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February 1, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Ms. E. G. Adensam, Chief
Licensing Branch No. 4

Re: Catawba Nuclear Station
Docket Nos. 50-413 and 50-414

Dear Mr. Denton:

Section 4.4.3.4 of the Catawba Safety Evaluation Report discusses Open Item 6, Instrumentation for Inadequate Core Cooling Detection. This item was also identified as License Condition 5. My letter of October 19, 1983 provided additional information on the core exit thermocouples and reactor vessel level instrumentation. The attached revised Catawba FSAR Table 1.9-1 pages supplement the previous description of the core exit thermocouples.

As noted in Table 1.9-1 (Page 11c), Incore Thermocouple System Upgrade, the upgrade of the Unit 1 system will be completed by or during the first refueling outage. We have concluded that this implementation schedule is justified as discussed below.

The original design of the Catawba Nuclear Station Incore Thermocouple System was non-safety related. After the TMI-2 accident, it was decided to upgrade this system to Class 1E. This upgrade was to be accomplished in two phases. Phase 1 included the upgrade to Class 1E of the in-containment portion of the system. This involved providing qualified connectors, cabling, and penetrations. Phase II of the upgrade involves the provision of a safety grade backup display.

Phase 1 of the work was initiated and involved:

1. Writing specifications, reviewing proposals, and procurement of the equipment necessary for the Phase 1 upgrade.

2. Reviewing vendor drawings and performing the Duke detailed design necessary for the installation.

3. Actual installation of the equipment.

This phase has been completed and constitutes the present design as described in FSAR Table 1.9-1.

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For the Phase II upgrade, rather than modify the control room displays in isolation, it was proposed that these displays be modified upon completion of the Control Room Design Review and the RB 1.97 Accident Monitoring Instrumentation Review. This assures that all pertinent criteria are properly considered in the final design of the display system and are consistent with the intent of Supplement 1 to NUREG-0737.

In pursuing this objective, Duke has done the following:

1. Performed a Control Room Design Review.

2. Performed a RG 1.97 Accident Monitoring Instrumentation Review.

3. Initiated the design engineering necessary to provide the Phase II upgrade.

The use of this orderly approach to the Phase II upgrade will lead to installation during the first refueling outage of Catawba Unit 1. This schedule provides for the Phase II upgrade to be an integrated part of the installation of changes resulting from the Accident Monitoring Instrumentation Review and the Control Room Design Review.

It is Duke Power Company's conclusion that the implementation date proposed for upgrading of the outside containment portion of the incore thermocouple system does not involve any adverse safety considerations. The thermocouple monitoring system as presently installed is a very simple system which, by virtue of its simplicity, is highly reliable and accessible. The design and capabilities of the existing (Phase I upgrade completed) and the upgraded (Phase II) Incore Thermocouple System are thoroughly addressed in FSAR Table 1.9-1.

It is important to note that for the existing system, environmental qualification is provided for the portion of the system which may be exposed to a harsh environment by an event for which the system is required to be operable. The remaining portions of the system are located in a mild environment.

In that the Phase II upgrade will only provide incremental improvements in the reliability and human factors aspects of existing displays, the proposed implementation date will not result in a reduction in the level of safety.

Very truly yours,

Hal B. Tucker

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Attachment

cc: Mr. James P. O'Reilly, Regional Administrator
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Response to TMI Concerns

Incore Thermocouple System

I. Present Design

The present incore thermocouple system has 65 T/C's (thermocouples) positioned to sense exit flow temperature of selected fuel assemblies. The T/C's penetrate the reactor vessel head in 5 locations known as instrument ports. Each instrument port has 13 T/C's. Electrical connection to the Class 1E T/C's is made at the instrument ports by qualified connectors. The Class 1E thermocouples are cabled to qualified thermocouple penetrations. Twenty (five per quadrant) Class 1E thermocouple channels are provided to insure a minimum of four per core quadrant are always operable. The system design accounts for attrition. The non-safety thermocouples are cabled to reference junction boxes inside containment to allow transition to copper for the remainder of the cabling including the run to an instrument penetration. Outside containment, the class 1E T/C's are cabled to reference junction boxes to allow the transition to copper wire. These cables are cabled to the backup display along with the non-safety T/C's. The backup display will display T/C readings in the control room by use of push-to-read switches. All T/C's are cabled from the backup display to the primary display, the plant computer.

A. Present System Capabilities (NUREG 0737 II.F.2 Attachment 1 format)

1. Core inlet temperature data is used with core exit temperature to give radial distribution of coolant enthalpy rise across the core. This is available to the operator via CRT or hard copy in the control room.

