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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 98 TO FACILITY OPERATING LICENSE NPF-35

AND AMENDMENT NO. 92 TO FACILITY OPERATING LICENSE NPF-52

DUKE POWER COMPANY, ET AL.

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

By letter dated April 13, 1992, as supplemented by letter dated June 8, 1992, the Duke Power Company (the licensee) submitted a request for changes to the Catawba Nuclear Station, Units 1 and 2, Technical Specifications (TS). The requested changes would revise TS 3.6.5.5 to allow a pressurizer enclosure hatch between the upper and lower containment volumes to be open for up to 6 hours, instead of 1 hour, to facilitate inspections of components such as power-operated relief valve (PORV) block valves. The June 8, 1992, letter provided clarifying information that confirmed the staff's understanding of the scope of work activities to be performed during the revised 6 hour interval and did not change the initial proposed no significant hazards consideration determination.

An ice condenser containment such as found at the Catawba facility is divided into three major compartments: the upper compartment, the lower compartment, and the ice condenser compartment. Any high-energy line breaks inside the containment, such as a LOCA or main steam line break, would occur in the lower compartment. The resultant high pressure would be relieved into the ice condenser compartment and then into the upper compartment. While in the ice condenser compartment, the air and steam would be cooled and the steam condensed by the ice bed. The action of the ice keeps the peak containment pressure during an accident relatively low (approximately 15 psig). If steam should pass directly from the lower to upper compartments, bypassing the ice condenser, it would not be condensed by the ice as designed. Too much bypass could cause the peak containment pressure to exceed the containment design capability. Therefore, the ice condenser bypass area (the total area of openings between the upper and lower compartments) must not exceed a certain limit during plant operation. Catawba is designed with certain necessary openings between the upper and lower compartments, such as the refueling canal drains which have a total area of 2.2 ft^2, and an additional 2.8 ft^2 is assumed for margin, giving a total design bypass area of 5 ft^2.

The pressurizer enclosure hatch is an opening between the upper and lower containment compartments. There are, in fact, five pressurizer enclosure hatches; the largest one has an area of 7.5 ft^2. Therefore, the effect that an open pressurizer hatch could have on the containment pressure analysis must be addressed in support of the requested Technical Specification change. In addition, each hatch cover is a heavy concrete plug that must be moved by a crane, so the potential effect of dropping a hatch cover while lifting it must also be addressed.

The licensee's submittals address these concerns, and the staff's evaluation is given below.

2.0 EVALUATION

The boundary between the upper and lower compartments is called the divider barrier or operating deck. It is for the most part horizontal and flat, but the tops of the steam generators and the pressurizer are considerably higher than the main part of the operating deck. The divider barrier "bulges" upward to cover the steam generators and pressurizer and enclose their upper parts in "doghouses" or enclosures that essentially conform to the shapes of the components. This places the components in the lower compartment, which is necessary to assure that any high-energy break occurs in the lower compartment, directing the released steam and heat through the ice condenser.

There are five hatches in the pressurizer enclosure to facilitate access to its interior from the upper compartment. Normally this is done only during plant shutdown, but the licensee has found it necessary to access the pressurizer enclosure during plant operation. It is not feasible to enter the upper part of the pressurizer enclosure from the containment lower compartment while the plant is operating, because of heat and radiation hazards and the cramped spaces through which one would have to pass. Thus, opening a pressurizer hatch is the only practical way to access the enclosure during operation.

During operation, situations arise where it is necessary to enter the pressurizer enclosure to perform inspections and maintenance. The most recent inspection at Catawba was performed as a conservative measure in response to the failure of the stem material of a pressurizer PORV block valve. The reason for this inspection, which required a Regional waiver of compliance, is described below.

The pressurizer PORVs, NC-32B, NC-34A, and NC-36B, are designed to limit system pressure during a large power mismatch and to prevent actuation of a high pressure reactor trip. The operation of these valves also limits the undesirable lifting of the spring-loaded pressurizer safety valves. The pressurizer PORVs open automatically when pressure exceeds the Process Control System setpoint.

