DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

May 19, 1982

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:

On March 8-11, 1982 representatives from Duke Power, Westinghouse, and the NRC/Instrumentation and Controls Systems Branch met at Duke's office in Charlotte, North Carolina. The purpose of this meeting was to discuss the Balance-of-Plant scope questions which were transmitted by Elinor G. Adensam's letters of December 21, 1981, January 12, January 21, and February 25, 1982. Attached is the meeting summary which was prepared following this meeting.

Very truly yours,

William O. Parker, Jr.

ROS/php
Attachments

cc: Mr. J. P. O'Reilly
Mr. P. K. Van Doorn
Mr. R. Guild
Palmetto Alliance
Mr. J. L. Riley
Mr. H. A. Presler

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NRC INSTRUMENTATION AND CONTROL SYSTEMS BRANCH (ICSB)

REVIEW MEETING ON CATAWBA FSAR

March 8-11, 1982 at the Electric Center in Charlotte, N. C.

Meeting Summary

1. Attendees - Lists attached

2. Agenda - BOP scope. Item identification is from the following NRC letters:

   December 21, 1981 - Items 1 through 4
   January 21, 1982 - Items 4 through 91
   January 12, 1982 - Items 92 through 97
   February 2, 1982 - (handout at NSSS meeting)
   - Items 98 through 116
   February 25, 1982 - Items 117 through 120

3. Items discussed:

   The following items were discussed and closed out:

   5, 8, 14, 16, 21, 24, 28, 32, 33, 34, 36, 37, 39, 41, 48, 52, 55, 60, 62, 63, 65, 67, 69, 72, 73, 75, 76, 77, 80, 81, 82, 83, 84, 85, 87, 92, 100, 103, 106, 108, 109, 113, 117, 118, and 119.

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station ______ Unit ______ File No. ______

Subject CATAWBA ICSB MEETING - 3/11/82

______ By ______ Date ______

Sheet No. ___ of ___ Problem No. ______ Checked By ______ Date ______

R.O. SHARPE	STEAM PRODUCTION-LICENSING
I.C. RATSEP	(W) N.S.
J.C. MESMERINGER	(W) N.S.
DL Sweat	DE-SRAL
J F [illegible]	DE-ELECTRICAL
M.H. Miller	DE-ELECTRICAL
M E Efird	DE-ELECTRICAL
M C [illegible]	" "
[illegible]	CATAWBA - STEAM
D W Murdock	DE-Electrical
S.J. EICHHOLZ	NRC-ANL
FH Burrows	NRC-NRR-ICSB
T.G. Dunning	NRC-ICSB
K.N JABBOUR	NRC/NRR/DOL/LB#4

Form 00184 (6-81)

DUKE POWER COMPANY

Dev./Station ______ Unit ______ File No. ______

Subject CATAWBA ICSB MEETING - 3/10/82

______ By ______ Date ______

Sheet No. __ of __ Problem No. ______ Checked By ______ Date ______

R O SHARPE	STEAM PRODUCTION - LICENSING
DL SWEAT	DESIGN ENG - LICENSING
I F MOSS	" " - ELECTRICAL
R A Dickard	" " "
J M PLUMMER	" " "
M E Efird	" " "
N.C. JAIN	" " "
A E Current	" " "
J.C. MESMERINGER	W N.S. I&CSL
IC RATZER	(W) N.S. I.L.T.
M.R. ADLER	(W) N.S. T.A.
RJ [illegible]	Design Eng - Electrical
DW Murdock	" "
I. S. EICHHOLZ	NRC-HNL
F.H. Burrows	NRC-NRR-ICSB
TOM DUNNING	—
K. N JABBOUR	NRC/NRR/DL/LB#4

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station ______ Unit ______ File No. ______

Subject CATAWBA ICSB MTG 3/8/82

ATTENDENCE By ______ Date ______

Sheet No. ___ of ___ Problem No. ______ Checked By ______ Date ______

RO Sharpe	Steam Prod Licensing
CC Rolfe	Design Eng Licensing
DL Sweat	"
I F Moss	DES. ENG - ELECT
M.E. Efird	" " "
J.M. Plummer	" " "
M.B. Laney	Steam I&C
T.E. Moondy	Steam I&C
R.L. Wolfgang	Steam I&E
S.G. DeGange	" "
J.K. Wallace	" I&E
W.R. McCollum	Steam – Catawba
[illegible] L. Hartzell	Steam – Catawba
D.W. Murdock	Design – Electrical
[illegible] Eichenberg	ANL for NRC
F.H. Burrows	NRC-NRR-ICSB
T.G. Dunning	NRC – ICSB
C.S. Gregory	Catawba NS - I&E
J.M. Stackley	CNS – I&E
NC Jain	DE/elect.

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station ______ Unit ______ File No. ______

Subject CATAWBA ICSB MEETING - 3/9/82

______ By ______ Date ______

Sheet No. ___ of ___ Problem No. ______ Checked By ______ Date ______

R O SHARPE	STEAM PRODUCTION - LICENSING
CC ROLFE	DESIGN ENG - LICENSING
DL SWEAT	" " "
[illegible]	" " - ELECTRICAL
R.A Dickard	" " "
M E Efird	" " "
NC JAIN	" " "
MH MILLER	" " "
C L HARTZELL	STM PRODUCTION - CATAWBA
DW Murdock	Design - Electrical
E.J. EICHHOLZ	NRC-ANL
F.A. Burrows	NRC - NRR - ICSB
T. DUNNING	" " "

The following items were discussed but require follow-up action:

2. The staff requested the applicant to perform a review to determine what, if any, design changes or operator actions would be necessary to assure that high energy line break will not cause control system failures to complicate the event beyond the FSAR analysis. This issue was addressed in the letter from R. Tedesco (NRC) to W. Parker (DPC) dated April 16, 1981, as Item 222.03. In the response to question 222.03 (Volume 13 of FSAR) the applicant states that the required review is not completed and results will be documented in a later revision. This item will remain open until applicant has submitted the results and our review of those results is completed.

   Response:

   Duke agreed that this item would remain open pending submittal of a response to question 222.03 (renumbered 420.03). Duke also agreed to change the actuation logic of the main steam PORV's to include a main steam isolation signal (MSIS). (K626 contact to be changed to K616).

7. Using detailed schematics describe the operation of circuits used for the NSW system. Discuss the design criteria for the instrumentation and control (i.e., indicators available, testability, automatic switch-over). Also discuss the interface with the bypass and inoperable status panel.

   Response:

   It was agreed that a potential exists for loss of automatic control (for a maximum of 11 seconds) if a lo-lo pit level occurs coincident with a station blackout. The lo-lo pit level provides a momentary signal to the standby nuclear service water pond (SNSWP) switchover valves which would not be sensed if this signal occured during a station blackout before the motor control center (MCC) power is sequenced back on. To avert this potential problem the SNSWP switchover relay's time delay will be increased to be longer than the time to sequence the MCC's back on following a station blackout.

10. Confirm that the FMEA, referenced in Section 7.3.2.1, for ESFAS includes (1) all BOP scope and (2) design changes subsequent to the design analyzed in the WCAP.

   Response:

   Duke agreed to revise Section 7.3.2.1 to indicate that interface criteria have been met.

11. Section 6.2.1.1.3.2.2 states that "Instrumentation provided to monitor and record the containment pressure and temperature and sump temperature during the course of an accident within the containment is discussed in Chapter 7." In our review of Chapter 7 we find some information on the containment pressure in Section 7.3.1.1.2 and Tables 7.5.1-1 and 7.5.1-2; however, no information on the instrumentation for the containment and sump.

    Response:

    Duke agreed to revise Section 6.2.1.1.3.2.2 to agree with the information provided in Chapter 7.

15. Describe how the effects of high temperatures in reference legs of steam generator water level measuring instruments subsequent to high energy breaks are evaluated. Identify and describe any modifications planned or taken in response to IEB 79-21. Describe the level measurement errors due to environmental temperature effects on level instruments (excluding steam generator level) including reference legs.

    Response:

    Duke agreed to provide a response to IE Bulletin 79-21.

18. Provide and describe the following information for NSSS and BOP safety related setpoints: (a) Provide a reference for the methodology used. Discuss any differences between the referenced methodology and the methodology used for Catawba. (b) Verify that environmental error allowances are based on the highest value determined in qualification testing. (c) Identify protection channels where the Technical Specification setpoint, with allowance for channel statistical error, falls within 5% of the instrument range limit or within 5% of the range between level measurement taps. For those cases, specify the remaining margin to the end of the range. (d) Document the environmental error allowance that is used for each reactor trip and engineered safeguards setpoint. (e) Identify any time limits on environmental qualification of instruments used for trip, post-accident monitoring or engineered safety features actuation. Where instruments are qualified for only a limited time, specify the time and basis for the limited time. (f) Address the effect of test equipment accuracy on setpoint errors. (g) As an example, derive the setpoints for the low-low steam generator level trip.