2. The plant computer via CRT is the operator's primary display having the following capabilities:

   a. A spatially oriented core map is available on demand indicating temperature and enthalpy rise at each core exit thermocouple location.

   b. The incore thermocouples are an input into the saturation monitor program to assist operator actions for inadequate core cooling procedures.

   c. Direct readout via CRT and hard copy print out capability is provided for all thermocouple temperatures. This out range extends from 200 degrees F. to 2300 degrees F.

   d. Trending of selected thermocouples to show temperature - time history is available on demand.

   e. Alarm capabilities are provided thru the saturation monitor program.

Response to TMI Concerns

f. Addressed in the Control Room Design Review.

3. A backup display is provided in the control room to read any of the thermocouples. With push-to-read switches, readings can be taken well within the six minute time guidance. The range of this backup display extends from 200 degrees F. to 2300 degrees F.

4. A human factor analysis will be part of the ongoing Control Room Review (See Response to Supplement 1 to NUREG-0737 which was transmitted by letter dated June 1, 1983 from H. B. Tucker to H. R. Denton).

5. Compliance with Appendix B to Item II.F.2 is addressed by the Incore Thermocouple System upgrade as described below and detailed in Section II.A.5.

6. The primary and backup displays are electrically independent and are on separate highly reliable power systems. Isolation devices are not necessary in the present system as the backup display is not in the circuit until a push-to-read switch is used.

7. Environmental qualification is provided for the portion of the Incore Thermocouple System which may be exposed to a harsh environment by an event for which the system is required to be operable. This qualification complies with the methodologies as described in FSAR Section 3.11 and the Duke Power Company NUREG 0588 submittal. The remaining portions of the system are located in a mild environment.

   The incontainment portion of the Incore Thermocouple System is seismically qualified to the requirements as defined in FSAR Section 3.10. Seismic qualification of the displays for the existing system is not provided. However in the unlikely event of a seismically induced failure of both existing display systems, T/C readings can be made utilizing portable instrumentation.

8. The availability of the present system is expected to be excellent with the plant computer functioning as the primary display. Based on experience at five other Duke nuclear units, the display availability is expected to be greater than 99%. The backup display is powered independently and further increases the overall system availability.

Response to TMI Concerns

9. The provisions of Duke Power Company's Quality Assurance Program as described in FSAR Chapter 17 and Topical Report Duke 1 were applied to the Class 1E incontainment portion of the system. The remainder of the existing system is non-safety.

II. Incore Thermocouple System Upgrade

The present incore T/C system will be upgraded in the following manner. From outside of containment the non-safety thermocouple cabling will not be altered. However, the Class 1E T/C cables will be cabled to a Class 1E backup display directly from the T/C penetrations. These T/C's will be cabled to the primary display using qualified isolation devices. The backup display will be selected as part of the ongoing control board review.

The upgrade of the incore T/C system will be completed on Unit 1 by or during the first refueling and on Unit 2 prior to fuel load.

A. Upgraded System Capabilities (NUREG 0737 II.F.2 Attachment 1 format)

Display capabilities will be the same as the present design description with exceptions listed below. Exception numbers correspond to original design numbers.

2(f) & 4. The control room review will be completed and all operator display devices will be human factor designed.

5. The following consists of an evaluation of the Catawba Nuclear Station Incore Thermocouple System upgrade compliance with Appendix B to Item II.F.2. The paragraph numbers relate directly to Appendix B paragraph numbering.

(1) The Class 1E instrumentation will be environmentally qualified in accordance with Catawba FSAR Section 3.11 and the Duke Power Company NUREG-0588 submittal. The qualification will apply from the sensor (qualification assumed per II.F.2 guidance) to the final display device. For the primary display via the plant computer, qualification applies from the sensor to the isolation device. The isolation device will be accessible for maintenance during accident conditions.

The Class 1E instrumentation will be seismically qualified in accordance with Catawba FSAR Section 3.10. This instrumentation will operate with the required accuracy after, but not necessarily during, a safe shutdown earthquake.

Response to TMI Concerns

Seismic qualification is not required for the primary display and associated hardware beyond the isolator.

(2) No single failure within the incore thermocouple system or its supporting systems will prevent the operator from being presented with the information he would need in order to determine the safety status of the station and to bring the reactor to a safe, stable condition following an accident. This is feasible because the incore thermocouple system has two reliable portions: (a) the non-safety primary display portion which has a battery-backed power source, (b) the redundant Class 1E portion which has separate battery-backed power sources.

