DUKE POWER COMPANY
P.O. BOX 33189
CHARLOTTE, N.C. 28242

HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

October 19, 1983

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. As noted therein, the Staff required additional information on core exit thermocouples and reactor vessel level measurement. This information is provided in the attached FSAR pages.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

ROS/php

Attachment

cc: Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

NRC Resident Inspector
Catawba Nuclear Station

Mr. Robert Guild, Esq.
Attorney-at-Law
P. O. Box 12097
Charleston, South Carolina 29412

Palmetto Alliance
2135½ Devine Street
Columbia, South Carolina 29205

B001
1/1

cc: Mr. Jesse L. Riley
Carolina Environmental Study Group
854 Henley Place
Charlotte, North Carolina 28207

margin to P_{sat}, and the minimum allowable margins to P_{sat} and T_{sat}. Alarm status is indicated by flashing the alarming parameter on the CRT graphic display, the Alarm CRT, and by printout on the Alarm Typer. Two alarm setpoints are provided for both T_{sat} and P_{sat}. The alarm setpoints are dependent on reactor power. Further details on this subcooling monitor are provided in Table 1.9-2.

Normal control board instrumentation for RCS temperature and pressure will be used in conjunction with a control room copy of the steam tables and a written procedure to determine margin to saturation as a backup to the computer calculation.

This system for determining the degree of subcooling will be fully operational by fuel loading.

Reactor Vessel Level Measurement

The reactor vessel level instrumentation system (RVLIS) is of Westinghouse design. The RVLIS is of standard Westinghouse design for upper head injection (UHI) reactor systems and utilizes a microprocessor for data processing. The RVLIS uses differential pressure (DP) transmitters to measure the pressure drops from the bottom of the reactor vessel to the hot legs for UHI plants and from the hot legs to the top of the reactor vessel. Under natural-circulation or no-circulation conditions, these pressure drops will provide indication of the collapsed liquid level or relative void content in the reactor vessel above and below the hot legs. Under forced-flow conditions, the pressure drops will provide indication of the vessel void content above the hot legs and the relative void content of the circulating primary coolant system fluid. Automatic compensation for changes in the temperature of the impulse lines leading from the reactor vessel and not legs to the DP transmitters is incorporated in the system. Strap-on RTD's are mounted on the vertical runs of the impluse lines for measuring impulse-line temperatures. Automatic compensation for changes in the reactor coolant system fluid densities is also incorporated in the system. Following a hypothetical accident which causes a loss of primary coolant, the RVLIS will be used by the plant operators to assist in detecting a gas bubble or void in the reactor vessel and assist in detecting the approach to a condition of inadequate core cooling. If forced-flow conditions are maintained after the accident, the RVLIS will also be used to assist in detecting the formation of void in the circulating primary coolant system fluid. The equipment which comprises the RVLIS includes the DP transmitters, impulse lines, impluse-line RTD's, in-containment sensor bellows units, out-of-containment hydraulic isolators, and all the necessary electronic signal conditioning, processing and display equipment. A technical description of the system appears in Westinghouse's manual entitled, "RVLIS - Summary Report, December, 1980."

An item-by-item discussion of NUREG-0737, II.F.2, is provided in Table 1.9-3.

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 T/C's is made at the instrument ports by qualified connectors. The class 1E thermocouples are cabled to qualified thermocouple penetrations. In accordance with NUREG-0737, the system will utilize 16 thermocouples per train and will be able to handle normal attrition. The non-safety thermocouples are cabled to reference junction boxes 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 a T/C 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.

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 readout 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.

   f. Addressed in the Control Room Design Review.

Response to TMI Concerns

3. A backup display is provided 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. See Duke Power Company, Topical Report, Quality Assurance Program, Duke - 1A.

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. Documentation is unavailable regarding the environmental capabilities of the present system, but all readouts are located in a mild controlled environment.

8. Availability of the plant computer has been greater than 99%. This documentation has previously been submitted via NUREG 0578/TMI Action Plan response.

