UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 136 TO FACILITY OPERATING LICENSE NPF-35

AND AMENDMENT NO. 130 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 10, 1995, Duke Power Company, et al. (DPC or the licensee), submitted a request for changes to the Catawba Nuclear Station, Units 1 and 2, Technical Specifications (TS). The requested changes would revise the required number of operable hydrogen igniters to allow removal of two hydrogen igniters serving the lower reactor cavity and incore instrument cable tunnel. These igniters are located in a high radiation area which poses an occupational exposure problem. The licensee has provided an analysis indicating that these two igniters are unnecessary. The attached figure depicts the location of the pair of igniters which are the subject of this evaluation.

2.0 EVALUATION

2.1 COMBUSTIBLE GAS CONTROL SYSTEMS - BACKGROUND

Combustible gases can form in a containment under post-accident conditions due to fuel cladding reaction (with steam or water), corrosion (particularly of zinc-based paint and cable insulation), and radiolysis of coolant. Containment pressure vessels and equipment in the containment are not designed to withstand the additional loads that would result from a large-scale combustion of hydrogen. Combustible gas control systems are therefore provided to prevent the occurrence of a potentially damaging hydrogen combustion event.

The combustible gas control systems and equipment provided at Catawba include recombiners, vent/purge systems, containment atmosphere mixing and monitoring systems, and distributed ignition (hydrogen igniter) systems. The recombiners serve as the primary means of combustible gas control for design basis accidents (DBA) that involve quantities of hydrogen associated with approximately 5% fuel clad metal-water reaction. The vent/purge systems provide a backup hydrogen control capability for design basis accidents. The Distributed Ignition (igniter) System (a.k.a., Hydrogen Mitigation System or "HMS") is provided for mitigation of recoverable degraded core events (TMI-type events that are "beyond design basis") involving up to 75% metal-water reaction. The design of those combustible gas control systems provided for the purpose of mitigating DBAs is based on Regulatory Guide 1.7. The design

of HMSs is based on the requirements of 10 CFR 50.44 (the "Hydrogen Rule"). The protection provided by igniters is based on the knowledge that immediate local burning of lean mixtures of combustible gas will prevent the subsequent formation of a larger, richer combustible mixture capable of supporting a major deflagration or detonation. Igniters are used in mid-size containments (i.e., ice condenser containment and Mark III containments). The Catawba facility has ice condenser-type containments. Smaller containments, such as BWR Mark I and Mark II containments are typically nitrogen-inerted. Large dry containments are not considered to be highly vulnerable due to their large internal free volume and HMSs were found not to be cost effective (Ref: Beckjord, Resolution of Generic Issue 121, March 24, 1992).

Regulatory guidance documents such as the Standard Review Plan and associated Regulatory Guides do not provide specific criteria regarding the locations of hydrogen igniters in those containments using igniter systems to comply with 10 CFR 50.44 requirements. The igniter locations at ice condenser facilities have been selected with a view toward providing coverage near hydrogen sources and in compartments where hydrogen could accumulate in both high locations and low locations. High locations have been included to account for the possibility of hydrogen pocketing at high points due to buoyancy. Low locations have been included to take advantage of the fact that burning will propagate upward in leaner mixtures. Igniter coverage is also provided in areas where low-concentration hydrogen mixtures could be rapidly concentrated into combustible mixtures due to ice or spray cooling effects (e.g., upper plenum of ice condenser). Both expert judgement and analysis were used in the igniter location selection process. As a result, differences exist among the facilities. The staff's safety evaluation of the lead plant HMS was published in NUREG-0011, Supplement No. 6 (Sequoyah SER) and provides a discussion of igniter locations. NUREG-1370 "Resolution of Unresolved Safety Issue A-48, Hydrogen Control Measures and Effects of Hydrogen Burns on Safety Equipment," provides an additional related background discussion.