Each pressurizer PORV block valve (NC-31B, NC-33A, and NC-35B) is used to isolate its associated PORV. Each pressurizer relief discharge line has an alarm to alert operators when an increase in temperature occurs (representing relief valves lifting or leaking).

On December 9, 1991, it was determined that the stem of 2NC-31B (PORV block valve) was broken. The stem material underwent metallurgical analysis. The analysis indicated that the failed stem material had reduced ductility at room temperature. As a result of this situation, Catawba committed to verify the position of the block valves following valve stroke tests (LER 414/91-016). It was determined that radiography would be the best method available to verify valve position.

Technical Specification (TS) 3.4.4 requires that the pressurizer PORVs and their associated block valves be OPERABLE in Modes 1, 2, and 3. Surveillance Requirement 4.4.4.2 requires that each block valve be demonstrated OPERABLE at least once per 92 days by operating the valve through one complete cycle of full travel. After completion of this surveillance, the block valves must be radiographed per the LER 414/91-016 commitment to verify their position. Performance of this radiography requires that the pressurizer enclosure hatch be open longer than the 1 hour allowed by the TS.

The effect of having the pressurizer enclosure hatch open was evaluated and determined by the licensee to have no significant safety impact. Catawba's letters dated March 18, 1992, and March 24, 1992, requested waivers of compliance from the current requirement of TS 3.6.5.5. These requests for waivers of compliance were granted, and the PORV block valves were radiographed successfully.

The Unit 1 PORV block valve stem material will be replaced during the End of Cycle 6 refueling outage. Therefore, the Unit 1 valves will not have to be radiographed again during this cycle. The Unit 2 valves will require quarterly testing three more times before the stem material can be changed during the End of Cycle 5 refueling outage. After replacement of the valve stem material, the block valves will not have to be radiographed quarterly following valve strokes.

Entries into the pressurizer enclosure are made during startup and shutdown to check for leaks. Planned entries into the pressurizer enclosure include:

1. Upon entering Mode 3 at the beginning of every refueling outage, an inspection of the packing leakoff lines on the PORVs and the PORV block valves is performed. While in the cavity, a general visual inspection for any type of leak or other problem is performed. This inspection must be performed in Mode 3 because it may not be possible to detect leakage as the unit is cooled down and depressurized. This practice began because several startups were delayed due to this type of leakage.

2. An inspection similar to the one described above is performed during Mode 3 following every refueling outage. The PORVs and PORV block valves are inspected for packing leakage. This is done to ensure the valves are in good condition for the cycle. Also, since the PORV block valves have a pressure seal used for the body-to-bonnet gasket (which can be affected by temperature changes), it is a good practice to perform a visual inspection of the valves and area.

3. If any valve work (seat, bonnet, packing, or removal) was performed during the refueling outage on the PORVs, block valves, or safety valves, a functional test for external leakage must be performed at full temperature and pressure. During every refueling outage, it is Catawba's practice to remove at least one pressurizer safety valve to meet the Overpressure Protection TS while in Low Pressure Mode. This means that the associated inlet and outlet flanges must have a functional inspection performed while in Mode 3. This inspection is performed during the inspection described in 2 above.

4. Operations surveillance, "Inside Containment Boric Acid Check," is performed upon entering Mode 3 at the start of a refueling outage, or after a trip following a long run. The licensee inspects all areas of containment, including the upper pressurizer enclosure, for signs of boric acid corrosion from leaks. When performed at the start of a refueling outage, this surveillance is scheduled with inspection 2 above.

There are also several reasons why unplanned entries into the pressurizer enclosure would be made. These include:

1. Suspected instrument tubing leak affecting pressurizer level indication.

2. Confirm pressurizer safety valve(s) leakage.

3. Confirm pressurizer PORV seat leakage.

4. Investigate pressurizer safety valve relief line high temperature.

Since there is an ongoing need to enter the pressurizer cavity for more than one hour, and since, the licensee submits, removing a pressurizer enclosure hatch does not have a significant effect on safety, the licensee has requested that TS 3.6.5.5 be modified to allow a hatch to be open for up to 6 hours.