    Response:

    As noted in the NSSS meeting summary, a setpoint study will be performed as a basis for the Technical Specifications. No additional action is required at this time.

30. The information provided in Section 7.2.2.2.3 on testing of the power range channels of the Nuclear Instrumentation System, covers only the testing of the high neutron flux trips. Testing of the high neutron flux rate trips is not included.

    Provide a description of how the flux rate circuitry is tested periodically to verify its performance capability.

    Response:

    Duke agreed to revise Section 7.2.2.2.3.

38. Describe compliance with Regulatory Guide 1.118 and IEEE Standard 338-1975. Confirm that technical specifications provide detailed instructions which insure that blocking of a selected protection function actuator circuit is returned to normal operation after testing. Confirm that technical specifications include RTS and ESFAS response times for reactor trip functions. Confirm that tests include all components, from sensor to operation of final actuation device, and describe a typical response time test. Indicate any area of non-compliance with basis for each.

    Response:

    Duke agreed to provide additional justification for not testing the response time of sensors in accordance with Regulatory Guide 1.118.

40. Describe the design criteria and tests performed on the isolation devices in the NSSS and BOP. Address results of analysis or tests performed to demonstrate proper isolation between separation groups.

    Response:

    Duke agreed to revise Section 7.1.2.2 to address BOP isolation devices.

42. Page 7.1-14. The section covering compliance with Regulatory Guide 1.53 addresses only Westinghouse equipment and associated topical reports. Provide the equivalent information for the BOP portions of plant safety systems and auxiliary systems required for support of safety systems.

    Response:

    Duke agreed to provide a discussion of BOP compliance with Regulatory Guide 1.53.

43. Page 7.1-14. The section covering compliance with Regulatory Guide 1.47 addresses only ESF systems. State compliance to Regulatory Guide 1.47 for other Catawba safety related systems.

Response:

Duke agreed to review further and provide additional information.

44. Describe the implementation of the bypassed and inoperable status indication provided for ESF and compliance with Regulatory Guide 1.47. Discuss types of status displays and alarms. Discuss computer utilization and software verification and validation techniques.

Response:

Duke agreed to review further and provide additional information.

45. The discussion on the operating bypasses of the Reactor Trip System (RTS) in Section 7.2.2.2.3 (Item 13), refers the bypass indication to Section 7.8. In our review of Section 7.8 we find Section 7.8.3, titled ESF Bypass Indication, but we can find no discussion on the RTS bypass indication.

Describe the RTS bypass indication system, provide a list of systems for which bypass indication is provided, and discuss how the bypass indication system conforms to the requirements of Regulatory Guide 1.47.

Response:

Duke agreed to review further and provide additional information.

46. Page 7.1-16. Provide a schedule for developing IEEE-338 reliability goals and demonstrating the adequacy of test frequencies.

Response:

Staff was advised by Duke that they are participants in industry studies and that Duke has not committed to following IEEE 330. Duke does not intend to provide a schedule for verifying test frequencies and that their test frequencies are based on past experience. Westinghouse pointed out that the NRC does not, after many years, have any reliability goals other than "Interim Guide," NUREG-0739 and that the concern with FSAR Section 7.1.2.4 wording was not a commitment, but a recognition that the NRC and industry is in the process of proposing goals and developing a data base.

No further action is required at this time.

47. Discuss the plans and schedule for complying with Regulatory Guide 1.97, Revision 2. Describe the conformance of the present design.

Response:

Duke advised the Staff that compliance with Regulatory Guide 1.97, Revision 2 was under review and would be provided at a later date.

49. Discuss the method of redundantly tripping the turbine following receipt of reactor protection signals requiring turbine trip.

Response:

Duke agreed to revise Figure 7.2.1-1 (16 of 16).

51. Using detailed schematics, describe the design of the pressurizer PORV control and block valve control. Does the current design still provide for actuation of the pressurizer spray or relief valves upon a single instrument failure? Identify and describe design features which ensure that the RCS pressure is safely controlled during low temperature operation to include parameters utilized and monitored for alarm indication. Discuss the degree of redundancy in the logic for the low temperature interlock for the RCS pressure control.

Response:

Duke agreed to revise Figure 7.6.21-1.

57. Describe the steam generator level instrumentation. Identify the channels for protection functions, control functions, and post-accident monitoring.

Response:

Duke agreed to revise Table 7.5.1-2 to provide the location of the programmed steam generator level indication and to revise Section 7.2.2.3.5 to provide the parameters used to program low steam generator level setpoint.

68. Confirm that technical specifications will include surveillance requirements for the RTD bypass loop flow alarms.

Response:

Duke agreed to provide a test abstract.

71. Using detailed system schematic, discuss the bypass, bypass interlock, and test provisions for containment ventilation isolation and control room ventilation isolation. The discussion should indicate those design features which insure that the safety function is not defeated during system test and that portions of the system are not inadvertently left in a bypassed condition after test.

Response:

Duke agreed to revise Figure 7.2.1-1 (8 of 16).

78. Revise Table 7.3.1-3 to include, under P-11, the automatic resetting of the "Auto-Start Defeat" logic for auxiliary feedwater pumps as discussed on page 7.4.3.

Response:

Duke agreed to revise Table 7.3.1-3.

79. For main steam and feedwater line valve actuation, describe control circuits for isolation valves and include automatic, manual and test features. Indicate whether any valve can be manually operated and whether each valve actuation level is alarmed in the control room. Indicate specific interfaces with the safety system electrical circuits.

Response:

Duke agreed to revise FSAR to add level switch information for the Condensate-Feedwater System.

86. Using detailed schematics, describe the operation of the UHI system. From the description of upper head injection (UHI) interlocks in Section 7.6.3, it appears that the requirements of Branch Technical Position ICSB 4 in providing automatic opening of the valves whenever either primary coolant system pressure exceeds the preselected value, or a safety injection signal is present, are not followed. If so, justify the approach taken. Also confirm that the ac control power supply used for the valve position indicating lights is independent of the power supply used for the annunciators that alarm if the valve is not fully closed above a set pressure, as required by ICSB 4.

Response:

The staff stated that they wanted a control room switch for each valve that would simultaneously close all UHI accumulator isolation valves. Duke requested a written position which they could review and decide whether they would comply or appeal.

90. Section 7.8.2, Monitor Light Panels, includes a statement that "An energized light on a monitor panel normally indicates that the monitored equipment is in its safety position or mode. Exceptions to this convention are identified to the operator."

Discuss the reasons why the exceptions were taken, list the equipment involved, and describe how the exceptions are identified to the operator.

Response:

Duke agreed to revise Section 7.8.2.

93. Table 1.9-1 (Page 8). The section covering the containment pressure monitor (required by TMI Action Plan Item II.F.1) does not discuss compliance with the design and qualification criteria. Appendix B of NUREG-0737, and the accuracy and response time specifications for the pressure monitor. Provide this information.

Response:

Duke agreed to revise Table 1.9-1.

94. Table 1.9-1 (Page 9). The section covering the containment water level monitor (required by TMI Action Plan Item II.F.1) does not discuss compliance with the design and qualification criteria, Appendix B of NUREG-0737. Provide this information.

Response:

Duke agreed to revise Table 1.9-1.

95. Table 1.9-1 (Page 9). The section covering the containment hydrogen monitor (required by TMI Action Plan Item II.F.1) does not discuss compliance with the design and qualification criteria, Appendix B of NUREG-0737 and the accuracy of this monitor. Provide this information.

Response:

Duke agreed to revise Table 1.9-1.

96. Table 1.9-1 (Page 14). In this section the applicant states "a decision on the necessity of incorporating an automatic PORV isolation system" is forthcoming. TMI Action Plan Item II.K.3.1 requires installation and testing of this system. This item will remain open until the applicant has submitted his position and our review of his position is completed.

Response:

The discussion of TMI Action Plan Item II.K.3.1 was revised in FSAR Revision 4 in response to question 440.T.2 from the Reactor Systems Branch.

97. Sections 7.4 and 7.5 of the FSAR do not cover compliance with applicable GDC's and Regulatory Guides. Provide a table, using Table 7-1 of NUREG-0800 Revision 2 as a guide, to show compliance with each applicable GDC and Regulatory Guide for each section of Chapter 7.

Response:

Duke agreed to revise Section 7.3.1.1.

102. Page 7.1-11 refers to 10.2.2 for a testing of reactor trip on turbine trip. Section 10.2.2 does not discuss testing of reactor trip circuit. Also discussion implies that the EH and stop valves are tested at power. Discuss testing of turbine trip of reactor during operation and include in FSAR.

Response:

Duke agreed to revise Section 10.2.2.

110. Figure 7.2.1-1 (8 of 16) shows deck recirculation fans. Does Catawba have these or should this be the containment air return and hydrogen skimmer? Also interlock by containment high pressure - isn't this the low (0.25 psig) interlock? Also annulus ventilation shown activate by S.I.S. - Section 7.6.15.1 says initiated by containment Hi-Hi pressure. Conflicts?

