available to restore power to the redundant hydrogen recombiner before a combustible mixture of 4% is reached at about 350 hours. It is reasonable to assume that given this time frame of 350 hours associated with a DBA, the diesel generator malfunction will be corrected or offsite power will be restored. The staff finds this resolution acceptable.

Based on our review of the licensee's general guidelines and of the detailed results, the staff concludes that the licensee has adequately addressed the postulated break interactions except for the two cases involving instrument lines discussed above.

4. Resolution of 12 Locations (Where Remedial Measures are Impractical)

As discussed in Reference 2, the basic approach is to show that conditions that could lead to a double-ended rupture do not exist. The fracture mechanics evaluation is done to show that a given size flaw remains stable under postulated loads and that smaller flaws are detectable by leakage detection systems. The jet impingement effects from cracks corresponding to the detectable leakage must also be considered.

(a) Fracture Mechanics

Appendix G of the licensee's submittal (Reference 4) was reviewed to determine if the fracture mechanics analysis of the twelve postulated break locations met the staff's criteria given in Reference 2. The staff has determined that significant margins against pipe break, given seismic and operating loads, exist at these locations. The analyses were performed with conservative values for postulated crack size and material properties. This analysis demonstrated to the staff's satisfaction that a crack of a size which would result in a 10 gpm leak would be stable in the presence of seismic and operating loads for a considerable period of time.

(b) Effects of Jets

The licensee assessed the jet impingement load from flaw sizes corresponding to a 10 gpm leak. Targets in the vicinity of these break locations were reviewed to ensure that no unacceptable damage would occur from these jets. The staff finds this acceptable.

5. Leakage Detection

As discussed in Section 4.15 of the Palisades IPSAR, the staff found that the leakage detection systems are able to detect a 1 gpm leak from the reactor coolant pressure boundary to the containment within 24 hours.

In the IPSAR, the staff concluded that the need for improved sensitivity should be determined from the fracture mechanics evaluation. A staff requirement for Technical Specification modifications to impose operability requirements for leakage detection systems was deferred until the pipe break evaluation was completed.

Given the significant resistance of the subject piping to pipe break and given the sensitivity of the existing leakage detection systems the staff finds the fracture mechanics evaluation acceptable and that no leak detection system modifications due to the subject postulated break locations need be made. Therefore, in accordance with IPSAR Section 4.15.2, the licensee should submit a request for amendment to modify the Technical Specifications concerning operability of leak detection systems that monitor leakage to the containment.

III. CONCLUSION

The staff has reviewed the licensee's analyses of high energy line breaks inside containment and concludes that the subject topic and thus IPSAR Section 4.9, is complete. Staff review of structural considerations will be coordinated with review of IPSAR Section 4.12 on Code, Load and Load Combination changes. It is the staff's position that the licensee should propose corrective measures for the two indicated break locations that affect multiple instrument lines. No modifications to plant leakage detection systems are required as a result of this review; therefore, the licensee should propose Technical Specification changes concerning operability of installed leakage detection systems in accordance with IPSAR Section 4.15.2.

IV. REFERENCES

1. NUREG-0820, Integrated Plant Safety Assessment Report for the Palisades Nuclear Power Plant, dated October 1982.

2. Letter from D. M. Crutchfield (NRC) to D. P. Hoffman (CPCo), dated December 4, 1981.

3. Letter from R. A. Vincent (CPCo) to D. M. Crutchfield (NRC), dated August 16, 1982.

4. Letter from K. A. Toner (CPCo) to D. M. Crutchfield (NRC), transmitting EDS Report No. 02-0540-1108, November 1982, dated December 9, 1982.

5. Letter from D. K. Davis (NRC) to J. McEwen (KMC), SEP Owners Group, dated July 20, 1978.