9. QA provisions cited in Appendix B do not apply to the present system.

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.

Response to TMI Concerns

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

6. The primary and backup display will be energized from independent battery backed power sources. The backup display and associated hardware will be on 1E power. Separation as defined in Chapter 8 will be met from the refueling canal to the isolation device.

7. The device 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. Quality Assurance provisions cited in Duke Power's QA program for nuclear safety related equipment will be met for all equipment installed except the primary display and hardware beyond the isolation device.

Procedures

See Section 13.5.

II.G EMERGENCY POWER FOR PRESSURIZER EQUIPMENT

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.

Response to TMI Concerns

Pressurizer Level Indication

Three redundant channels of pressurizer level instrumentation are provided. These channels are part of the safety-related portion of the Process Control System which receives its power from the Vital Instrumentation and Control Power System (See Section 8.3.2).

Table 1.9-3 (Page 1)

Reactor Vessel Level Instrumentation System

		Reference	Deviations
1.	Description of the proposed final system including:		
	a. a final design description of additional instrumentation and displays;	Items A, B	Functionally, None
	b. detailed description of existing instrumentation systems.	Items H, I	Functionally, None
	c. Description of completed or planned modifications.	Same as 1(a)	----------
2.	A design analysis and evaluation of inventory trend instrumentation, and test data to support design in item 1.	Items A,B,C, D,E,F	Functionally, None
3.	Description of tests planned and results of tests completed for evaluation, qualification, and calibration of additional instrumentation.	Items C,D,E,F	None
4.	Provide a table or description covering the evaluation of conformance with NUREG-0737: II.F.2, Attachment 1, and Appendix B (to be reviewed on a plant specific basis)	Items G, K	None
5.	Describe computer, software and display functions associated with ICC monitoring in the plant.	Items A, B	None
6.	Provide a proposed schedule for installation, testing, and calibration and implementation of any proposed new instrumentation or information displays.	Item L	None
7.	Describe guidelines for use of reactor coolant inventory tracking system, and analyses used to develop procedures.	Item J	None

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Reactor Vessel Level Instrumentation System

		Reference	Deviations
8.	Operator instructions in emergency operating procedures for ICC and how these procedures will be modified when final monitoring system is implemented.	Item J, M	None
9.	Provide a schedule for additional submittals required.	N/A	

Explicit confirmation of conformance to the Appendix B (NUREG-0737) items listed below for the Reactor Vessel Level Instrumentation System.

		Confirmation	Deviations
1.	Environmental qualification	Item K	None
2.	Single failure analysis	Item G	None
3.	Class 1E power source	Yes	None
4.	Availability prior to an accident	One channel (Per Tech. Spec.)	None
5.	Quality Assurance	Yes, as described in Duke Power Co. Topical Report, Quality Assurance Program, Duke-1A	None
6.	Continous indications	Yes	None
7.	Recording of instrument outputs	Yes (Single train)	None
8.	Identification of instruments	Item A	None
9.	Isolation	Yes	None

For the Westinghouse Differential Pressure (dp) system a detailed response to the plant specific items stated below is provided.

		Response
A.	Westinghouse dp System	
	1. Describe the effect of instrument uncertainties on the measurement of level.	Item B

Table 1.9-3 (Page 3)

Reactor Vessel Level Instrumentation System

		Response
2.	Are the differential pressure transducers located outside containment?	Yes
3.	Are hydraulic isolators and sensors included in the impulse lines?	Yes

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Reactor Vessel Level Instrumentation System