Response:

Duke agreed to revise Section 7.6 and Figure 7.2.1-1 (8 of 16).

111. Section 7.6.11.3.1 states the hydrogen recombiner auto initiated by signal from ESFAS yet other sections say local manual control.

Response:

Duke agreed to revise Section 7.6.11.3.1.

112. Section 7.6.11.3.19 states hydrogen recombiner has read-outs in control room. Other sections say no. Hydrogen sample is used to verify proper operation.

Response:

Duke agreed to revise Section 7.6.11.3.19.

115. Page 10.3-2. Discuss main steam isolation valves with solenoids, trains, etc.

Response:

See response to item 79.

120. First paragraph on page 7.6-36 of FSAR states: "Upon high radiation the air flow is automatically directed through the filter train." First paragraph on page 9.4-7 of FSAR states: "Upon indication of high radiation level in the unit vent, the Auxiliary Building supply and exhaust fans are automatically stopped." Please clarify this apparent discrepancy.

Response:

Duke agreed to revise Section 7.6.13.1.

NRC / ICBS ITEM #10

FSAR INSERT (7.3.2.1)

DUKE POWER AND WESTINGHOUSE HAVE JOINTLY REVIEWED THE INTERFACE CRITERION OF THE WCAP 8584 REV. 1. ALL ITEMS IMPORTANT TO PRESERVE THE REDUNDANCY, AND TO ENSURE THAT NO SINGLE CREDIBLE EVENT WILL PREVENT OPERATION OF THE REQUIRED BALANCE OF PLANT SAFETY SYSTEMS HAVE BEEN COMPLIED WITH.

Refer to Section 6.2.1.5 for an analysis of the minimum containment pressure transient used in the analysis of the emergency core cooling system.

to be deleted

Instrumentation provided to monitor and record the containment pressure and temperature and sump temperature during the course of an accident within the containment is discussed in Chapter 7.

Ice condenser instrumentation is discussed in Section 6.7.15.

6.2.1.2 Containment Subcompartments

6.2.1.2.1 Design Basis

Consideration is given in the design of the Containment internal structures to localized pressure pulses that could occur following a loss-of-coolant accident. If a loss-of-coolant accident were to occur due to a pipe rupture in these relatively small volumes, the pressure would build up at a rate faster than the overall Containment, thus imposing a differential pressure across the walls of the structures.

These subcompartments include the steam generator enclosure, pressurizer enclosure, and the reactor cavity. Each compartment is designed for the largest blowdown flow resulting from the severance of the largest connecting pipe within the enclosure or the blowdown flow into the enclosure from a break in an adjacent region.

The extent to which pipe restraints are used to limit the break area of pipe ruptures is presented in Section 3.9.

The preliminary calculated differential compartment pressures are increased by a minimum of 40 percent for the design of interior structure walls, slabs, and component supports. The final calculated differential compartment pressures and component support loads due to final calculated differential pressures are in all cases less than those used for design.

The final calculated differential compartment pressures and component support loads due to final calculated differential pressures are in all cases less than those used for design.

The basic performance of the Ice Condenser Reactor Containment System has been demonstrated for a wide range of conditions by the Waltz Mill Ice Condenser Test Program. These results have clearly shown the capability and reliability of the ice condenser concept to limit the Containment pressure rise subsequent to a hypothetical loss-of-coolant accident.

To supplement this experimental proof of performance, a mathematical model has been developed to simulate the ice condenser pressure transients. This model, encoded as computer program TMD (Transient Mass Distribution), provides a means for computing pressures, temperatures, heat transfer rates, and mass flow rates as a function of time and location throughout the Containment. This model is

ICSB Q. 40

INSERT 7.1.2.2. (END OF 7.1.2.2)

ELECTRICAL ISOLATION IN THE BOP CIRCUIT DESIGN IS ACHIEVED BY THE USE OF OPTICAL ISOLATION DEVICES. THE ISOLATION DEVICES ARE DESIGNED AND SUCCESSFULLY TESTED FOR MAINTAINING A MINIMUM OF 2300 VRMS ISOLATION BETWEEN THE INPUT AND OUTPUT CIRCUITRY.

A DESCRIPTION OF CRITERION USED FOR PHYSICAL SEPARATION OF CLASS IE CIRCUITS IS PROVIDED IN SEC. 8.3.1.4.

ICSB Q42

Discussion

A comparison of the design of each nuclear safety-related filter system to this regulatory guide is provided in Section 12.3.3.4.

Regulatory Guide 1.53

Application of the Single-Failure Criteria to Nuclear Power Plant Protection Systems (6/73).

Discussion - Westinghouse

Westinghouse furnished systems meet the recommendations of this regulatory guide in accordance with the comments of Section 7.1.2.4.2.

Discussion - Duke

As noted in Section 8.1.5.2, the Class 1E onsite power system, both ac and dc, have sufficient independence and redundancy to perform their safety function assuming a single failure.

→ INSERT A

Regulatory Guide 1.54

Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants (6/73).

Discussion

Conformance to the requirements of this regulatory guide are discussed in Sections 6.1.2.1 and 6.1.2.2.

Regulatory Guide 1.55

Concrete Placement in Category I Structures (6/73).

Discussion

The Catawba design and construction requirements and procedures for concrete placements in Category I structures are in conformance with the requirements of Regulatory Guide 1.55.

Regulatory Guide 1.56

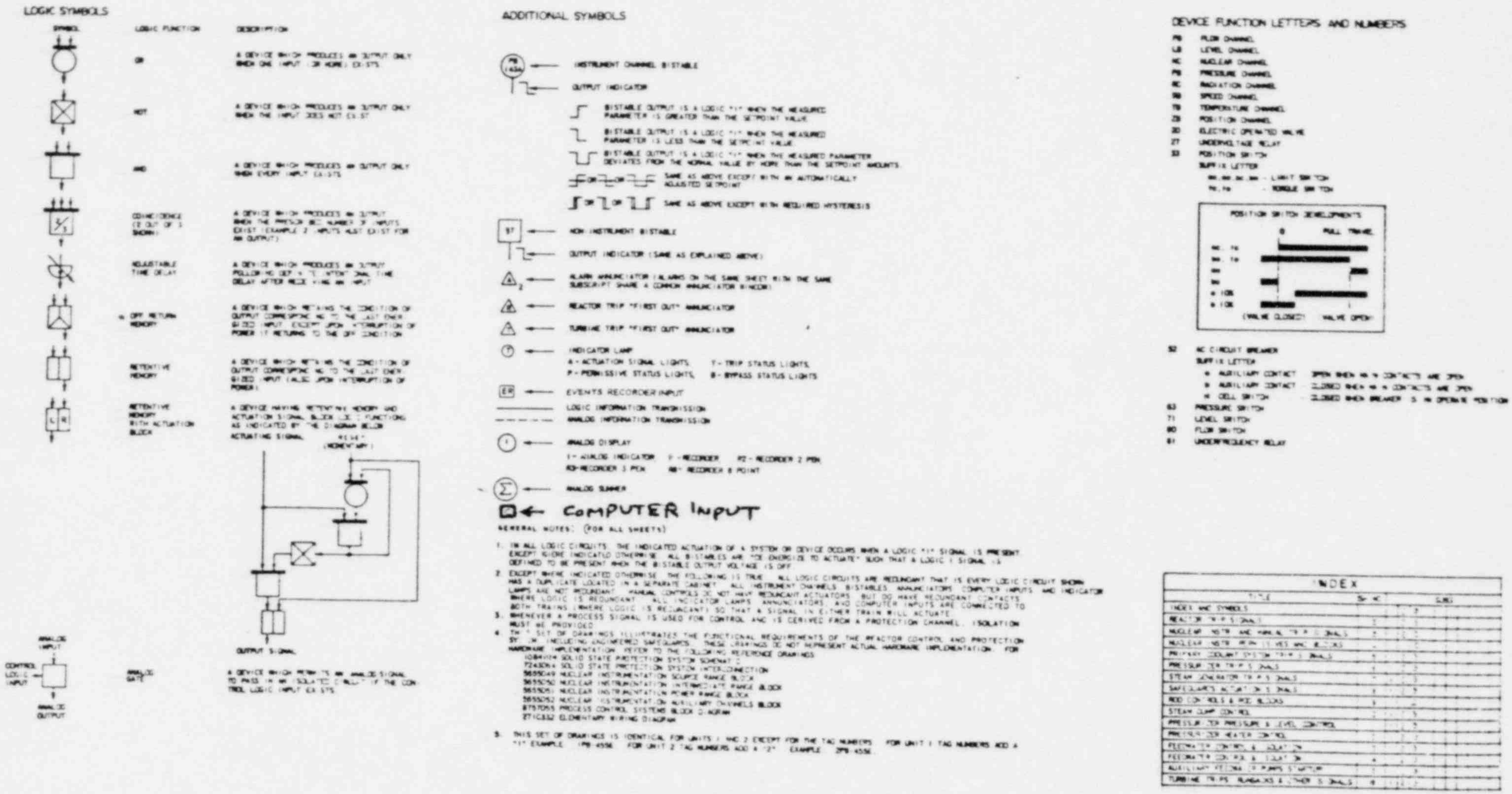
Maintenance of Water Purity in Boiling Water Reactors (/673).

