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

SAFETY EVALUATION

CONSTRUCTION PERMIT CPPR-126 AMENDMENT NO. 8

COMANCHE PEAK UNIT 1

INTRODUCTION

By letter dated August 20, 1984, Texas Utilities Generating Company (TUGCO or the licensee), the lead construction agent of the Comanche Peak Steam Electric Station, requested an amendment to Construction Permit CPPR-126, to incorporate the partial Exemption granted by the Commission, dated August 28, 1984, pertaining to General Design Criterion (GDC) 4 of 10 CFR 50, Appendix A. The partial exemption granted by the Commission will not require the licensee to install jet impingement shields in eight locations per loop in the Comanche Peak, Unit 1 primary coolant piping system, as specified in Section 4.0 of the value-impact analysis submitted by the licensee's letter to the Commission (TXX-4159) dated April 23, 1984, which together with the technical information contained in the Westinghouse Report WCAP-10527, provided a comprehensive justification in support of requesting a partial exemption from the requirements of GDC 4.

EVALUATION

By letter dated August 28, 1984, the licensee was informed that the Commission had granted the Exemption requested, to the extent clarified in the licensee's letter dated June 7, 1984, and enclosed a copy of the Exemption to the licensee. The licensee was advised that NRC was processing the requested Construction Permit amendment separately (licensee's August 20, 1984 letter) in order to make the Exemption effective.

The staff's detailed evaluation and basis for granting the partial exemption to the requirements of GDC 4 is delineated in the Exemption enclosed to the NRC letter dated August 28, 1984. A summary of the staff's evaluation findings and conclusions immediately follow.

SUMMARY OF EVALUATION FINDINGS

From its evaluation of the analysis contained in Westinghouse Report WCAP-10527 for Comanche Peak, the staff found that the licensee presented an acceptable technical justification, which adequately addressed the staff's evaluation criteria, for not installing protective devices to deal with the dynamic effects of large pipe ruptures in the main loop primary coolant system piping of Comanche Peak Units 1 and 2. This finding is predicated on the fact that each of the parameters evaluated for Comanche Peak is enveloped by the generic analysis performed by Westinghouse, contained in Westinghouse Report WCAP-9558, Revision 2, and accepted by the staff in Enclosure (1) to NRC Generic Letter 84-04 (February 1, 1984). Specifically, the NRC determined that:

(1) The loads associated with the highest stressed location in the main loop primary system piping for Comanche Peak are considerably lower than the bounding loads used by Westinghouse in Report WCAP-9558 or those established by the staff as limits (e.g., a moment of 42,000 in-kips in Enclosure (1) to 8 Generic Letter 84-04).

(2) For Westinghouse plants, there is no history of cracking failure in reactor primary coolant system loop piping. The Westinghouse reactor coolant system primary loop has an operating history which demonstrates its inherent stability. This includes a low susceptibility to cracking failure from the effects of corrosion (e.g. intergrannular stress corrosion cracking), water hammer, or fatigue (low and high cycle). This operating history totals over 400 reactor-years, including five plants each having 15 years of operation and 15 other plants with over 10 years of operation.

(3) The results of the leak rate calculations performed for Comanche Peak, using an initial through-wall crack are identical to those of Enclosure 1 to the NRC Generic Letter 84-04. The Comanche Peak plant has an RCS pressure boundary leak detection system which is consistent with the guidelines of Regulatory Guide 1.45, and it can detect leakage of one (1) gpm in one hour. The calculated leak rate through the postulated flaw is large relative to the sensitivity of the Comanche Peak plant leak detection system.

(4) The expected margin in terms of load for the leakage-size crack under normal plus SSE loads is within the bounds calculated by the staff in Section 4.2.3 of Enclosure (1) to NRC Generic Letter 84-04. In addition, the staff found a significant margin in terms of loads larger than normal plus SSE loads.

