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December 27, 1983

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

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
Instrumentation for the Detection of Inadequate
Core Cooling
NRC Docket Nos. 50-454/455 and 50-456/457

References (a): October 27, 1982 letter from B. J.
Youngblood to L. O. DelGeorge

(b): February 8, 1983 letter from T. R.
Tramm to H. R. Denton

Dear Mr. Denton:

This is to provide additional information regarding instrumentation to be installed at our Byron and Braidwood Stations for the detection of inadequate core cooling (ICC). Review of this information should close Outstanding Item 9 of the Byron SER.

Enclosed are Tables CET-1 and CET-2 which provide a point-by-point evaluation of the ICC instrumentation to the criteria contained in Item II.F.2, Attachment 1 and Appendix B of NUREG-0737. This information supplements the response in Reference (b) to Question 8 of Reference (a).

Please address further questions to this office.

One (1) signed original and fifteen (15) copies of this letter and the enclosed tables are provided for NRC review.

Very truly yours,

T. R. Tramm
Nuclear Licensing Administrator

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Enclosures

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TABLE CET-1
EVALUATION OF ICC DETECTION INSTRUMENTATION
TO ATTACHMENT 1 OF II.F.2

ITEM

- 1 Byron/Braidwood Stations - Units 1 and 2 have 65 core exit thermocouples (CETs) each, distributed over the top of the core. FSAR Subsection 4.4.6.1, Section 7.7 and Appendix E, Section E.31 contain information regarding the CET sensors. Figure 3-4A of FSAR Appendix E, Section E.31 depicts the locations of the CET.
- 2 The plant process computer and peripherals meet the primary display requirements for CET temperatures. Reference FSAR Appendix E, Section E.31, paragraph 3.2.2.
 - 2.a A spatial CET temperature map is available on demand.
 - 2.b A selected CET temperature will be displayed continuously on demand as part of the Safety Parameter Display System (SPDS). This temperature will be the maximum CET temperature of all CETs monitored. Reference FSAR Appendix E, Section E.17.
 - 2.c The SPDS provides the capability to display individual CET temperatures. Hardcopy printing of the CET temperatures is available from the process computer printer. The CET temperature range of 200-1800°F is met.
 - 2.d The SPDS will provide the trend capability showing the temperature-time history of the CET values.
 - 2.e The SPDS will provide the alarm capability for CET temperatures exceeding safe limits.
 - 2.f The SPDS development process has included a human-factors review of the design to insure that the human engineering and interface aspects of the design are acceptable.
- 3 Backup displays are provided on the main control board which are capable of selective indication of all 65 CETs. Two channels of display are available with 33 and 32 CETs on Channel A & B, respectively.
- 4 The types and locations of primary (SPDS) and backup displays and alarms have been reviewed for human factors acceptability. The use of these display systems will be addressed in operating and emergency procedures and operator training.

TABLE CET-1

(CONT'D)

ITEM

5. The instrumentation has been evaluated for conformance to Appendix B of NUREG-0737 (Ref. Table CET-2).
6. The CETs, processor cabinets and back-up displays feature a two train design. Each train is physically departed in accordance with Regulatory Guide 1.75 up to and including the isolation of the output to the process computer. Each train also receives power from independent, ESF power sources. The primary display (SPDS) is powered from a highly reliable power source which is battery backed.
7. The instrumentation shall be environmentally and seismically qualified as stated in Table CET-2, Item 1.
8. The primary and backup display systems are designed and powered to provide the highest availability possible. The redundancy and separation supporting the backup displays should be adequate to meet the minimum display requirements of four CET per core quadrant. A calculated availability figure is not available. The availability of the instrumentation will be addressed in the Technical Specifications.
9. The quality assurance provisions of Appendix B, Item 5, will be applied to the instrumentation as described in the Appendix B evaluation in Table CET-2.

TABLE CET-2

EVALUATION OF ICC DETECTION INSTRUMENTATION

TO APPENDIX B OF NUREG-0737

ITEM	RESPONSE
1.	The ICC detection instrumentation (HJTCs & CETs) are seismically and environmentally qualified to the requirements of IEEE 344-1975 and IEEE-323-1974, respectively, and as specified in FSAR Appendix E, Section E.31, Subsection 5.0. The isolation devices in the CET and HJTC processors are accessible for maintenance following an accident.
2.	The ICC detection instrumentation (HJTCs & CETs) through the isolation devices meet the single failure requirements of NUREG-0737 Appendix B. Both channels of the HJTC system and the CET system are provided with direct-indicating displays.
3.	The ICC detection instrumentation (HJTCs & CETs) through the isolation devices are powered from ESF power sources.
4.	The ICC detection instrumentation (HJTCs & CETs) through the isolation devices are designed to operate during normal as well as emergency conditions. The availability will be addressed in the Technical Specifications.
5.	Recommendations of the following Regulatory Guides were considered in the design of ICC instrumentation: <ul style="list-style-type: none">1.28 "Quality Assurance Program Requirements" (Design & Construction)1.30 "Quality Assurance Requirements for the Installation Inspection and Testing of Instrumentation and Electric Equipment.1.38 "Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage and Handling of Items for Water-Cooled Nuclear Power Plants"1.58 "Qualification of Nuclear Power Plant Inspection, Examination and Testing Personnel"1.64 "Quality Assurance Requirements for the Design of Nuclear Power Plants"1.74 "Quality Assurance Terms and Definitions"1.88 "Collection, Storage and Maintenance of Nuclear Power Plant Quality Assurance Records"1.123 "Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants"1.144 "Auditing of Quality Assurance Programs for Nuclear Power Plants"

TABLE CET-2

(CONT'D)

<u>ITEMS</u>	<u>RESPONSE</u>
6.	The ICC detection instrumentation (HJTCs & CETs and SMM) outputs are continuously available through the back-up and primary displays.
7.	The ICC detection instrumentation (HJTCs & CETs and SMM) have trending information provided by the Safety Parameter Display System (SPDS).
8.	The ICC detection instrumentation (HJTCs and CETs) is specifically identified so that the operator can easily discern that they are intended for use under accident conditions.
9.	Signals from ICC detection instrumentation (HJTCs & CETs) which are provided for other uses are passed through qualified isolation devices.
10.	<p>The ICC detection instrumentation operational availability may be checked in the following ways:</p> <ul style="list-style-type: none">a. Additional and separate indications of cold leg temperature, hot leg temperature and pressurizer pressure on the control board.b. The HJTCs and CETs have multiple sensors in each channel for the operator to correlate and check inputs.c. The HJTC sensor output may be tested by the operator reading the temperature of the unheated thermocouple and comparing to other temperature indications.d. A manual steam table calculation of subcooled margin can be made from main control board indications to correlate with the SPDS SMM indication.
11.	Servicing, testing and calibrating programs shall be consistent with operating technical specifications.
12.	The ICC instrumentation are not intended to be removed from service 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 setpoint adjustments, calibration adjustments and test points.
14.	The SPDS is designed to minimize any anomalous indications to the operator (Ref. FSAR Appendix E, Section E.17).

TABLE CET-2

(CONT'D)

<u>ITEM</u>	<u>RESPONSE</u>
15.	Instrumentation is designed to facilitate replacement of components or modules. The instrumentation design is such that malfunctioning components can be identified easily.
16.	The design incorporates this requirement to the extent practical.
17.	The design incorporates this requirement to the extent practical.
18.	The HJTCs & CET systems are designed to be capable of periodic testing.