The staff gave careful consideration to the igniter selection as part of its review. The original computer models used by the staff and applicants did not model the cavity/instrument tunnel space as a separate compartment. A detailed description of the McGuire and Catawba igniter systems, including discussions of background experiments, analyses, and research, is provided in "An Analysis of Hydrogen Control Measures at McGuire Nuclear Station", Revision 16, transmitted by letter dated August 5, 1993, from M. S. Tuckman, DPC, to the NRC, a three-volume document known as the "Redbook." The igniter system at Catawba consists of 72 glow plug igniters arranged in two trains. Each protected area is served by two independently powered igniters (Ref: DPC response to the July 21, 1981, NRC Request for Additional Information). All compartments are provided with direct igniter coverage. According to the Redbook, the McGuire and Catawba igniter systems are identical except for minor differences in terminal box designation and igniter location (but not total number). Additional igniters are provided that are not included in the Sequoyah/Watts Bar/D.C. Cook facilities, each of which have 68 igniters. The pair of igniters that the licensee has requested to eliminate at Catawba are among those. (See attached figure)

2.2 NEED FOR IGNITERS IN THE LOWER CAVITY/INSTRUMENT TUNNEL

2.2.1 SEQUOYAH LEAD REVIEW

The Catawba Hydrogen Mitigation System (HMS) was designed to provide direct hydrogen igniter coverage for all compartments in the containment (Ref: Redbook 3.4). This was a licensee initiative that resulted in the installation of additional igniters at Catawba and McGuire located in an area not included in the Sequoyah lead HMS design. (The HMS at Sequoyah was reviewed as the "lead HMS design".) As noted above, the locations of concern for this review were not identified as being separate compartments or locations and were treated and analyzed as being contiguous portions of the lower containment area. The containment arrangements of the Tennessee Valley Authority and DPC ice condenser facilities are sufficiently similar that the approved Sequoyah locations, as described in the aforementioned Sequoyah SER, are considered sufficient with respect to mitigation of hydrogen combustion scenarios encompassed by the hydrogen rule. Based on the results of the original lead HMS review, the existing pair of igniters located in the lower reactor cavity can be removed from the required operability list.

2.2.2 LICENSEE'S SUPPORTING INFORMATION

In the April 10, 1995, application, the licensee provided a discussion of supporting analyses. The analyses performed by the licensee utilized the HECTR code and MAAP code. The reactor cavity subcompartment area was modeled as a separate compartment joined by one and two junctions (separate cases) to the lower compartment. Accident sequences selected to reflect the 10 CFR 50.44 recoverable (in vessel) degraded core scenarios were analyzed; four loss-of-coolant accident (LOCA) scenarios with HECTR and one with MAAP. For MAAP, only a small break was analyzed since HECTR results indicated that all four cases produced similar behavior. The HECTR and MAAP results indicated that hydrogen concentration in the cavity is maintained below 4% (non-combustible) when one flow junction is modeled. With both junctions modeled, mixing with the lower compartment occurs. This precludes the potential for a higher hydrogen concentration in the cavity than exists in the igniter-covered lower compartment.

A LOCA in the reactor cavity was also considered. There is greatly reduced probability of a break in the cavity, due to the very small percentage of reactor coolant system piping in that area. However, should a break occur in the cavity, combustion would be unlikely due to steam and/or water inerting effects. The licensee further considered the possibility of a hydrogen detonation in the lower cavity and concluded that it would present little threat due to the obstructions and energy-absorbing mechanisms.

The staff does not consider it necessary to perform independent or confirmatory analyses.

3.0 SUMMARY

Based on the information provided above, the results of the lead HMS review, and the licensee's supporting information, the staff concludes that the pair of igniters installed in the lower reactor cavity need not be required to be operable.

4.0 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.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change surveillance requirements. 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 (60 FR 49932 dated September 27, 1995). 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.

6.0 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.