Discussion

This regulatory guide is not applicable to the Catawba Nuclear Station.

INSERT A ICSB Q42

¶ Control system design for Balance of Plant safety ~~system~~ and support systems includes implementation of single failure criteria. These systems are discussed in detail in Section 7.4, 7.5 and 7.6. Westinghouse equipment is addressed in Section 7.1.

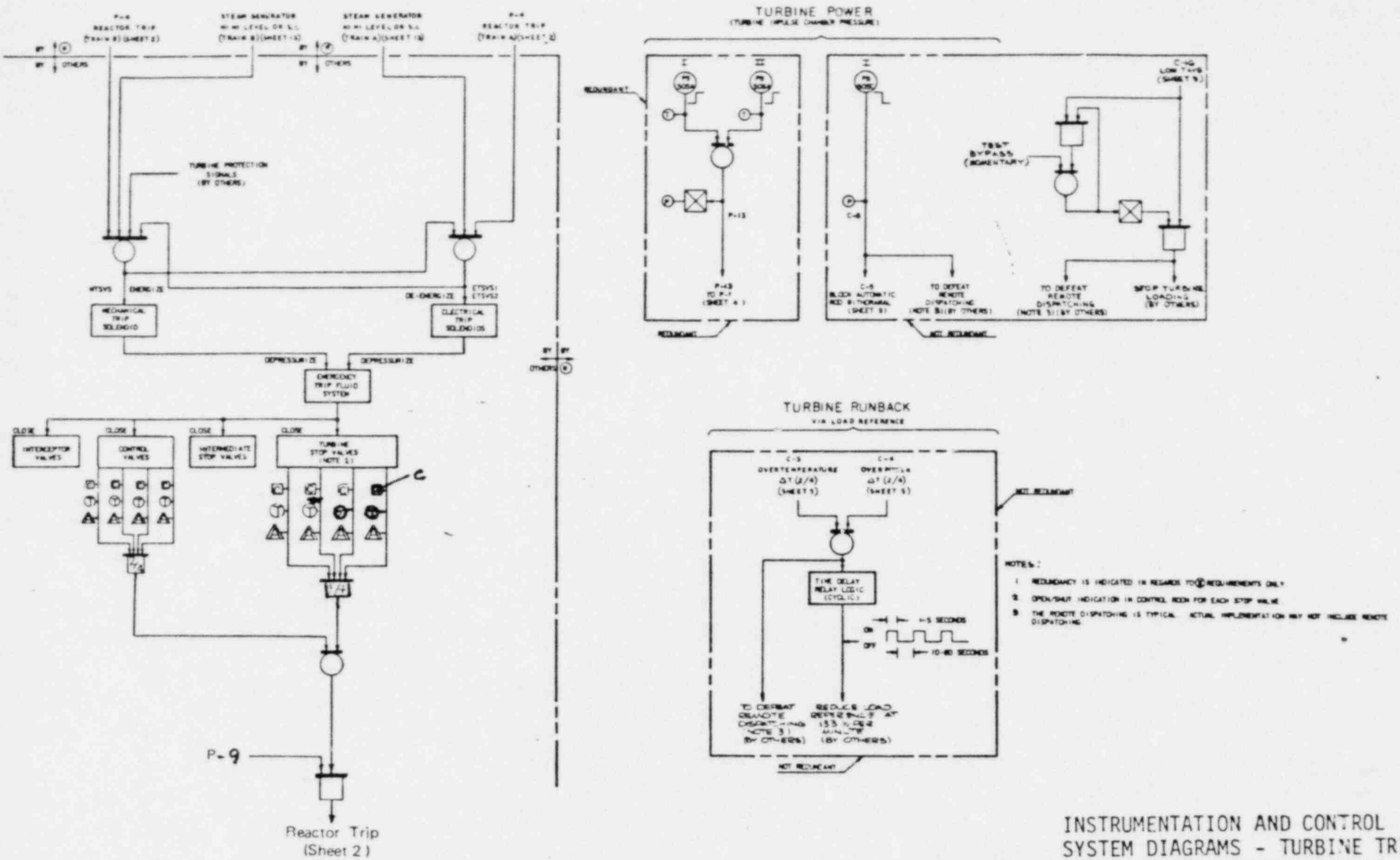


QUESTION 49

INSTRUMENTATION AND CONTROL SYSTEM DIAGRAMS - INDEX AND SYMBOLS

CATAWBA NUCLEAR STATION

Figure 7.2.1-1
(1 of 16)



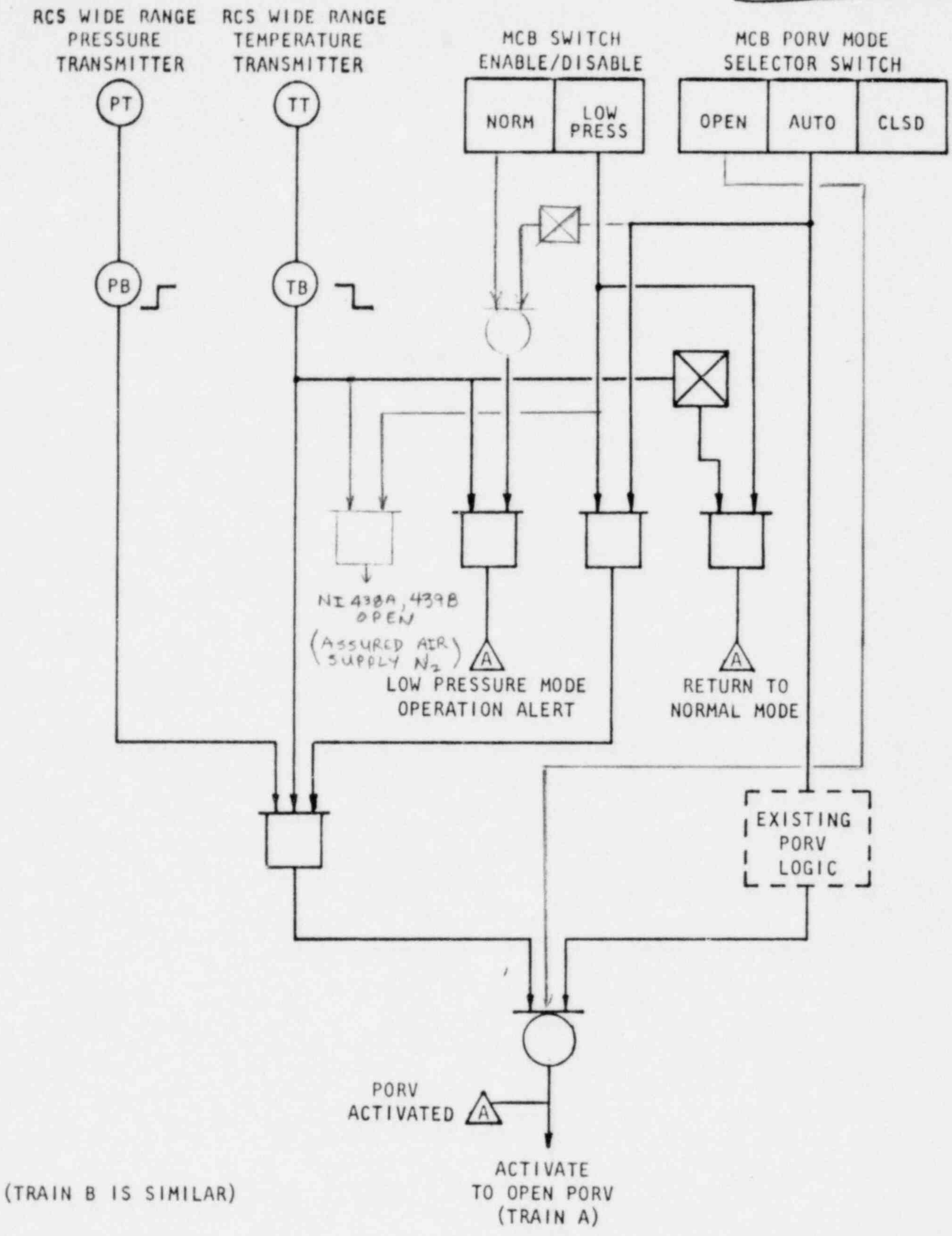
INSTRUMENTATION AND CONTROL SYSTEM DIAGRAMS - TURBINE TRIPS, RUNBACKS, AND OTHER SIGNALS

CATAWBA NUCLEAR STATION

Figure 7.2.1-1
(16 of 16)

