REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8110280126 DOC.DATE: 81/10/22 NOTARIZED: NO DOCKET #
FACIL:50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
AUTH.NAME AUTHOR AFFILIATION
UHRIG,R.E. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
EISENHUT,D.G. Division of Licensing

SUBJECT: Forwards response to Core Performance Branch request for addl info re instrumentation to detect conditions of inadequate core cooling.Updated info in response to 811019 telcon encl.

DISTRIBUTION CODE: B001S COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 20
TITLE: PSAR/FSAR AMDTS and Related Correspondence

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
ACTION:	A/D LICENSNG	1	0	LIC BR #3 BC	1	0
	LIC BR #3 LA	1	0	NERSES,V. 01	1	1
INTERNAL:	ELD	1	0	GEOSCIENCES 28	2	2
	HUM FACT ENG 40	1	1	HYD/GEO BR 30	2	2
	I&C SYS BR 16	1	1	I&E 06	3	3
	IE/EPDB 35	1	1	IE/EPLB 36	3	3
	LIC GUID BR 33	1	1	LIC QUAL BR 32	1	1
	MATL ENG BR 17	1	1	MECH ENG BR 18	1	1
	MPA	1	0	NRR/DE/CEB 11	1	1
	NRR/DE/EQB 13	3	3	NRR/DSI/AEB 26	1	1
	NRR/DSI/ASB 27	1	1	NRR/DSI/CPB 10	1	1
	NRR/DSI/CSB 09	1	1	NRR/DSI/ETSB 12	1	1
	OP LIC BR 34	1	1	POWER SYS BR 19	1	1
	PROC/TST REV 20	1	1	QA BR 21	1	1
	RAD ASSESS BR22	1	1	REAC SYS BR 23	1	1
	REG FILE 04	1	1	SIT ANAL BR 24	1	1
	STRUCT ENG BR25	1	1			
EXTERNAL:	ACRS 41	16	16	BNL(AMDTS ONLY)	1	1
	FEMA-REP DIV 39	1	1	LPDR 03	1	1
	NRC PDR 02	1	1	NSIC 05	1	1
	NTIS	1	1			

NOV 01 1981

TOTAL NUMBER OF COPIES REQUIRED: LTTR 63 ENCL 58

P.O. BOX 529100 MIAMI, FL 33152

FLORIDA POWER & LIGHT COMPANY

October 22, 1981
L-81-463

Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Eisenhut:

Re: St. Lucie Unit 2
Docket No. 50-389
Requests for Additional Information
Inadequate Core Cooling Instrumentation

Attached is Florida Power & Light Company's response to a Core Performance Branch request for additional information concerning instrumentation to detect conditions of inadequate core cooling. Also attached is additional and updated information on the same subject requested by the NRC staff during a telephone conversation on October 19, 1981 between J. Westhoven (C-E), R. Gritz (FPL), V. Nerses (NRC), and T. Huang (NRC). The attached information should close out this item for St. Lucie Unit 2. Should you have any additional questions, please call us.

Very truly yours,

Jack E. Vessely for

Robert E. Uhrig
Vice President
Advanced Systems & Technology

REU/TCG/ah

Attachments

cc: J. P. O'Reilly, Director, Region II (w/o attachments)
Harold F. Reis, Esquire (w/o attachments)

B001
s
1/1

ATTACHMENT "A"

Response to NRC Questions on Inadequate Core Cooling Instrumentation

ATTACHMENT A

Response to NRC Questions on Inadequate Core Cooling Instrumentation

(1-13) Responses to questions (1-13) were responded to on a generic basis by the C-E Owners Group. These responses were provided in CEN-181-P, "Generic Responses to NRC Questions on the C-E Inadequate Core Cooling Instrumentation", which was transmitted in a letter from K. P. Baskin (Chairman C-E Owners Group 1 to D.M. Crutchfield dated September 15, 1981. That letter also transmitted CEN-185, "Documentation of Inadequate Core Cooling Instrumentation for Combustion Engineering Nuclear Steam Supply Systems", which is applicable to the St. Lucie-2 ICC instrumentation.

Question 14: Describe how the processor tests operate to determine that the sensor outputs are within range. How are the ranges selected?

Response: Analog signals are converted to digital form through a 12 bit resolution A/D converter. The input electrical ranges are preprogrammed to 0-10V, 1-5V, 4-20 ma, 10-50 ma, and a range suitable for Type K thermocouples.

