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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
SUPPORTING AMENDMENT NO. 39 TO LICENSE NO. DPR-31
FLORIDA POWER AND LIGHT COMPANY
TURKEY POINT NUCLEAR GENERATING UNIT NO. 3
DOCKET NO. 50-250

Introduction/Background

By letter (L-78-312) dated September 26, 1978, as supplemented by letter (L-78-323) dated October 2, 1978, Florida Power & Light Company (FPL) submitted information to justify continued operation of Turkey Point Unit No. 3 for an additional four (4) equivalent months beyond the eight (8) months, beginning February 1, 1978, currently authorized by License Amendments Nos. 32 and 36, dated January 31, 1978, and June 2, 1978, respectively.

License Amendment No. 32 authorized six equivalent months of operation. The basis for establishing a six month period of operation was the preventive tube plugging performed by FPL under accepted plugging criteria implemented following the last inspection of the steam generators completed in December 1977, along with an analysis of the information developed as a result of the steam generator tube inspections conducted in Turkey Point Unit No. 3, in November and December 1977. The criteria for preventive tube plugging were determined from the predicted growth of regions in the tube support plate in which the severity of tube denting would make tubes in these regions susceptible to stress corrosion cracking. Specifically, the rate of growth of these regions was one-third distance between tube rows per month of equivalent power operation for tubes in columns 14 thru 80 and two-thirds distance between tube rows per month in columns 1 thru 13 and 81 thru 94.

License Amendment No. 36 authorized two additional equivalent months of operation. The basis for allowing two more months of operation was that the consequences of the maximum primary to secondary leakage rate, estimated by the staff, that would be expected during a postulated main steam line break (MSLB) were acceptable. In order to bound the number of tubes that could possibly develop thru-wall cracks, we conservatively assumed that all tubes predicted to be within the 17.5% hoop strain contour are in a state of incipient cracking and would crack through when subjected to the expected pressure differentials during a postulated MSLB accident. This assumption is conservative in that successive inspection results indicated that not all tubes within the predicted boundary (17.5% strain) actually restrict the 0.540 inch probe.

Discussion

The licensee has used steam generator inspection results from Turkey Point 4 to predict the conditions that will exist in the Turkey Point 3 steam generators. The progression of flow slot closure in the worst steam generator of Turkey Point 3, generator B, is approximately six months behind that observed in the worst steam generator of Turkey Point 4, also generator B. The two inspections of Turkey Point 4 steam generators at points beyond full closure of flow slots were examined and, based on these data, FPL estimates that at 12 EFPM beyond closure the maximum predicted number of restricted unplugged tubes within the 17.5% tube hoop strain contour for Turkey Point 3 is 184. Restricted tubes are defined as those which restrict either the 0.650, 0.610, or 0.540 inch probes. Turkey Point 3 will be at approximately 12 EFPM beyond full flow slot closure at the end of an additional 4 months of operation. Assuming all 184 restricted tubes developed thru-wall cracks during a postulated MSLB, the licensee has estimated a maximum primary to secondary leakage rate of approximately 9.90 gpm.

FPL has evaluated the effects of the calculated leakage rate. Analyses have shown that such low leakage rates during a MSLB would have a negligible effect on primary system thermal hydraulic parameters, the DNBR, the percent of coolant volume lost by leakage, or the time to terminate the core transient. Also, the effect of secondary to primary leakage during a LOCA would be negligible relative to primary system thermal hydraulic parameters when compared to the effects of the LOCA on these parameters.

Based on the information discussed above, FPL concludes that Turkey Point 3 can be safely operated for an additional four (4) equivalent months beyond the currently authorized eight (8).

The licensee assumes in their leakage rate calculations that only one crack per tube could develop during a postulated MSLB. To justify this assumption, they reference Figure I-3 in their June 9, 1977, (L-77-173), Turkey Point 4 submittal. This figure indicates that one tube/support plate intersection leads the others in the magnitude of denting to the extent that leakage would occur at this intersection during normal operation prior to any other dented intersection along a tube degrading to such a point that it would develop a leak during a postulated MSLB accident.