ICSB QUESTION 49

QUESTION 51



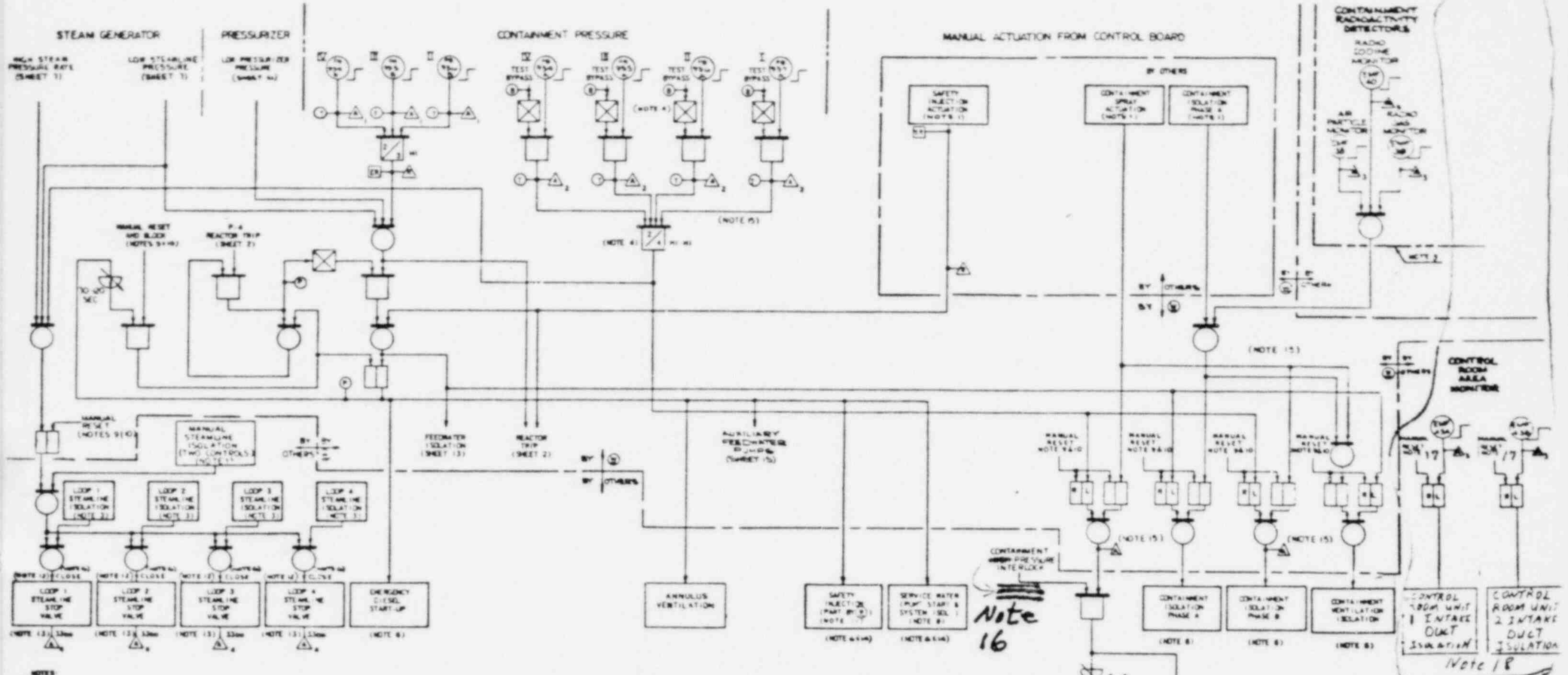
REACTOR COOLANT SYSTEM OVERPRESSURE PROTECTION SYSTEM FOR LOW PRESSURE/ TEMPERATURE WATER SOLID CONDITIONS LOGIC DIAGRAM

CATAWBA NUCLEAR STATION

Figure 7.6.21-1

CONTROL ROOM INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR TO MONITOR SIGNIFICANT PLANT PARAMETERS DURING NORMAL OPERATION

Parameter	No. of Channels Available	Typical Range	Indicated Accuracy (1)	Indicator/ Recorder	Location	Notes
2. Steam Generator Level (narrow range)	4/steam generator	+7 to -5 feet from nominal full load level	±4% of ΔP level (hot)	All channels indicated. The channels used for control are recorded.	Control board	
3. Steam Generator Level (wide range)	1/steam generator	+7 to -41 ft from nominal full load level	+5% of level (cold)	All channels recorded.	Control board	
4. Programmed Steam Generator Level Signal	1/steam generator	+7 to -5 feet	±4%	All channels ~~indicated~~ recorded	Control Board	
5. Main Feedwater Flow	2/steam generator	0 to 120% of maximum calculated flow	±5%	All channels indicated. The channels used for control are recorded.	Control board	
6. Magnitude of Signal Controlling Main and Bypass Feedwater Control Valves	1/main 1/bypass	0 to 100% of valve opening	±1.5%	All channels indicated.	Control board	1. One channel for each main and bypass feedwater control valve 2. OPEN/SHUT indication is provided in the control room for each main and bypass feedwater control valve



NOTES:

1. TWO MOMENTARY CONTROLS, ONE FOR EACH TRAIN.
3. ONE MOMENTARY CONTROL PER LOOP ON THE CONTROL BOARD.
4. CONTAINMENT PRESSURE BISTABLES FOR SPRAY ACTUATION ARE ENERGIZE TO ACTUATE (OTHER BISTABLES ARE DE-ENERGIZE TO ACTUATE).
5. ENCLOSED CIRCUITRY IS NOT PART OF THE SAFEGUARDS SYSTEM AND IS NOT REDUNDANT.
6. COMPONENTS ARE ALL INDIVIDUALLY SEALED IN (LATCHED), SO THAT LOSS OF THE ACTUATION SIGNAL WILL NOT CAUSE THESE COMPONENTS TO RETURN TO THE CONDITION HELD PRIOR TO THE ADVENT OF THE ACTUATION SIGNAL.
8. SERVICE WATER SYSTEM ISOLATION IS USED ONLY IF REQUIRED.
9. THE REDUNDANT MANUAL RESET CONSISTS OF TWO MOMENTARY CONTROLS ON THE CONTROL BOARD, ONE FOR EACH TRAIN.
10. SUPPLIED BY OTHERS.
11. NUCLEAR STEAM SUPPLY SYSTEM SEQUENCE REQUIREMENTS SPECIFIED BY Ⓦ
12. ALSO CLOSES THE BYPASS VALVE IN PARALLEL WITH THE ASSOCIATED STEAM LINE STOP VALVE.
13. LIGHTS SHOULD BE PROVIDED IN THE CONTROL ROOM FOR EACH STEAM LINE STOP VALVE TO INDICATE WHEN THE VALVE IS FULLY CLOSED OR FULLY OPEN.
14. THE ACTUATION MAY BE DELAYED AND SEQUENCED IF THE EMERGENCY DIESEL POWER CAPABILITY IS LESS THAN THE TOTAL LOAD WITH ALL SYSTEMS STARTING. THE TIME DELAY(S), IF USED, MAY NOT EXCEED THE MAXIMUM STARTING TIME REQUIREMENTS FOR EACH SYSTEM.
15. SOME ENGINEERED SAFEGUARDS FUNCTIONS ARE NOT WITHIN THE FUNCTIONAL DESIGN SCOPE OF W NUCLEAR ENERGY SYSTEMS BUT ONLY SHOWN ON THIS SHEET AS THE FUNCTIONS ARE BUILT IN THE W SUPPLIED EQUIPMENT.

CONTAINMENT AIR RETURN FANS & HYDROGEN SKIMMER FANS

16. Containment Pressure > 0.25 PSIG
17. The manual reset consists of two control switches located on the control board.
18. The Unit 1 and Unit 2 intakes are totally redundant.

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INSTRUMENTATION AND CONTROL SYSTEM DIAGRAMS - SAFEGUARDS ACTUATION SIGNALS

DUKE POWER

CATAWBA NUCLEAR STATION

Figure 7.2.1-1 (8 of 16)

8. Main feedwater line isolation as required to prevent or mitigate the effect of excessive cooldown.

9. Start the emergency diesels to assure backup supply of power to emergency and supporting systems components.

10. Annulus Ventilation System actuation to maintain a negative pressure in the Annulus.

11. Containment spray actuation which performs the following functions:

    a. Initiates ~~deck recirculating fans~~ containment air return fans ~~and hydrogen skimmer fans~~ (after time delay) and containment spray to reduce containment pressure and temperature following a loss of coolant or steamline break accident inside of containment.

    b. Initiates Phase B containment isolation which isolates the containment following a loss of reactor coolant accident or a steam or feedwater line break within containment to limit radioactive releases. (Phase B isolation together with Phase A isolation results in isolation of all but safety injection and spray lines penetrating the containment.)

7.3.1.1.2 Analog Circuitry

The process analog sensors and racks for the Engineered Safety Features Actuation System are covered in Reference 1. Discussed in this report are the parameters to be measured including pressures, flows, tank and vessel water levels, and temperatures as well as the measurement and signal transmission considerations. These latter considerations include the transmitters, orifices and flow elements, resistance temperature detectors, as well as automatic calculations, signal conditioning, and location and mounting of the devices.

