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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

VIRGINIA ELECTRIC AND POWER COMPANY

NORTH ANNA POWER STATION, UNIT NO. 1

DOCKET NO. 50-338

Introduction

In our Safety Evaluation Report dated January 15, 1980, we concluded that the Virginia Electric and Power Company's (the licensee's) corrective actions for the North Anna Power Station, Unit No. 1 (NA-1) was adequate to ensure steam generator integrity for short-term operations. However, we undertook the review of long-term consequences of the licensee's corrective actions relating to tube integrity, tube support plate corrosion and changes in steam generator chemistry with ammonia/boric acid additions for long-term operation. Our letter dated April 8, 1980 requested additional information from the licensee regarding the long-term consequences of the corrective actions as stated above. The licensee provided the additional information in letters dated June 18 and June 30, 1980 which described the water chemistry at NA-1.

Long-term steam generator tube integrity is dependent on the licensee's success in halting the amount of denting-like degradation that has developed in the NA-1 steam generators by use of the ammonia/boric acid soak and ammonia/boric acid water treatment described in the licensee's submittals. While it is recognized that the use of this treatment in Pressurized Water Reactors (PWR) steam generators to halt denting is to some extent still experimental, both laboratory data with model boilers and previous experience at another PWR plant have indicated that it is beneficial in halting the further progression of denting even though all of the harmful impurities (in the other instances, chlorides) were not removed prior to the boric acid soak.

Evaluation

The data submitted by the licensee suggest that the incipient denting that developed at NA-1 was triggered by one or more injections of resin beads into the steam generators that led locally to an acidic sulfate environment in the crevices between the tube and the tube support plates. At NA-1, although much of the acidic sulfate contamination was removed by steam generator blowdown and flushing previous to starting the ammonia/boric acid water treatment, not all of the contamination was removed, as evidenced by some hideout return of the contamination subsequent to the water treatment. It is considered impossible to remove all hideout contamination from a steam generator over a short period of time. Runaway magnetite formation in the presence of corrosive anions such as chlorides (and possibly sulfates) has been demonstrated in the laboratory and in previous experience at another utility to be effectively stopped by the use of a boric acid ammonia treatment such as that proposed by the licensee. While

admittedly its use in a steam generator with the water chemistry history like that at NA-1 (acidic sulfate rather than acidic chloride) has not yet been demonstrated, all evidence points to the fact that this water treatment should successfully reduce corrosion of the steam generator support plates without adversely affecting the corrosion of the steam generator tubing. The licensee has provided information that no acid solutions will be added to the steam generators throughout the course of this treatment.

Calculations have been made of the pH values available in the water as a result of the ammonia/boric acid treatment. These calculations were made on the basis of the range of temperatures available in the feedwater train of the secondary side of the steam generator. The calculations show that the treated water will have a pH slightly greater than neutral under all postulated conditions. Under these conditions, corrosion of all of the materials in this system should be minimal.

NA-1 has implemented a hydrogen monitoring program since the boron soak. The data from this monitoring program have shown no abnormal increase in hydrogen evolution and the hydrogen value is stable (0.5 gram moles per hour). It should be noted that massive increase in the hydrogen values would indicate rapidly increasing corrosion in the steam generators.

Conclusion

Though the corrective action taken by the licensee, i.e., the ammonia/boric acid treatment is to some extent experimental, this water treatment should halt further tube degradation by the denting process at the NA-1 steam generators. This water treatment, in a steam generator that is essentially free of chlorides, should halt corrosion of the tube support plates without introducing corrosion of the other materials in the steam generator circuit.

It is our conclusion that periodic inservice inspections of the steam generators, which are required by the NA-1 Technical Specifications, will provide for the monitoring of further tube denting. In order that we be appraised of the effectiveness of the ammonia/boric acid treatment, eddy current and visual inspection results for the forthcoming steam generator inspection (during the second refueling outage), we have requested that the licensee submit these results 30 days after completion of the NA-1 steam generator inspection.

Date: November 21, 1980