Functionally, the analog signals are first converted into volts, then scaled to engineering units. The input variable is then compared to upper and lower out of range values to detect out of range inputs. If the variable is out of range, the display will clearly identify the variable as out of range. The out of range variables will be eliminated from algorithms.

Question 15: Describe the display measurement units.

Response: The primary ICC display will be in the Critical Function Monitoring System. However, the QSPDS display will present the measured variables in engineering units. The engineering units will be in units most directly describing the process. For the ICC detection variables, the following units will be used:

FUNCTION	UNITS
1. Saturation/Subcooled Margin	- °F of PSIA (subcooled or superheat)
Inputs	- °F or PSIA
2. Reactor Vessel Level Above the Core	- % height above the core and discrete level displays
Inputs	- °F
3. Core Exit Thermocouple Temperature	- °F

Question 16: Describe which parameter or parameters would need to be calculated from the sensor inputs. The description of the QSODS implies that such a calculation might or might not be required. When would it be required? When would it not be required?

Response: The following ICC detection parameters or variables require calculation from sensor inputs:

1. Saturation or subcooled margin - The maximum of the temperature inputs and the minimum of the pressure inputs are compared to the saturation temperature or pressure to determine the temperature and pressure margin to saturation. Superheat will be calculated up to the difference between the range of the inputs and the saturation temperature.

2. Reactor vessel level above the core - The HJTC sensor differential temperature and the unheated temperature are compared to setpoints to determine if a liquid covered or uncovered condition exists at each sensor location. The corresponding level output is directly related to the number of sensors that detect liquid or an uncovered state.

3. Representative core exit thermocouple temperature - A temperature will be calculated to represent the number of core exit thermocouple temperatures across the core. This calculation has not been determined yet. It is anticipated to be an average calculation such as the averaging of the five highest temperatures.

Question 17: Specifically, describe the automatic on-line surveillance tests.

Response: The following on-line surveillance tests are performed in the QSPDS:

1. The temperature inside the QSPDS cabinet with a cooling system alarm on high temperature.

2. Power failure to the processor with alarm on failure.

3. Bad sensors and broken communication links with indication on the display.

4. CPU memory check and data communication checks with alarm and indication on the plasma display and digital panel meter on the cabinet. (These checks are performed periodically.)

5. Alalog input offset voltage with compensation performed automatically.

6. Inputs out of range with alarm (see Question 14).

7. Low HJTCS differential temperature with alarm.

Question 18: Describe the manual on-line diagnostic capability and procedures.

Response: The automatic on-line surveillance tests replace the need for a manual initiated on-line or off-line diagnostic test to be performed by the computer. A page displaying the status of the automatic surveillance tests will be provided to aid operator diagnostics.

Additionally, the following manual test capabilities are included in the design:

1. Calibration of the A/D boards (with automatic offset voltage compensation).

2. Reset of the system.

Question 19: Discuss the predetermined setpoint for the heated junction thermocouple signals and how it will be selected.

Response: A setpoint on each of two inputs determines the presence or absence of liquid at each HJTC senor location:

1. Differential temperature between the unheated and heated HJTC junctions, and

2. Unheated HJTC junction temperature.

When either of these two input temperatures exceeds the setpoint for the respective input temperature, the logic indicates that the liquid level has dropped to a level lower than the sensor location. The setpoint values are predetermined and are installed as part of the level logic software. The differential temperature setpoint is calculated (based on tests) to be low enough to obtain a good response time but high enough to assure liquid is not present. The unheated junction temperature setpoint is calculated to assure that liquid is not present at the sensor position.

ATTACHMENT "B"

Draft Responses to Appendix 1.9B

Section 3.1.1 Replacement

3.1.1 SATURATION MARGIN

Saturation Margin Monitoring (SMM) provides information to the reactor operator on (1) the approach to and existence of saturation and (2) existence of core uncovery.

The SMM includes inputs from RCS cold and hot leg temperatures measured by RTDs, the temperature of the maximum of the top three Unheated Junction Thermocouples (UHJTC), representative core exit temperature, and pressurizer pressure sensors. The UHJTC input comes from the output of the HJTCS processing units. In summary, the sensor inputs are as follows:

Input	Range
Pressurizer Pressure	0-3000 psia
Cold Leg Temperature	0-710°F
Hot Leg Temperature	0-710°F
Maximum UHJTC Temperature of top three sensors (from HJTC processing)	200-2300°F
Representative CET Temperature	200-2300°F

3.2 DESCRIPTION OF ICC PROCESSING

The following sections provide a preliminary description of the processing control and display functions associated with each of the ICC detection instruments in the AMS. The sensor inputs for the major ICC parameters; saturation margin, reactor vessel inventory/temperature above the core, and core exit temperature are processed in the two channel QSPDS and transmitted to the Safety Assessment System for primary display and trending.