The sensors monitoring the primary system are located as shown on the piping flow diagrams in Chapter 5, Reactor Coolant System. The secondary system sensor locations are shown on the steam system flow diagrams given in Chapter 10.

Containment pressure is sensed by four physically separated differential pressure transmitters mounted by strong supports outside of the containment, (these transmitters are connected to containment atmosphere by a filled and sealed hydraulic transmission system). The distance from penetration to transmitter is kept to a minimum, and separation is maintained. This arrangement, together with the pressure sensors external to the containment, forms a double barrier and conforms to GDC 56 and Regulatory Guide 1.11.

7.3.1.1.3 Digital Circuitry

The Engineered Safety Features logic racks are discussed in detail in Reference 2. The description includes the considerations and provisions for physical and electrical separation as well as details of the circuitry. Reference 2 also covers certain aspects of on-line test provisions, provisions for test points, considerations for the instrument power source, and considerations for accomplishing physical separation. The outputs from the analog channels are

Q110

combined into actuation logic as shown on Sheets 5 (T_{avg}), 6 (Pressurizer Pressure), 7 (Steam Pressure), 8 (Engineered Safety Features Actuation), and 14 (Auxiliary Feedwater) of Figure 7.2.1-1.

To facilitate Engineered Safety Features actuation testing, two cabinets (one per train) are provided which enable operation, to the maximum practical extent, of safety features loads on a group by group basis until actuation of all devices has been checked. Final actuation testing is discussed in detail in Section 7.3.2.

7.3.1.1.4 Final Actuation Circuitry

The outputs of the Solid State Logic Protection System (the slave relays) are energized to actuate, as are most final actuators and actuated devices. These devices are listed as follows:

1. Safety Injection System pump and valve actuators. See Chapter 6 for flow diagrams and additional information.

2. Containment isolation (Phase A - "T" signal isolates all non-essential process lines on receipt of safety injection signal; Phase B - "P" signal isolates remaining process lines (which do not include safety injection lines) on receipt of 2/4 High-High containment pressure signal). For further information, see Section 6.2.4.

3. Service water pump and valve actuators. (See Chapter 9).

4. Auxiliary feedwater pumps start (See Chapter 10).

5. Diesel start (See Chapter 8).

6. Feedwater isolation (See Chapter 10).

7. Ventilation isolation valve and damper actuators (See Chapter 6).

8. Steam line isolation valve actuators (See Chapter 10).

9. Containment spray pump, valve actuators, containment air return fans ~~and deck recirculating fans~~ ~~and hydrogen skimmer fans~~ (See Chapter 6).

10. Annulus ventilation.

If an accident is assumed to occur coincident with a station electrical blackout, the Engineered Safety Features loads are sequenced onto the diesel generators. This sequence is discussed in Chapter 8. The design meets the requirements of Criterion 35 of the 1971 GDC.

7.3.1.1.5 Support Systems

The following systems are required for support of the Engineered Safety Features:

1. Service Water - Heat Removal (See Chapter 9).

2. Component Cooling Water Systems - Heat Removal (See Chapter 9).

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INTERLOCKS FOR ENGINEERED SAFETY FEATURES ACTUATION SYSTEM

Designation	Input		Function Performed
P-11 (CONT)	2/3 Pressurizer pressure above setpoint	(a)	Reinstates automatically safety injection and steamline isolation on low steamline pressure and automatically blocks steamline pressure rate
		(b)	Defeats manual block of safety injection actuation and steamline isolation on low steamline pressure and defeats steamline isolation on high steamline negative pressure rate
P-12	2/4 T_{avg} below setpoint	(a)	Blocks steam dump
		(b)	Allows manual bypass of steam dump block for the cooldown valves only
	3/4 T_{avg} above setpoint	(a)	Defeats the manual bypass of steam dump block
P-14	2/3 Steam generator water level above setpoint on any steam generator	(a)	Closes all feedwater control valves
		(b)	Trips all main feedwater pumps which closes the pump discharge valves
		(c)	Actuates turbine trip
		(e)	Delete manual block of motor driven auxiliary feedwater pumps automatic starting on 2/4 low-low steam generator level and loss of both main feedwater pumps as outlined in Section 7.4.1.1.

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7.8 OPERATING CONTROL STATIONS

Consistent with proven power station design philosophy, all controls, instrumentation displays, and alarms required for startup, operation, and shutdown of Units 1 and 2 are located in one centralized control room and are readily available to the operator. Remote control stations are provided for certain auxiliary systems which do not involve unit control or emergency functions.

7.8.1 GENERAL LAYOUT

The control room design is such that one man can supervise operation of both units during normal steady state conditions; however, other qualified operators are always available to assist during normal and abnormal operating conditions. Figure 13.0-1 shows the control board arrangement for both units.

7.8.2 MONITOR LIGHT PANELS

Eight monitor light panels are provided in the control room to enable the operator to quickly assess the status of all remotely-operated engineered safety features valves, motors, fans, etc.

Each monitor light panel consists of an array of white lights, one for each engineered safety feature component monitored. The monitor lights [redacted] are not energized when the monitored component is in the position or mode required for [redacted] power operation. An energized light on a monitor light panel [redacted] indicates that the monitored component is in its safety position or mode. ~~Exceptions to this convention are identified to the operators.~~

This statement will be deleted

The eight monitor light panels are arranged to monitor particular groupings of components as follows:

Grouping One Panel	-	components that are normally in their safety positions and receive an ESFAS signal to insure correct positioning (containment isolation valves excepted).
Grouping Two Panel	-	components that are normally positioned for safety injection but are realigned for recirculation.
Grouping Three Panel	-	components that are aligned for safety injection by an ESFAS signal and are realigned for recirculation.
Grouping Four Panel	-	components that are aligned for safety injection by an ESFAS signal and are not realigned for recirculation (containment isolation valves excepted).
Grouping Five Panel	-	components that are normally aligned for safety injection and cold leg recirculation, but must be realigned for hot leg recirculation.
Grouping Six Panel	-	upper head injection isolation valves (monitor lights are energized after closure of UHI isolation valves on accumulator low liquid level).
Grouping Seven Panel	-	redundant indication for components that are normally aligned for safety injection with power removed.

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Addition to Table 1-9.1 (Pg. 9)

INSERTS 93,94,95

THIS INSTRUMENTATION IS PROVIDED IN RESPONSE TO THE REQUIREMENTS OF APPENDIX B OF NUREG 0737. FURTHER DESIGN INFORMATION IS PRESENTED IN TABLE 7.5.1-1.

impulse line has a fail-closed isolation valve located in the annulus. These valves are normally open and have position indication and manual control in the control room. Continuous indication from each transmitter pressure is recorded. These instruments are completely independent of the existing containment pressure transmitters.

INSERT 93 →

Containment Water Level

Two containment floor and equipment sumps are provided on the floor of the lower containment (El 550'-6") to collect floor drains and equipment drains. However, these sumps and their associated pumps and instrumentation serve no safety function.

The containment emergency recirculation sump at Catawba encompasses the entire floor of the lower containment. The two ECCS recirculation lines take suction just inside the Containment wall at elevation 552' and are oriented horizontally. They are not located in the bottom of a recess or sump in the floor. Redundant safety grade level instrumentation is provided to measure emergency recirculation sump level. The range of this instrumentation is 0-20 feet (El 552' to El 572') which is equivalent to a lower containment volume of approximately 1,000,000 gallons. The accuracy of this instrumentation is 10% over the full range.

The redundant differential pressure transmitters utilized in this instrumentation are located in the annulus where a filled capillary system connects its associated transmitter with bellows sensors located inside containment. Continuous indication from each transmitter is provided in the control room. In addition, ~~one~~ both channels of containment water level ~~is~~ are recorded.

INSERT 94 →

Containment Hydrogen Monitoring

Continuous indication of hydrogen concentration in the containment atmosphere is provided in the control room. This hydrogen monitoring system consists of two redundant Comsip, Inc./Delphi Systems Division K-111 analyzer systems with a range of 0 to 30% hydrogen by volume. These analyzers operate independent of the recombiner system and are powered from redundant Class 1E power supplies. Each analyzer has its own containment sample and return lines, and is able to monitor either of two identical containment sampling headers or the calibration gases. Each analyzer has a local control panel indicator and alarm and a separate control room indicator and alarm. In addition, one channel of containment hydrogen concentration is recorded.

Each containment sample header has five inlet samples available for monitoring.

1. Top of containment
2. Operating level
3. Basement
4. Radiation Monitor/Recombiner Inlet header
5. Radiation Monitor/Recombiner Discharge header

All sample selection and switching is accomplished manually by the operator from the local analyzer control panel.

