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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

AMENDMENT NOS. 39, 37, 48 AND 47

LICENSE NOS. DPR-19, DPR-25, DPR-29, AND

DRESDEN AND QUAD CITIES NUCLEAR POWER STATIONS

COMMONWEALTH EDISON COMPANY

DOCKET NOS. 50-237, 50-249, 50-254 AND 50-265

Introduction

By letters dated September 10, 1974 and May 17, 1976, as supplemented by letters dated March 21, 1977 and March 13, 1978, Commonwealth Edison (CE) proposed changes to the Technical Specifications appended to Operating Licenses DPR-19 and DPR-25 for Dresden Units 2 and 3, and Technical Specifications appended to Operating Licenses DPR-29 and DPR-30 for Quad Cities Units 1 and 2. The changes would modify the reactor coolant system thermal and pressurization limitations to account for irradiation induced increases in reactor vessel metal nil ductility temperature (RT_{NDT}). The CE submittals were based on the determination that certain changes were necessary to bring the reactor coolant system pressure-temperature limits into conformity with the requirements of Appendix G to 10 CFR Part 50.

Discussion

Title 10 CFR Part 50, Appendix G "Fracture Toughness Requirements", requires that pressure-temperature limits be established for reactor coolant system heatup and cooldown operations, inservice leak and hydrostatic tests, and reactor core operation. These limits are required to ensure that the stresses in the reactor vessel remain within acceptable limits. They are intended to provide adequate margins of safety during any condition of normal operation, including anticipated operational occurrences.

The specific pressure-temperature limits which are initially established depend upon the metallurgical properties of the reactor vessel material and the design service conditions. However, the metallurgical properties vary over the lifetime of the reactor vessel because of the effects of neutron irradiation. One principal effect of the neutron irradiation is that it causes the reactor vessel nil ductility temperature (RT_{NDT}) to increase or shift with time. The practical results of the RT_{NDT} shift

[1] RT_{NDT} is the temperature associated with the transition from ductile to brittle fracture mode of failure.

is that for any given value of reactor pressure, the reactor vessel metal temperature must be maintained at higher values during the heatup and cooldown process. By periodically revising the pressure-temperature limits to account for neutron irradiation induced increases in RT_{NDT}, the stresses in the reactor vessel are maintained within acceptable limits.

Evaluation

The CE submittals dated September 10, 1974 and May 17, 1976 included, for the Dresden Units and Quad Cities Units, respectively, pressure-temperature limits for hydrostatic testing, mechanical heatup and cooldown and minimum temperature for Core Operation (criticality). During our review of these submittals we determined that the radiation damage estimate curves, i.e., the effect of neutron fluence on RT_{NDT}, did not appear to be as conservative as that presented in Regulatory Guide 1.99.

In a letter dated February 15, 1978[1], CE stated that their radiation damage estimates were based on a "worst case" basis. Subsequent staff calculations made on "worst case" conditions[2] determined the end of life neutron fluence at the one-quarter thickness (1/4T) location to be 9×10^{17} n/cm^2.[3]

Branch Technical Position MTEB 5-2 "Fracture Toughness Requirements" requires that calculations be performed in regions of high stress unless the assumed RT_{NDT} of the beltline region is at least 50°F above the RT_{NDT} of all higher stressed regions. To satisfy this requirment, CE obtained stress intensities in regions of discontinuities by adjusting the results of a generic analysis made to account for differences between the design and materials of the Dresden and Quad Cities vessels and those of the reference plant. We have reviewed the licensee's submittal and determined that this is an acceptable procedure for calculating pressure-temperature operating limits. The operating limits for hydrostatic testing, mechanical heatup or cooldown, and minimum temperature for core operation (criticality) were calculated by CE and submitted on March 13, 1978.[4]

Based on the use of the previously discussed "worst case" damage estimates, an end of life neutron fluence of 9×10^{17} n/cm^2 at the 1/4T location, and the limiting curves submitted on March 13, 1978, we conclude that these limits and damage estimates are acceptable for operation through approximately 6 effective full power years. Accordingly, the staff added a Specification to the temperature and pressure limits to require that the figures for hydrostatic testing, mechanical heatup and cooldown, and minimum temperature for core operation (criticality) will be updated to account for radiation damage at least 6 months prior to 6 effective full power years. This additional requirement was discussed with and agreed to by the licensee.

We conclude that the pressure-temperature operating limits as amended by the staff are acceptable through 6 EFPY. For this operating period the proposed pressure-temperature operating limits are in accordance with Appendix G, 10 CFR Part 50. Compliance with Appendix G in establishing safe operating limitations will ensure adequate safety margins during operation, testing, maintenance and postulated accident conditions and constitute an acceptable basis for satisfying the requirements of NRC General Design Criterion 31, Appendix A, 10 CFR Part 50.

Environmental Consideration

We have determined that the amendments do not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendments involve an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of these amendments.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendments do not involve a significant increase in the probability or consequences of accidents previously considered and do not involve a significant decrease in a safety margin, the amendments do 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 conducted in compliance with the Commission's regulations and the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Dated: November 13, 1978

References

1. Letter to Don Davis (NRC/ORB #2) from M. S. Turbak (CE); dtd February 15, 1978.

2. i.e., the upper limit line in Regulatory Guide 1.99, Revision 1.

3. Adjusted data from Table 2-2 of NEDO-21708 per instructions in table note. Results from this procedure yield more conservative results than those supplied by CE.

4. Submitted as Figures 4, 5, and 6 in attachment to letter from M. S. Turback (CE) to George Lear (NRC/ORB #3); dtd March 13, 1978.