3.2.1 SATURATION MARGIN

The QSPDS processing equipment will perform the following saturation margin monitoring functions:

1. Calculate the saturation margin

   The saturation temperature is calculated from the minimum pressure input. The temperature subcooled or superheat margin is the difference between saturation temperature and the sensor temperature input. Three temperatures subcooled or superheat margin presentations will be available. These are as follows:

a. RCS saturation margin - the temperature saturation margin based on the difference between the saturation temperature and the maximum temperature from the RTDs in the hot and cold legs.

b. Upper head saturation margin - temperature saturation margin based on the difference between the saturation temperature and the UHJTC temperature (based on the maximum of the top three UHJTC).

c. CET saturation margin - temperature saturation margin based the difference between the saturation temperature and the representation core exit temperature calculated from the CETs (Section 2.2.3).

2. Process sensor outputs for determination of temperature saturation margin.

3. Provide an alarm output for an annunciator when temperature saturation margin reaches a preslected setpoint (expected to be within 0°F to 50°F subcooled) for RCS or upper head saturation margin. CET saturation margin is not alarmed to avoid possible spurious alarms.

3.2.2 HEATED JUNCTION THEMOCOUPLE

The QSPDS processing equipment performs the following functions for the HJTC:

1. Determine collapsed liquid level above core.

   The heated and unheated thermocouples in the HJTC are connected in such a way that absolute and differential temperature signals are available. This is shown in Figure 2-6. When liquid water surrounds the thermocouples, their temperature and voltage outputs are approximately equal. The voltage $V_{(A-C)}$, on Figure 2-6 is therefore, approximately zero. In the absence of liquid, the thermocouple temperatures and output voltage become unequal, causing $V_{(A-C)}$ to rise. When V of the individual HJTC rises above a predetermined setpoint, liquid inventory does not exist at this HJTC position.

2. Determine the maximum upper plenum/head fluid temperature of the top three unheated thermocouples for use as an output to the SMM calculation. (The temperature processing range is from 100°F to 2300°F).

3. Process input signals to display collapsed liquid level and unheated junction thermocouple temperatures.

4. Provide an alarm output when any of the HJTC detects the absence of liquid level.

5. Provide control of heater power for proper HJTC output signal level. Figure 2-7 shows the design for one of the two channels which includes the heater controller power supplies.

3.2.3 CORE EXIT THERMOCOUPLE SYSTEM

The QSPDS performs the following CET processing functions:

1. Process core exit thermocouple inputs for display.

2. Calculate a representative core exit temperature. Although not finalized, this temperature will be either the maximum valid core exit temperature or the average of the five highest valid core exit temperatures.

3. Provide an alarm output when temperature reaches a preselected value.

4. Process CETs for display of CET temperature and superheat.

These functions are intended to meet the design requirements of NUREG-0737, II.F.2. Attachment 1.

3.3 SYSTEM DISPLAY

The ICC detection instrumentation displays in both the SAS (primary displays) and the QSPDS (backup displays) have an ICC summary page as part of the core heat removal control critical function supported by more detailed display pages for each of the ICC variable categories.

The summary page will include:

1. RCS/Upper Head saturation margin - the maximum of the RCS and Upper Head saturation margin.

2. Reactor vessel level above the core.

3. Representative core exit temperature.

Since the SAS has more display capabilities than the QSPDS such as colorgraphics, trending, and a larger format, additional information may be added and with a better presentation than is available with the QSPDS. These variables are incorporated in other SAS system displays.

Since the SAS receives both QSPDS channels of ICC input, the SAS displays both channels of ICC information. The QSPDS displays only one channel of ICC information for each video display unit.

Although all inputs are accessible for trending and historical recall, the SAS has a dedicated ICC trend page for RCS/upper head saturation margin, reactor vessel level, and representative core exit temperature and core exit saturation margin. These are also available as analog outputs from the QSPDS cabinet.