In conjunction with their request for an extension of four (4) months, the licensee has proposed additional operating restrictions to the Turkey Point 3 operating license. They include requiring a gauging inspection of a steam generator if the 0.3 gpm primary to secondary leakage rate limit is exceeded or a shutdown to repair any leak due to the denting phenomenon occurs, and requiring an inspection of all three steam generators if leakage attributable to the denting phenomenon occurs in two or more tubes in any 20 day period.

Evaluation

The licensee submitted leakage rate calculations for conditions that would be expected during a postulated MSLB accident. These calculations are based on the assumption that only tubes predicted to be restricted within the projected 17.5% tube hoop strain contour could develop a crack and leak during a postulated MSLB. In our previous safety evaluation reports on this subject, e.g., as in our safety evaluation report attached to Amendment No. 36 to Facility Operating License No. DPR-31 for Turkey Point 3 dated June 2, 1978, we assumed that all tubes predicted to be within the 17.5% strain contour could crack under postulated MSLB conditions. However, this is the first time a licensee has estimated the total number of tubes expected to restrict all three probe sizes. Since 1) preventive plugging in the tubelane regions is based on the number and location of tubes found to restrict either the 0.540 or 0.610 inch probes, 2) inspection results indicate that not all tubes within the 17.5% hoop strain boundary restrict even the 0.650 inch probe, and 3) it is not likely that any tubes besides those dented to such a point that they do not allow passage of a 0.540 inch probe will develop cracks and leak, we believe that the licensee's assumptions are conservative for estimating the maximum expected leakage during a postulated MSLB accident. Therefore, the conclusions reached by the licensee are valid and the NRC staff has concluded the following:

1. The primary degradation mechanism in Turkey Point 3 steam generators is associated with the denting phenomenon and the tube cracking is expected to occur at tube/support plate intersections (since all row 1 tubes have been previously plugged). The type of cracks associated with tube denting are constrained by the support plate, and will not burst open during a MSLB accident.

2. The leak rate associated with these cracks is very small. The estimated leakage rate of 0.05 gpm per tube under accident loads is reasonably conservative. This leakage rate has been determined experimentally by Westinghouse.

3. The data discussed above, i.e., Figure 1-3 of the June 9, 1977, Turkey Point 4 submittal, will most likely also be valid for the Turkey Point 3 steam generators and, therefore, only one crack per tube need be postulated for the leakage rate calculations.

4. It is a reasonably conservative assumption that only restricted tubes within the 17.5% strain contour could crack and leak during a postulated MSLB accident and the actual leakage rate should be bounded by the calculated rate.

5. Therefore, the total leakage rate in the affected steam generator would most likely not exceed 10 gpm.

6. A primary to secondary leak rate of 10 gpm will have a negligible effect on primary system thermal hydraulic parameters, the DNB ratio, the percentage of reactor coolant volume lost by leakage, and the time to terminate the core transient during a postulated MSLB accident.

7. The effect of secondary to primary leakage during a LOCA would be negligible relative to primary system thermal hydraulic parameters when compared to the effects of the LOCA itself on these parameters.

8. Although tubes that, according to the current plugging criteria should be plugged, are remaining in service, the currently imposed operating restrictions adequately address the possibility of cracks and subsequent leakage developing during normal operation.

9. The additionally imposed operating restrictions will assure that unexpected acceleration of tube denting is recognized and dealt with in a timely, orderly fashion.

10. An additional four (4) equivalent* months of operation of Turkey Point 3 is therefore acceptable.

For the foregoing reasons we conclude that an additional four months of operation, under the constraints imposed by the existing facility operating license and new constraints agreed to by the licensee, will not significantly change the basic conclusions stated in the previous safety evaluation report attached to License Amendment No. 32, dated January 31, 1978.

Environmental Consideration

We have determined that the amendment does 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 amendment involves 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 this amendment.

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.

*For purposes of this SER, equivalent operation is defined as operation with a primary coolant temperature greater than 350°F.

References

1. Letter from R. E. Uhrig to NRC dated March 1, 1978.

2. Letter from C. M. Stalling VEPCO to B. C. Rusche NRC dated March 25, 1977 (Docket No. 50-280).

3. Letter to FPL granting Amendment No. 32 to DPR-31 dated January 31, 1978.