Additional diverse Class 1E indications of reactor coolant system pressures and temperatures are provided to assist the operator in the case of discrepancies in redundant read-outs.

Redundant Class 1E channels are electrically independent, energized from separate power supplies, and are physically separated per FSAR Sections 7.1.2.2 and 8.3.1.4 up to and including the isolation device. Direct recording and trending capabilities are provided for any of the 65 incore thermocouple channels.

(3) The Class 1E Incore Thermocouple Instrumentation and backup display will be powered by Class 1E power sources.

The primary incore displays are powered by battery-backed power sources.

(4) Incore instrumentation channel availability will be addressed in the Catawba Technical Specifications.

(5) The provisions of Duke Power Company's Quality Assurance Program as described in FSAR Chapter 17 and Topical Report Duke 1 are to be applied to the Class 1E portion of the Incore Thermocouple System. The primary display and other non-safety hardware beyond the isolation device are not required to be governed by this QA program. For further information on the Class 1E quality assurance provided, please consult the cited references.

Response to TMI Concerns

(6) Indication and recording capabilities have been provided as specified in the applicant's response to Supplement 1 to NUREG 0737, Regulatory Guide 1.97 Rev. 2 Section.

(7) Same answer as 6.

(8) Identification of the appropriate post-accident channels is performed as described in the response to Supplement 1 to NUREG 0737, Regulatory Guide 1.97 Rev. 2 Section.

(9) Qualified isolation devices are being utilized to isolate the Class 1E portions of the system from the non-safety portions as specified in RG 1.75.

(10) Test capabilities are provided to check channel operational availability during reactor operation.

(11) Servicing, testing, and calibration programs will be specified to maintain the capabilities of the system.

(12) Means for the removal of channels for maintenance are included in the design, and those means are under administrative control.

(13) The Catawba incore design facilitates the administrative control of the access to setpoint adjustments, calibration adjustments, and test points.

(14) The Catawba design minimizes the existence of conditions which could lead to anomalous indications and confusion of the operator.

(15) The Catawba design facilitates the recognition, location, replacement, repair, or adjustment of malfunctioning components or modules.

(16) All incore instrumentation system inputs are from sensors which directly measure the desired variables (core exit temperatures).

(17) To the extent practical, the same instruments are utilized for accident monitoring as are used for normal operations of the station.

Response to TMI Concerns

(18) Periodic testing of the incore instrumentation channels will be in accordance with FSAR Table 1.8-1, position on Regulatory Guide 1.118.

6. The primary and backup display will be energized from independent battery-backed power sources. The backup display and associated hardware will be supplied with Class 1E power. Due to physical constraints in the reactor vessel head area configuration, full separation as defined in FSAR Sections 7.1.2.2 and 8.3.1.4 cannot be attained. The maximum practical separation will be provided in this area and mineral insulated cabling is used to enhance separation and integrity. Once the cabling leaves the refueling canal area separation as specified in FSAR Section 7.1.2.2 and 8.3.1.4 is maintained for the entire remainder of the system cabling.

7. The Class 1E T/C instrumentation (T/C qualification assumed) will be seismically and environmentally qualified up to and including the isolation device. Seismic qualification will be consistent with the methodologies described in Section 3.10. Instrumentation subject to a harsh environment will be environmentally qualified consistent with the Duke Power Company position on the Category II Guidelines of NUREG 0588 as detailed in the Duke submittal of June 30, 1982. The isolation device will be in an accessible area following an accident.

8. The availability of the Class 1E back-up displays will be addressed in the Technical Specifications.

9. The provisions of Duke Power Company's Quality Assurance Program as described in FSAR Chapter 17 and Topical Report Duke 1 are to be applied to the Class 1E portion of the Incore Thermocouple System. The primary display and other non-safety hardware beyond the isolation device are not required to be governed by this QA program. For further information on the Class 1E quality assurance provided, please consult the cited references.

Procedures

See Section 13.5.

II.G EMERGENCY POWER FOR PRESSURIZER EQUIPMENT

Response to TMI Concerns

Pressurizer PORV

The pressurizer power-operated relief valves are air-operated with DC control solenoids. Power for the solenoid valves is supplied from the 125VDC Vital Instrumentation and Control Power System (See Section 8.3.2). The solenoid operators and their controls are safety-related.

Pressurizer PORV Block Valves

The pressurizer PORV block valves are motor-operated valves with both motive and control power supplied from the 600VAC Essential Auxiliary Power System (See Section 8.3.1). The block valves including their power and control circuits are safety-related.