Attachment: Figure

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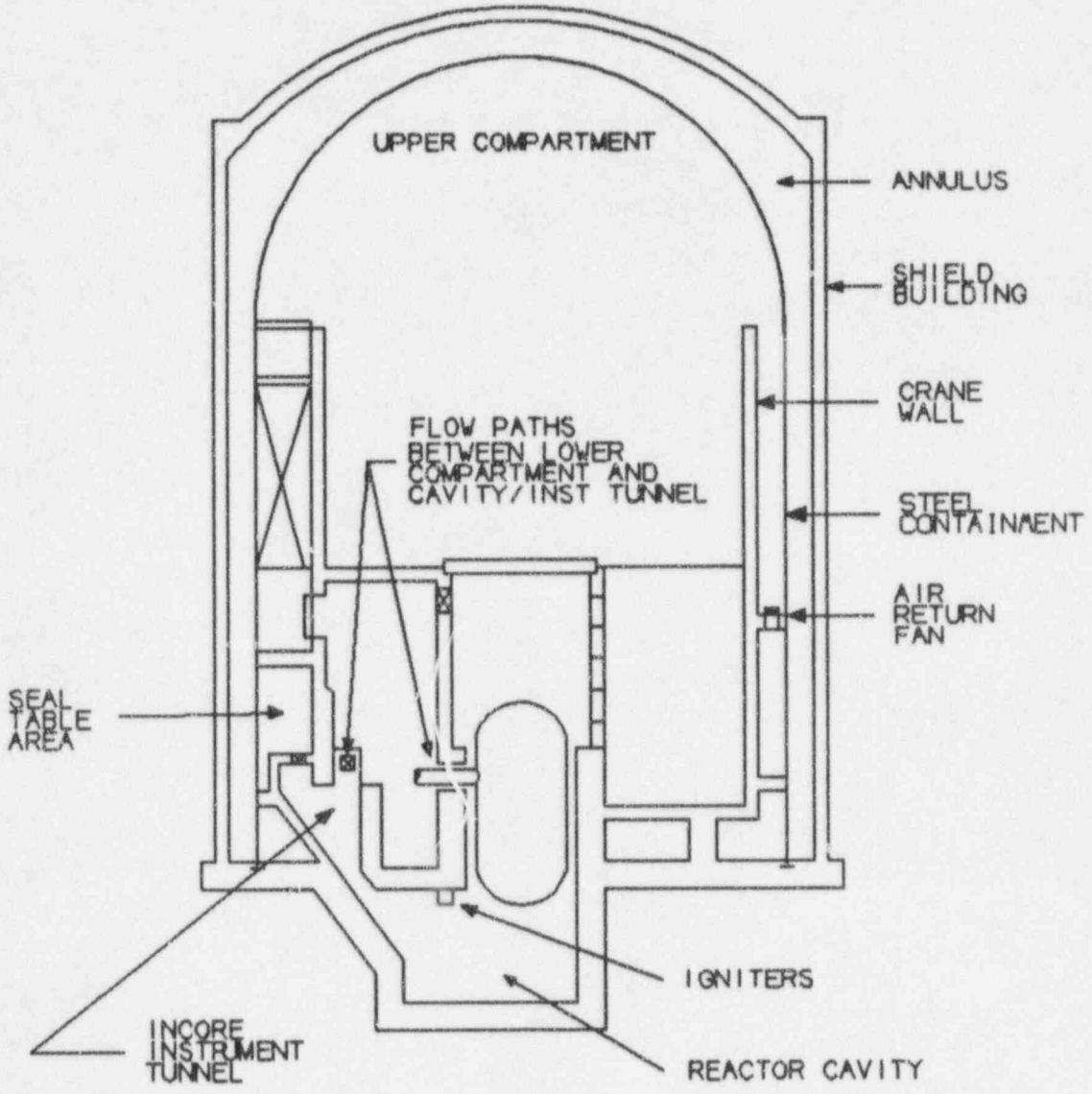
ICE CONDENSER CONTAINMENT



FIGURE