REFERENCE ITEM A	SUMMARY REPORT
	Westinghouse Reactor Vessel Level Instrumentation System for Monitoring Inadequate Core Cooling December, 1980.
	Submittal Letter T. M. Anderson (W) to Darrell G. Eisenhut (NRC) NS-TMA-2358 of December 23, 1980.
REFERENCE ITEM B	25 RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION
	On the Westinghouse R.V.L.I.S. Summary Report
REFERENCE ITEM C	SUPPLEMENTARY INFORMATION
	Submittal Letter E. P. Rahe (W) to L. E. Phillips (NRC) NS-EPR-2579 of March 19, 1982.
REFERENCE ITEM D	W EVALUATION OF TESTS
	S-UT-3, S-UT-6, S-UT-7, S-NC-2, S-NC-3, S-NC-8 Submittal Letter E. P. Rahe (W) to L. E. Phillips (NRC) NS-EPR-2526 of December 9, 1981.
REFERENCE ITEM E	W EVALUATION OF TEST S-UT-8
	Submittal Letter E. P. Rahe (W) to L. E. Phillips (NRC) NS-EPR-2542 of January 13, 1982.
REFERENCE ITEM F	W EVALUATION OF TEST S-1B-1 AND FUNCTIONAL TEST
	Submittal Letter E. P. Rahe (W) to L. E. Phillips (NRC) SED-SA-0081 of June 28, 1982.
REFERENCE ITEM G	RESPONSE TO REQUEST TO WOG FOR ADDITIONAL INFORMATION
	Submittal Letter E. P. Rahe (W) to Dennis M. Crutchfield (NRC) NS-EPR-2597 of May 14, 1982.
REFERENCE ITEM H	RCS WIDE RANGE PRESSURE INSTRUMENTATION
	Submittal Letter of E. P. Rahe (W) to R. C. Deyoung (NRC) NS-DPR-2586 of April 21, 1982.
REFERENCE ITEM I	RELEVANT DRAWINGS OF EXISTING INSTRUMENTATION SYSTEMS
	8757D55 Revision 4 W Process Block Diagrams. (See Sheet for W. R. RCS $\bar{T}_{HOT}$)

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Reactor Vessel Level Instrumentation System

1098E74 Sh 1 Rev 8 W RCS Flow Diagram
FSAR Fig. 5.1-3 RCS Flow Diagram.

Note that W Process Block Diagram which shows W. R. RCS Pressure is not recommended as suitable interfacing instrumentation. Refer to Item H.

REFERENCE ITEM J

Critical safety function status trees for core cooling and system inventory volumes 1, 2, and 3 Emergency Response Guidelines (ERG) Developed by Westinghouse Owner's Group (WOG) Sections FR-C.1 and C.2, FR-I.3, FR-P.I.

Refer also E20.26 (which is a new section to be added, for natural circulation cooldown regarding depressurization in the upper head. Although this shows the use of the RVLIS instrumentation, it is not specifically for inadequate core cooling (ICC) monitoring.

Volume 1 and 2 was under cover of OG-64, 11/30/81 O. Kingsley (WOG) to D. Eisehut (NRC)

Volume 3 was under cover of OG-83, 1/4/83, O. Kingsley (WOG) to D. Eisenhut (NRC)

All member utilities received copies under cover of letters:

WOG-81-235, 12/2/81
WOG-83-100, 1/4/83

REFERENCE ITEM K

ENVIRONMENTAL QUALIFICATION

(Note Various Equipment Data Qualification Packages) - i.e., EQDP - for RVLIS instrumentation are submittals as supplements to the Environmental Qualification topicals WCAP-8587, non-proprietary (which provides summary EQDP-s) and WCAP-8687, proprietary (which provides detailed EQDP's).

EDQP References are as follows:

1. ESE-2 D/P Transmitters Outside Containment
2. ESE-42 Strap-on RTDs
3. ESE-48 High Volume Pressure Sensor
4. ESE-49 Differential Pressure Indicator Switches

Reactor Vessel Level Instrumentation System

5.	ESE-50C	RVLIS-86 Microprocessor
6.	ESE-53	Plant Safety Monitoring System Electronics

REFERENCE ITEM L — IMPLEMENTATION SCHEDULE

The RVLIS will be fully operational by fuel load.

REFERENCE ITEM M — ICC OPERATING PROCEDURES

Duke Power plans to upgrade the Catawba emergency operating procedures based upon the Emergency Response Guidelines (ERG) developed by the Westinghouse Owners Group. The RVLIS will be incorporated into procedures according to these guidelines.