As mentioned earlier, the two safety concerns with opening the pressurizer hatch are:

1) The effect of increased bypass area on the containment pressure and temperature transient during an accident, and

2) The possibility of dropping the hatch while lifting it.

These will be addressed in turn.

1) Bypass area

The containment pressure transient during a LOCA in an ice condenser containment has two peaks: one approximately at the end of the blowdown of the reactor coolant system (sometimes called the peak compression pressure), and the second sometime after all the ice melts (called the long-term peak pressure). The long-term peak is usually higher than the compression peak.

As part of the plant design, Westinghouse analyzed the effects of divider barrier leakages for bypass areas of up to 50 ft^2. The results are presented in Final Safety Analysis Report (FSAR) Section 6.2.1.1.3.1, Table 6-12, and Figure 6-18. The results of this analysis show that the pressure peaks are below the design pressure. In fact, the staff found, in its SER for the operating license for Catawba (NUREG-0954, dated February 1983), the following: "The applicant has also provided analyses which indicate that about 40 ft^2 of bypass area can be accommodated in the design without the design pressure of the containment being exceeded." The licensee has provided more specific calculations to support the TS change request, discussed below.

The calculation of the new peak compression pressure consists of an extrapolation of Westinghouse results found in the Catawba FSAR, Section 6.2.1.1.3.1 (Loss of Coolant Accident). The compression peak pressure during the blowdown phase of the accident was calculated by Westinghouse to be 7.57 psig, which includes 0.4 psi for the effect of the operating deck bypass area which is assumed to be 5 ft^2.

The effect of the potential deck leakage is expressed by the following equation, which was derived by Westinghouse based on the Waltz Mill test results:

$$\Delta P_{max} = \text{Bypass Flow Area} \times 0.080$$

Substituting the additional area of 7.5 ft^2, resulting from the open pressurizer hatch, in the above equation, the following increase in peak pressure is obtained:

$$\Delta P_{max} = 7.5\ ft^2 \times 0.080 = 0.6\ psi$$

Hence, the new compression pressure is 8.17 psig, which is well below the acceptance criterion of 14.68 psig.

The open pressurizer hatch will not increase the long term containment peak pressure (14.05 psig) since increased bypass would delay melting of the ice (the bypassed steam is condensed by the containment spray in the upper compartment, instead of by the ice), resulting in lower decay heat at the time the ice is depleted. The LOTIC analysis in the FSAR assumed a zero deck leakage for conservatism (faster ice meltout).

The limiting case for containment temperature is a steam line break with the peak occurring in the lower containment. Additional bypass area would result in a lower temperature peak, by directing part of the steam into the upper containment. However, the upper containment temperature is not a concern, since it is 150 to 200°F below the peak in lower containment (FSAR Figure 6-20 through 6-22). The containment pressure from a steam line break is bounded by the LOCA pressure.

Based on the foregoing, the staff finds that the removal of the pressurizer hatch for the purpose of performing work would not result in exceeding the containment design pressure should a LOCA occur while the hatch is removed.

2) Possible dropping of the hatch

The second area of concern is the removal of the pressurizer enclosure hatch during Modes 1-4. The licensee's letters dated March 15 and March 21, 1990, requested staff approval of a revision to a commitment that heavy loads would not be handled in the Catawba reactor building during plant operation in Modes 1 (power operation) through 4 (hot shutdown). The conclusions of the drop analysis for the pressurizer enclosure hatch stated that the dropped hatch would not penetrate the operating floor and the structural stability and functional requirements would be maintained. It was also stated that there are no safety-related components in the drop zones, and that the analyses of the postulated load drops indicate that the intent of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," has been met.

The staff issued an SER to the licensee dated March 27, 1990, which concluded that the removal of the pressurizer enclosure hatch during Modes 1-4 to perform inspections inside the pressurizer was acceptable.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the South Carolina State official was notified of the proposed issuance of the amendments. The State official had no comments.

4.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve 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 has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (57 FR 20510, dated May 13, 1992). Accordingly, the amendments meet 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 the amendments.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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