(5) The margin between the leakage-size crack and the critical-size crack was calculated. Again, the results demonstrated that a significant margin exists and is within the bounds of Section 4.2.3 of Enclosure 1 to the NRC Generic Letter 84-04.

(6) As an integral part of its review, the staff's evaluation of the material properties data in the Westinghouse Report WCAP-10456 is enclosed as Appendix 1 to the Exemption granted by the Commission. In this data for ten (10) plants, including the Comanche Peak Units, are presented, and lower bound or "worst case" materials properties were identified and used in the analysis presented in Westinghouse Report WCAP-10527. The staff's upper bound of 3000 in-lb/in^2 on the applied J (Appendix 1 of the Exemption, page 6) was not exceeded; the applied J for Comanche Peak in the Westinghouse Report WCAP-10527 was substantially less than 3000 in-lb/in^2.

The NRC staff, after several review meetings with the Advisory Committee on Reactor Safeguards (ACRS) and a meeting with the NRC Committee to Review Generic Requirements (CRGR), concluded that for certain facilities an exemption from the regulations would be acceptable as an alternative for resolution of USI A-2 for sixteen facilities owned by eleven licensees in the Westinghouse Owner's Group (one of these facilities, Fort Calhoun has a Combustion Engineering nuclear steam supply system). This NRC staff position was stated in Generic Letter 84-04, published on February 1, 1984. The generic letter states that the affected licensees must justify an exemption to GDC 4 on a plant-specific basis. Other PWR applicants or licensees may request similar exemptions from the requirements of GDC 4 provided that they submit an acceptable technical basis for eliminating the need to postulate pipe breaks.

The acceptance of an exemption was made possible by the development of advanced fracture mechanics technology. These advanced fracture mechanics techniques deal with relatively small flaws in piping components (either postulated or real) and examine their behavior under various pipe loads. The objective is to demonstrate by deterministic analyses that the detection of small flaws by either inservice inspection or leakage monitoring systems is assured long before the flaws can grow to critical or unstable sizes which could lead to large break areas such as the DEGB or its equivalent. The concept underlying such analyses is referred to as "leak-before-break" (LBB). There is no implication that piping failures cannot occur, but rather that improved knowledge of the failure modes of piping systems and the application of appropriate remedial measures, if indicated, can reduce the probability of catastrophic failure to insignificant values.

Advanced fracture mechanics technology was applied in Westinghouse Topical Reports WCAP-9558, Rev. 2, and WCAP-9787 and Westinghouse Letter Report NS-EPR-2519 to the NRC dated November 10, 1981, submitted to the staff by Westinghouse on behalf of the licensees belonging to the USI A-2 Owners Group. Although the Westinghouse topical reports were intended to resolve the issue of asymmetric blowdown loads that resulted from a limited number of discrete break locations, the technology advanced in these reports demonstrated that the probability of breaks occurring in the primary coolant system main loop piping is sufficiently low such that these breaks need not be considered as a design basis for requiring installation of pipe whip restraints or jet impngement shields. The staff's Topical Report Evaluation is attached as Enclosure 1 to NRC Generic Letter 84-04.

Probabilistic fracture mechanics studies conducted by the Lawrence Livermore National Laboratories (LLNL) on both Westinghouse and Combustion Engineering nuclear steam supply system main loop piping (LLNL Report UCRL-86249, Feb. 1984) confirm that both the probability of leakage (e.g., undetected flaw growth through the pipe wall by fatigue) and the probability of a DEGB are very low. The results given in Reference 8 are that the best-estimate leak probabilities for Westinghouse nuclear steam supply system main loop piping range from 1.2×10^{-8} to 1.5×10^{-7} per plant year and the best-estimate DEGB proabilities range from 1×10^{-12} to 7×10^{-12} per plant year. Similarly, the best-estimate leak probabilities for Combustion Engineering nuclear steam supply system main loop piping range from 1×10^{-8} per plant year to 3×10^{-8} per plant year, and the best-estimate DEGB probabilities range from 5×10^{-14} to 5×10^{-13} per plant year. These results do not affect core melt probabilities in any significant way.