INSERT 95 →

Containment High Range Radiation Monitoring

Q 471.14 Two physically and electrically separated radiation monitors are installed inside the containment. Monitor 1EMF53A is located at elevation 580', 0°17', and monitor 1EMF53B is located at elevation 580', 180°17'. These monitors are supplied by General Atomics and will feature GA detector model number RD23. Each monitor utilizes an ionization chamber to measure gamma radiation and will cover the range from 10^0 to 10^8 R/hr. No overlapping of ranges is required. Monitor sensitivity to 62 Kev is 9.8×10^{-12} Amps/Rad/hr and the

sensivity to 52 Kev is 9.0×10^{-12} Amps/Rad/hr. Seismic qualification and environmental qualification of these monitors are discussed in Sections 3.10 and 3.11, respectively.

One monitor (1EMF53A) is powered from the Train A vital instrument bus, and the other monitor (1EMF53B) is powered from the Train B vital instrument bus. Analog meters (one per train) continuously indicates monitor output in the control room. A continuous strip chart recorder (one train) is also located in the control room.

An electronic calibration of the monitors is performed every refueling outage. In addition a radiation source is used to perform an in-situ calibration of the monitor range below 10 R/hr.

II.F.2 INADEQUATE CORE COOLING INSTRUMENTS

Subcooling Monitor

The margin to saturation is calculated from Reactor Coolant System (RCS) pressure and temperature measurements (wide-range and low-range pressures, wide-range hot leg temperatures, and temperatures from in-core thermocouples). When RCS pressure is below 800 psig, wide-range and low-range pressure inputs are compared, and if the inputs agree within 20 psig the low range pressure inputs are used. The wide range pressure inputs are used for the remaining conditions. The in-core thermocouple readings (65) are averaged and compared with the four wide-range hot leg temperatures (RTD's). The highest of these temperatures and the appropriate pressure are then used to calculate a conservative margin to saturation. Averaging of the thermocouple readings and calculation of margin to saturation are performed by the plant computer.

The computer output consists of a CRT graphic display of conservative margin to saturation conditions, that is, a plot of plant pressure and temperature in relation to a computer generated saturation curve. In addition, the following numerical values are displayed: each RCS hot leg temperature, RCS pressure, power level, margin to P_{sat}, each RCS loop margin to T_{sat}, thermocouple average

QUESTION 97

8. Main feedwater line isolation as required to prevent or mitigate the effect of excessive cooldown.

9. Start the emergency diesels to assure backup supply of power to emergency and supporting systems components.

10. Annulus Ventilation System actuation to maintain a negative pressure in the Annulus.

11. Containment spray actuation which performs the following functions:

    a. Initiates deck recirculating fans (after time delay) and containment spray to reduce containment pressure and temperature following a loss of coolant or steamline break accident inside of containment.

    b. Initiates Phase B containment isolation which isolates the containment following a loss of reactor coolant accident or a steam or feedwater line break within containment to limit radioactive releases. (Phase B isolation together with Phase A isolation results in isolation of all but safety injection and spray lines penetrating the containment.)

INSERT 12 →

7.3.1.1.2 Analog Circuitry

The process analog sensors and racks for the Engineered Safety Features Actuation System are covered in Reference 1. Discussed in this report are the parameters to be measured including pressures, flows, tank and vessel water levels, and temperatures as well as the measurement and signal transmission considerations. These latter considerations include the transmitters, orifices and flow elements, resistance temperature detectors, as well as automatic calculations, signal conditioning, and location and mounting of the devices.

The sensors monitoring the primary system are located as shown on the piping flow diagrams in Chapter 5, Reactor Coolant System. The secondary system sensor locations are shown on the steam system flow diagrams given in Chapter 10.

Containment pressure is sensed by four physically separated differential pressure transmitters mounted by strong supports outside of the containment, (these transmitters are connected to containment atmosphere by a filled and sealed hydraulic transmission system). The distance from penetration to transmitter is kept to a minimum, and separation is maintained. This arrangement, together with the pressure sensors external to the containment, forms a double barrier and conforms to GDC 56 and Regulatory Guide 1.11.

7.3.1.1.3 Digital Circuitry

The Engineered Safety Features logic racks are discussed in detail in Reference 2. The description includes the considerations and provisions for physical and electrical separation as well as details of the circuitry. Reference 2 also covers certain aspects of on-line test provisions, provisions for test points, considerations for the instrument power source, and considerations for accomplishing physical separation. The outputs from the analog channels are

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INSERT 12

12. The Auxiliary Building Ventilation System, The Control Room Area Ventilation System, and the Diesel Building Ventilation System actuate to the following safety modes.

    a. The Auxiliary Building Ventilation System aligns to the filtered exhaust mode to maintain the emergency core cooling system pump rooms at a negative pressure.

    b. Diesel Building Ventilation System actuates to maintain proper ventiiation of the Diesel Building for Equipment operation.

    c. Control Room Area Ventilation System actuates to maintain the environment in the control room, control room area, and switchgear rooms within acceptable limits for equipment operation and post-accident habitability.

on the control panel to allow the operator to select the maximum load to be carried by the turbine. If the flow reference signal exceeds the limit established by the potentiometer, the output flow reference signal is limited to the limit value and a load set motor runback is initiated to drop the load setpoint to slightly above the level of the limit. To prevent excessive decrease of the main steam (throttle) pressure, a main steam (throttle) pressure limiter circuit is provided to close the controlling valve set when the main steam (throttle) pressure falls below a preset level. The regulation of this circuit is fixed at 10%. When the main steam (throttle) pressure falls below an adjustable setpoint, the flow reference signal to the controlling valve set is limited to the value permitted by the level of the main steam (throttle) pressure. The pressure set point is adjustable from zero to rated pressure by changing the position of a motor driven potentiometer using increase and decrease pushbuttons on the control panel. Meters indicate the pressure setpoint selected as well as the actual main steam (throttle) pressure. Associated with the load control unit is a rate sensitive power load unbalance circuit whose purpose is to initiate control valve fast closing action under load rejection conditions that might lead to rapid rotor acceleration and consequent overspeed. Valve action will occur when the power exceeds the load by at least 40% and generator current is lost in a time span of 10 ms or less. Pressure is used as a measure of power, and generator current is used as a measure of load to provide discrimination between loss of load incidents and occurrences of electrical system faults.

Stage pressure feedback circuitry is incorporated in the EHC system to provide more linear turbine response to the load signal and to maintain near constant turbine output while testing control valves. During control valve testing, a feedback signal opens the control valves that are not being tested as the tested valve closes to maintain near constant turbine output during the test.

The turbine and its control valves must be designed to pass the rated flow at throttle pressure existing at the main stop valves at rated output of the NSSS, i. e., at the lowest point of the pressure range. At higher throttle pressure the CV's will, therefore, have excess capacity which would cause a non-linear regulation characteristic. In addition, overload could occur if the pressure does not follow the design steady state curve during load changes or even in steady state. The positioning system for CV's is designed to account for these effects by the use of a throttle pressure compensator which is in service at all times. It consists of an electrical throttle pressure sensor the output of which is used to adjust the gain (opening rate) of the CV's in a manner inversely proportional to the instantaneous throttle pressure. Since the flow capacity of a CV is proportional to the pressure ahead of the valve, the described action will correctly compensate for the varying throttle pressure.

The main stop valve position loop consists of electronic circuitry, a hydraulic actuator and a linear position transducer. Main stop valve testing is provided to determine the operational status of the valve system during normal operation and to increase the probability that the valves will fast close on a turbine trip. When a given valve is tested it slowly closes until its position switch energizes the associated solenoid valve which tests the valve fast operation through a short stroke near bottom. The individual main stop valve test also results in actuation of the dedicated limit switch which provides an input to the four out of four reactor trip logic.

ICSB Q102

The control valve position loop consists of electronic circuitry, an electro-hydraulic servovalve, a hydraulic actuator and a linear position transducer. By use of valve position feedback control, the control valve flow control unit positions the control valves according to the flow demand signal from the load control unit, or directly from the control panel. The purpose of the valve position feedback control is to keep the valve stem of the control valve at a desired position regardless of disturbances in the steam path as well as in the position control system itself. Valve position control is performed by using a feedback path that transmits the actual valve position back to a point where it is compared algebraically with the reference input. The error signal, when different from zero, positions the hydraulic actuator via the servovalve in order to make it zero. Control valve testing is designed to allow regular testing of each valve with the effects to on-line turbine operation minimized. ICSB Q102 Both normal and fast-acting valve operation are tested. The individual control valve test also results in actuation of the dedicated pressure switch which provides an input to the two out of four reactor trip logic. Power load unbalance directly and simultaneously energizes all control valve fast acting solenoid valves through full stroke. On loss of feedback signal a fully open valve will remain open and a partially open valve will close. The control valves will also close on servovalve failures and loss of emergency trip oil pressure.