Each QSPDS safety grade backup display also has available the most reliable basic information for each of the ICC instruments. These displays are human engineered to give the operator clear unambiguous indications. The backup displays are designed:

1. To give instrument indications in the remote chance that the primary display becomes inoperable.

2. To provide confirmatory indications to the primary display.

3. To aid in surveillance tests and diagnostics.

The following sections describe displays as presently conceived for each of the ICC instrument systems. Both primary and backup displays are intended to be designed consistent with the criteria in II.F.2 Attachment 1 and Appendix B.

3.3.1 SATURATION MARGIN DISPLAY

The following information is presented on the primary SAS and backup (QSPDS) displays:

1. Temperature and pressure saturation margins for RCS, Upper Head, Core Exit Temperature.

2. Temperatures and pressure inputs.

3.3.2 HEATED JUNCTION THERMOCOUPLE SYSTEM DISPLAY

The following information is displayed on the CFMS and QSPDS displays:

1. Liuqid inventory level above the fuel alignment plate derived from the eight discrete HJTC positions.

2. 8 discrete HJTC positions indicating liquid inventory above the fuel alignment plate.

3. Inputs from the HJTCS:

   a. Unheated junction temperature at the 8 positions.

   b. Heated junction temperature at the 8 positions.

   c. Differential junction temperature at the 8 positions.

2.3.4. CORE EXIT THERMOCOUPLE DISPLAY

The following information is displayed on the SAS display:

1. A spatially oriented core map indicating the temperature at each of the CET's.

2. A selective reading of CET temperatures.

3. The representative core exit temperature.

The following information is displayed on the QSPDS display:

1. Representative core exit temperature.

2. A selective reading of the CET temperatures (two highest temperatures in each quadrant)

3. A listing of all core exit temperatures.

Replacement Section
5.0 SYSTEM QUALIFICATION

The qualification program for St. Lucie-2 ICC instrumentation will be based on the following three categories of ICC instruments:

1. Sensor instrumentation within the pressure vessel.

2. Instrumentation components and systems which extend from the primary pressure boundary up to and including the primary display isolator and including the backup displays.

3. Instrumentation systems which comprise the primary display equipment.

The in-vessel sensors represent the best equipment available consistent with qualification and schedular requirements (as per NUREG-0737, Appendix B). Design of the equipment will be consistent with current industry practices in this area. Specifically, instrumentation will be designed such that they meet appropriate stress criteria when subjected to normal and design basis accident loadings. Seismic qualification to safe shutdown conditions will verify function after being subjected to the seismic loadings.

The out-of-vessel instrumentation system, up to and including the primary display isolator, and the backup displays will be environmentally qualified in accordance with IEEE-323-1974. Plant-specific containment temperature and pressure design profiles will be used where appropriate in these tests. This equipment will also be seismically qualifed according to IEEE-STD-344-1975. CEN-99(S), "Seismic Qualification of NSSS Supplied Instrumentation

Equipment, Combustion Engineering, Inc." (August 1978) describes the methods used to meet the criteria of this document.

FP&L is evaluating what is required to augment the out-of-vessel Class 1E instrumentation equipment qualification program to NUREG-0588. Consistent with Appendix B of NUREG-0737, the out-of-vessel equipment under procurement is the best available equipment. FPL expects to complete this evaluation by the end of the first quarter of 1982.

Revision to Section
6.2 PROTOTYPE TESTING

The Phase 3 test program will consist of high temperature and pressure testing of the manufactured prototype system HJTC probe assembly and processing electronics. Verification of the HJTC system prototype will be the goal of this test program. The Phase 3 test program is expected to be completed by the end of the first Quarter of 1982.

Revision to Setion
9.0 SCHEDULE FOR ICC INSTRUMENTATION INSTALLATION

Flordia Power and Light is actively pursuing, procuring and expediting equipment necessary to implement requirements for TMI item II.F.2, "Instrumentation for Inadequate Core Cooling". However, this commitment is predicated upon manufacturers and vendors meeting their scheduled delivery promises. When firm schedules are developed FPL will inform NRC of the most probable implementation date.