ENVIRONMENTAL ASSESSMENT

In advance of issuing the Exemption, the Commission published in the Federal Register on August 27, 1984 (49FR33945) an "environmental assessment and finding of no significant impact." It was stated in that assessment that the planned Exemption action would not have a significant effect on the quality of the human environment. The Exemption granted involves design features located entirely within the plant restricted area as defined in 10 CFR Part 20; does not affect plant radioactive and non-radioactive effluents; has no other environmental impact; and does not involve the use of resources not previously considered in the Final Environmental Statement (construction permit and operating license) for Comanche Peak Unit 1.

This amendment involves changes in the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission had determined that this amendment involves no significant hazards considerations. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

CONCLUSION

In granting the Exemption, the staff found that the advanced fracture mechanics techniques used by the licensee provided an assurance that flaws in primary system piping will be detected before they reach a size that could lead to unstable crack growth. For this reason, further protection provided by jet impingement shields against the dynamic effect of jet impingement resulting from the discharge from a double-ended guillotine break in the primary piping is unnecessary. With full protection against dynamic effects provided by advanced analysis techniques, and based on the considerations discussed above, we conclude that: (1) the proposed amendment to Construction Permit CPPR-126 permitting the use of the Exemption in construction of Unit 1 does not involve a significant increase in the probability or consequences of accidents previously considered, does not create the possibility of an accident of a type different from any evaluated previously, does not involve a significant decrease in a safety margin, and thus does not involve a significant hazards consideration; (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; and (3) such activities will be in compliance with the Commission's regulations and the issuance of the amendment will not be inimical to the common defense and security, or to the health and safety of the public.

/s/
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/s/
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CONCURRENCES: *See previous concurrences

DL:LB#1	DL:LB#1	*DL:LB#1
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10/18/84	10/18/84	10/7/84 10-26-84

Date of Issuance: OCT 2 6 1984

REFERENCES

(1) Westinghouse Report MT-SME-3135, "Technical Basis for Eliminating Large Primary Loop Pipe Ruptures as the Structural Design Basis for Comanche Peak Units 1 and 2," Oct. 1983, Westinghouse Class 2 proprietary.

(2) Westinghouse Report WCAP-10456, "The Effects of Thermal Aging on the Structural Integrity of Cast Stainless Steel Piping for Westinghouse Nuclear Steam Supply Systems," Nov. 1983, Westinghouse Class 2 proprietary.

(3) NRC letter to R. J. Gary of Texas Utilities Generating Company, "Request for Additional Information Concerning Leak-Before-Break Analysis for Comanche Peak Steam Electric Station (Units 1 and 2) dated Mar. 2, 1984.

(4) Westinghouse Report WCAP-10527, "Technical Bases for Eliminating Large Loop Pipe Rupture as the Structural Design Basis for Comanche Peak Units 1 and 2", Apr. 1984, Westinghouse Class 2 proprietary.

(5) Texas Utilities Generating Company letter TXX-4197, "Request for Partial Exemption" (H. C. Schmidt to B. J. Youngblood) dated June 7, 1984.

(6) Texas Utilities Generating Company letter TXX-4118, "Request for Partial Exemption" (R. J. Gary to B. J. Youngblood) dated Feb. 17, 1984.

(7) Westinghouse Report WCAP-9558, "Mechanistic Fracture Evaluation of Reactor Coolant Pipe Containing a Postulated Circumferential Throughwall Crack," Rev. 2, May 1981, Westinghouse Class 2 proprietary.

(8) NRC Generic Letter 84-04, "Safety Evaluation of Westinghouse Topical Reports Dealing with Elimination of Postulated Breaks in PWR Primary Main Loops," Feb. 1, 1984.