The intercept valve position loop for valves #1, #2, and #3 consists of electronic circuitry, electro-hydraulic servovalve, a hydraulic actuator and a linear position transducer. By use of valve position feedback control, the intercept valve flow control unit positions the intercept valves according to the flow demand signal received from the load control unit, standby control unit, or directly from the control panel. Intercept valves #4, #5, and #6 open after valves #1, #2, and #3 have opened; these valves do not have the electro-hydraulic servovalve. The purpose of valve position feedback control is to keep the valve stem of the intercept valve at a desired position regardless of disturbances in the steam path as well as in the position control system itself. Valve position control is performed by using a feedback path that transmits the actual valve position back to a summing point where it is compared algebraically with the reference input. The error signal, when different from zero, positions the hydraulic actuator via the servo valve in order to make it zero. Intercept valve testing is designed to allow regular testing of each valve and its intermediate stop valve with the effects to on-line turbine operation minimized. The intercept valve master-slave relationship is disrupted while both normal and fast-acting valve operations are tested. The intercept valves will fast close on a large closing position error and on turbine trips.

The EHC system incorporates a standby control system which provides the capability of manual turbine control in the event of failure of the automatic speed control and/or load control subsystems. The standby control system is independent of the speed and load control units, and may be used to maintain power output while the failed subsystems are being repaired. Although the valve loops and power supplies are common to both systems, they incorporate sufficient redundancy to prevent shutdown of the unit if a malfunction in a valve loop or power supply should occur. Two lines of defense are provided against overspeed while operating in the standby control mode. The first line

7.6.14.3.17 Access to Setpoint Adjustments, Calibration, and Test Points

Access to setpoint adjustments, calibration and test points for the Control Room Area HVAC System safety-related instrumentation and controls is controlled by administrative and security measures.

7.6.14.3.18 Identification of Protective Action

The safety-related instrumentation and controls of the Control Room Area HVAC System are train related and do not include protection channels as defined in IEEE 279-1971. The protection channels that actuate this system are part of the ESFAS and are described in Section 7.3.

7.6.14.3.19 Information Read-Out

Information read-outs are provided in the control room to monitor the safety functions of the Control Room Area HVAC System.

7.6.14.3.20 System Repair

The Control Room Area HVAC System is designed to facilitate the replacement, repair, or adjustment of malfunctioning instruments and controls.

7.6.14.3.21 Identification

The safety-related instrumentation and control equipment of the Control Room Area HVAC System is physically identified as described in Section 7.1.2.3.

7.6.15 ANNULUS VENTILATION SYSTEM INSTRUMENTATION AND CONTROL

7.6.15.1 Description

Two redundant 100 percent capacity trains of annulus ventilation collect and filter gaseous leakage during accident conditions, and relieve the post accident pressure buildup in the Containment/Reactor Building annulus. The Annulus Ventilation System is discussed in Section 9.4.9.

The Annulus Ventilation System is not normally in operation. In the event of an accident, a SAFETY INJECTION signal from the ESFAS automatically starts and aligns the system to maintain the annulus pressure at or below -0.5 inches of water gauge. The recirculation and exhaust dampers are regulated automatically by annulus pressure signals to maintain the designed negative pressure in the annulus. Manual controls for the Annulus Ventilation System are provided in the control room.

The instrumentation and controls for the Annulus Ventilation System are powered from the same train of essential auxiliary power as their associated trained ventilation equipment.

- Proposed FSAR Change Q111

7.6.11.3.1 General Functional Requirements

The instrumentation and fans controls associated with the containment air return and hydrogen skimmer ~~and hydrogen recombiner system~~ are designed with reliability and redundancy to automatically initiate their safety functions upon receipt of a signal from the ESFAS. The Hydrogen Recombiners are manually initiated to reduce hydrogen content within containment.

7.6.11.3.2 Single Failure Criterion

The containment air return, hydrogen skimmer and hydrogen recombiner system instrumentation and controls are designed such that no single failure can prevent the system from performing its safety function.

7.6.11.3.3 Quality of Components and Modules

The quality assurance program under which the components of this system are qualified is described in Chapter 17.0. This program includes appropriate requirements for design review, procurement, inspection, and testing to ensure that system components are of a quality consistent with minimum maintenance requirements and low failure rates.

7.6.11.3.4 Equipment Qualification

Qualification of electrical equipment is discussed in Sections 3.10 and 3.11.

7.6.11.3.5 Channel Integrity

The redundant trains of the safety related instrumentation and controls of the Containment Air Return, Hydrogen Skimmer and Hydrogen Recombiner System are designed to maintain their functional capability.

7.6.11.3.6 Channel Independence

The safety-related instrumentation and controls for the containment air return, hydrogen skimmer, and hydrogen recombiner system are physically separated and electrically isolated as discussed in Section 8.3.1.4.

7.6.11.3.7 Control and Protection System Interaction

The safety-related instrumentation and controls for the containment air return, hydrogen skimmer, and hydrogen recombiner system are train related and do not include protection channels as defined in IEEE 279-1971. The protection channels that actuate this system are part of the ESFAS and are described in Section 7.3.

7.6.11.3.8 Derivation of System Inputs

System inputs are provided by the ESFAS or are derived from direct measurement of the desired variables.

operated from the control room. The hydrogen recombiners are manually operated from their local control panels.

7.6.11.3.17 Access to Setpoint Adjustments, Calibration, and Test Points

Access to setpoint adjustments, calibration, and test points are controlled by administrative and security measures.

7.6.11.3.18 Identification of Protective Action

The safety-related instrumentation and controls for the containment air return, hydrogen skimmer, and hydrogen recombiner system are train related and do not include protection channels as defined in IEEE 279-1971. The protection channels that actuate this system are part of the ESFAS and are described in Section 7.3.

7.6.11.3.19 Information Read-Out

Information read-outs related to the operation of the containment air return fans and associated dampers and valves and hydrogen skimmer ~~, and hydrogen recombiner system~~ are provided in the control room. ~~and on local control panels.~~ Information read-outs for the hydrogen recombiners are provided on their local control panel.

7.6.11.3.20 System Repair

The containment air return, hydrogen skimmer, and hydrogen recombiner system is designed to facilitate the replacement, repair, or adjustment of malfunctioning instruments and controls.

7.6.11.3.21 Identification

The safety-related instrumentation and control equipment of the containment air return, hydrogen skimmer, and hydrogen recombiner system is physically identified as described in Section 7.1.2.3.

7.6.12 SPENT FUEL POOL COOLING SYSTEM

7.6.12.1 Description

The Spent Fuel Pool Cooling System is designed to remove heat from the spent fuel pool and maintain the purity and optical clarity of the pool water during fuel handling operations. The fuel pool cooling pumps and refueling water storage tank isolation valves are controlled from the control room. ESFAS provides permissives to automatically trip the spent fuel pool cooling pumps, and close the refueling water storage tank isolation valves. The Spent Fuel Pool Cooling System has two separate and redundant trains. The Spent Fuel Pool Cooling System instrumentation and controls receive electrical power from the Essential Auxiliary Power System which is described in Section 8.3.

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The Auxiliary Building Filtered Exhaust System and the Auxiliary Shutdown Panel Room Supply System have two separate and redundant trains. A single failure analysis of the Filtered Exhaust System and the auxiliary shutdown panel air handling units is provided in Table 9.4.3-1. Capability to start the Auxilairy Building Filtered Exhaust System is provided in the control room. The ESFAS provides signals to automatically shutdown non-essential Auxiliary Building ventilation system components and start the Auxiliary Building Filtered Exhaust System. Radiation monitors are provided in the ducts prior to the Filter Train by-pass dampers. Upon high radiation the by-pass dampers close automatically. The air flow is then directed through the Filter Train and exhausted to the Unit Vent.

In the Unit Vent radiation monitors are provided to detect radiation. Upon high radiation, the Auxiliary Building Supply Units, Unfiltered Exhaust Units, and Filtered Exhaust Units are shutdown automatically. An ESFAS or blackout sequencer signal bypass these permissives in the Filtered Exhaust Unit controls in order to maintain their safety function.

7.6.13.2 Design Bases

The Auxiliary Building Ventilation System instrumentation and controls are designed to provide reliable control of the Auxiliary Building Ventilation System during normal and accident conditions.

7.6.13.3 Analysis

The requirements of IEEE 279-1971 are written for protection systems as defined in Section 1 of that standard; therefore, these requirements are not directly applicable to the controls of this ESF support system. However, a discussion of the extent to which the design of this system meets the appropriate portions of IEEE 279, Section 4, is provided below:

7.6.13.3.1 General Functional Requirements

The Auxiliary Building Ventilation System safety-related instrumentation and controls monitor and provide manual and automatic control of the Auxiliary Building Ventilation.

7.6.13.3.2 Single Failure Criterion

No single failure within the safety-related instrumentation and control of the Auxiliary Building Ventilation System can prevent the system from performing its safety function.

7.6.13.3.3 Quality of Components and Modules

The quality assurance program under which the components of this system are qualified is described in Chapter 17.0. This program includes appropriate requirements for design review, procurement, inspection, and testing to ensure that system components are of a quality consistent with minimum maintenance requirements and low failure rates.

7.6.13.3.4 Equipment Qualification

Qualification of electrical equipment is discussed in Sections 3.10 and 3.11.