APPENDIX 1.9B Section 10 Will Be Deleted

Replacement Table
I.9B-2

TABLE I.9B-2
EVALUATION OF ICC DETECTION
INSTRUMENTATION TO DOCUMENTATION
REQUIREMENTS OF NUREG-0737 ITEM
II.F.2

ITEM	RESPONSE
1.a.	Description of the ICC Detection Instrumentation is provided in Section 3.0. The instrumentation to be added includes the modified SMM, the HJTC Probe Assemblies, and Improved ICI (CET) Detector Assemblies.
1.b.	The instrumentation described in Section 2.0 will be the ICC detection instrumentation design for FPL.
1.c.	The planned modifications to the existing Unit 2 instrumentation will be made prior to fuel load. Modifications include changes to the SMM, design, procurement and installation of the HJTC probe assemblies, and improved ICI Detector Assemblies (which necessitate installation of improved ICI Nozzle Flanges). The final ICC Detection Instrumentation will be as described in Section 3.0.
2.	The design analysis and evaluation of the ICC Detection Instrumentation is discussed in Sections 2.0 and 4.0. and Appendix A. Testing is discussed in Section 6.0.
3.	The HJTCS has one remaining test phase. The Phase 3 test program will consist of high temperature and pressure testing of a manufactured production prototype system HJTC probe assembly and processing electronics. The Phase 3 test program will be executed at the C-E test facility used for the Phase 2 test and is expected to be completed by the first quarter of 1982. No special verification or experimental tests are planned for the hot leg and cold leg RTD sensors, the pressurizer pressure sensors, or the Type K (chromel-alumel) core exit thermocouples since they are standard high quality nuclear instruments with well known responses. For qualification testing, all out-of-vessel sensors and equipment, including the QSPDS up to and including the isolation to the SAS, will be environmentally qualified to IEE Std. 323-1974 as interpreted to CENPD-255 Rev. 01, "Qualification of C-E Instruments", as interpreted by CENPD-182, and seismically qualified to IEEE STd. 344-1975, "Seismic Qualification of C-E Instrumentation Equipment". The qualification to NUREG-0588 is being addressed by the C-E Owners' Group (See the response to item 1 in Table 3 for more information).

Table 1.9B-2 Continued

Necessary augmenting of out of vessel class 1E instrumentation to NUREG-0588 requirements will be addressed by the FPL evalation to be completed by the end of the first quarter of 1982.

4. This table evaluates the ICC Detection Instrumentation's conformance to the NUREG-0737, Item II.F.2 documentation requirements. Table 1.9B-3 evaluated conformance to Attachement 1 of Item II.F.2 Table 1.9B-4 evaluates conformance to Appendix B of NUREG-0737.

5. The ICC detection instrumentation processing and display consists of two computer systems; the 2 redundant channel safety grade microcomputer based QSPDS, and the SAS. The ICC inputs are acquired and processed by the safety grade QSPDS and isolated and transmitted to the primary display in the SAS. The QSPDS also has the seismically qualified backup displays for the ICC detection instruments. The software functions for processing are listed in Section 3.2, the functions for display are listed in Section 3.3.

The software for the QSPDS is being designed consistent to the recommendations of the draft standard, IEEE std. P742/ANS 4.3.2, "Criteria for the Application of Programmable Digital Computer Systems in the Safety Systems of Nuclear Power Generating Stations". This design procedure verifies and validates that the QSPDS software is properly implemented and integrated with the system hardware to meet the system's functional requirements. This procedure is quality assured by means of the C-E QADP. Since C-E has designed the only licensed safety grade digital computer system in the nuclear industry, C-E has the facilities and experience to design reliable computer systems.

The QSPDS hardware is designed as a redundant safety grade qualified computer system which is designed to the unavailability goal of 0.01 with the appropriate spare parts and maintenance support.

6. Section 9.0 discusses the schedule for installation and implementation of the complete ICC Detection Instrumentation.

7. Guidelines for use of the ICC Detection Instrumentation are discussed in Section 7.0.

8. A future amendment will discuss key operator actions in the current emergency procedures for ICC. The ammendment will be submitted prior to fuel load. Section 7.0 discusses the emergency procedures to be implemented upon incorporation of the complete ICC Detection System.

Table 1.9B-2 Continued

9. The following describes additional submittals that will be provided to support the acceptability of the final ICC Detection Instrumentation.

   1) Environmental and Seismic Qualification of the instrumentation equipment. Additional evaluation to NUREG-0588 will be provided by June 1982.

   2) Modifications to emergency procedures (prior to fuel load).

   3) Changes to Technical Specifications (prior to fuel load)

TABLE 1.9B-3
EVALUATION OF ICC DETECTION INSTRUMENTATION TO ATTACHMENT 1 of II.F.2

ITEM	RESPONSE
1	St. Lucie 2 has 56 core exit thermocouples (CETs) distributed uniformly over the top of the core, Section 3.1.3 has a discription of the CET sensors, Figure 1.9B-7 depicts the locations of the CETs.
2.	The SAS meets the primary display requirements for CET temperatures.
2.a.	A spatial CET temperature map is available on demand.
2.b.	A selective representative CET temperature will be displayed continuously on demand. Although not finalized, this temperature will be either the maximum CET temperature or the average of the five highest CET temperatures.
2.c.	The SAS provides direct readout of CET temperature with a dedicated display page. The line printer provides the hardcopy capability for recording CET temperatures.
2.d.	The SAS has an extensive trend and historical data storage and retrieval system. The historical data storage and retrieval system function allows all ICC inputs to be recorded, stored, and recalled by the operator. The operator (and other user stations) can graphically trend any CET value on the display screen. A dedicated ICC trend page which includes the representative CET temperature and representative CET saturation margin will be accessible to the users.
2.e.	The SAS has alarm capabilities and visually displayed value alarms on the system level pages.
2.f.	The SAS is an extensively human-factor designed display system which allows quick access to requested displays.
3.	ICC instrumentation QSPDS design incorporates a minimum of one backup display with the capability of selective reading of a minimum of 16 operable Thermocouples, 4 from each quadrant. All CET temperatures can be displayed within 5 minutes.
4.	The types and locations of displays and alarms are determined for the primary display by performing a human-factors analysis. The QSPDS also incorporates human factors engineering. The use of these display systems will be addressed in operating procedures, emergency procedures, and operator training.
5.	The ICC instrumentation was evaluated for conformance to Appendix B of NUREG-0737 (see Table 1.9B-4).

Table 1.9B-3 Continued

6. The QSPDS channels are Class 1E, electrically independent, energized from independent station Class 1E power sources and physically separated in accordance with Regulatory Guide 1.75 "Physical Independence of Electric Systems" January 1975 (R1) up to and including the isolation devices.

7. ICC instrumentation shall be environmentally qualified pursuant to C-E owners group qualification program. The isolation devices in the QSPDS are accessible for maintenance following an accident.

8. Primary and backup display channels are designed to provide the highest availability possible. The QSPDS is designed to provide 99% availability. The availability of the QSPDS will be addressed in the Technical Specifications.

9. The quality assurance provisions of Appendix B, Item 5, will be applied to the ICC detection instruments as described in the Appendix B evaluation in Table 1.9B-4.

Revision to Table 1-9B-4

ITEM	RESPONSE
5.	1.144 "Auditing of Quality Assurance Programs for Nuclear Power Plants".
6.	The ICC detection instrumentation outputs are continuously available on the QSPDS displays through manual callup of displays through manual callup of displays. Additionally, one channel of analog trend recording will continuously indicate the ICC summary variables.
7.	The ICC instrumentation is designed to provide readout display and trending information to the opeartor through the SAS and analog trend recording of the ICC summary variables. (See Section 3.3).
8.	The inadequate core cooling instrumentation is specifically and singularly identified so that the operator can easily discern their use during an accident condition.
9.	Transmission of signals from instruments of associated sensors between redundant IE channels or between 1E and non-1E instrument channels are isolated with isolation devices qualified to the provisions of Appendix B.
10.	The QSPDS consists of two redundant channels to avoid interruptions of display due to a single failure. If in the remote chance that one complete QSPDS channel fails, the operator has: 1) Additional channels of ICC sensor inputs for cold leg temperature, hot leg temperature, and pressuizer pressure on the control board separate from the QSPDS. 2) The HJTCS and CET have multiple sensors in each channel for the operator to correlate and check inputs. 3) The HJTCS sensor output may be tested by the operator reading the temperature of the unheated thermocouple and comparing to other temperature indications. 4) Other variables are available to the operator on the Main Control Board for verifying the ICC parameter.
11.	Servicing, testing and calibrating programs shall be consistent with operating technical specifications.
12.	The ICC instrumentation, including the QSPDS, are not intended to be removed or bypassed during operation. Administrative control will be necessary to remove power from a channel.
13.	The system design is such as to facilitate administrative control of access to all setpoints adjustments, calibration adjustments and test points.

Revision to Table 1.9B-4 Continued

14. The QSPDS is designed to minimize anomalous indications to the operator (see section 3.3).

15. Instrumentation is designed to facilitate replacement of components or modules. The instrumentation design is such that malfunctioning components can be identifed easily.

16. The design incorporates this requirement to the extent practical.

17. The design incorporates this requirement to the extent practical.

18. The system is designed to be capable of periodic testing of instrument channels.