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April 15, 1981

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Attn: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
Washington, DC 20555

Reference: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
Response to NUREG-0737, ICC Instrument System

Gentlemen:

Forwarded herewith is the Evaluation Report of the ICC instrument System (Inadequate Core Cooling) conformance to NUREG 0737 Item II.F.2 criteria in accordance with our letter dated December 31, 1980.

This evaluation revealed that the requirements for the ICC system can be met by the Westinghouse Reactor Vessel Level Instrument System (RVLIS) with the Core Exit Thermocouples (CETC's). The evaluation of the CETC's will be submitted by July 1, 1981 as indicated in our letter of December 31, 1980.

If you have any questions regarding this response, please contact my office.

Very truly yours,

J. J. Carey
Vice President, Nuclear

cc: D. A. Beckman, Resident Inspector
U.S. Nuclear Regulatory Commission
Beaver Valley Power Station
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U.S. Nuclear Regulatory Commission
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EVALUATION OF THE INADEQUATE CORE COOLING (ICC) INSTRUMENT SYSTEM FOR CONFORMANCE TO NUREG 0737 ITEM II.F.2 INCLUDING ATTACHMENT 1 AND APPENDIX B

This discussion presents the evaluation of the instrument system planned for detection of inadequate core cooling (ICC) for its conformance to the criteria contained in NUREG 0737 Item II.F.2 and Appendix B. Evaluation and proposed actions pertaining to the core-exit thermocouples to the criteria of Attachment 1 will be provided by July 1, 1981 as identified in the Duquesne Light Company response of December 30, 1980 (Reference 1) to NUREG 0737.

Background

During Duquesne Light Company's preparation of the response to NUREG 0737 Item II.F.2 due on January 1, 1981, the evaluation of the ICC Instrument System was deferred pending evaluation of additional information specific to Beaver Valley Power Station, Unit 1 since the bulk of material available and under evaluation was generic rather than plant specific.

Discussion

This evaluation of the ICC Instrument System includes identification of the components constituting the ICC Instrument System, the basis for this selection of component instruments and a completed checklist on these components itemizing the criteria contained in both Item II.F.2 and Appendix B to NUREG 0737 and indicating whether the criteria is met, including any proposed action if the criteria is not met. The method of evaluation using the checklist is to indicate briefly how conformance is considered achieved and identify the source document and specific section supporting that conclusion. It should be noted that since the plant specific ICC Instrument system design is not completed for Beaver Valley Power Station, Unit 1, some of the criteria is not stated as met but it is intended that the criteria will be met by the final system design.

System Components for the Inadequate Core Cooling Determination System

The substantial amount of analysis of events which may lead to conditions of inadequate core cooling performed in response to item I.C.1 of NUREG 0737 and the procedures which have evolved from that analytical effort have identified a number of instruments which are important in determining the adequacy of core cooling. These instruments include: a) reactor coolant system pressure and temperature, by use of which the degree of subcooling can be determined by use of steam tables, b) the subcooling monitor, c) the reactor vessel water level instrument system and, d) the core exit thermocouples. Each of these instruments or instrument systems provides information to the operator by which he may assess the adequacy of core cooling. Item II.F.2 of NUREG 0737 requires information related to instrumentation used in addition to the subcooling monitor for determining the adequacy of core cooling.

Duquesne Light Company letter entitled "Response to NUREG 0737," dated December 31, 1980 provided a response to all items of documentation required under II.F.2 except the conformance of the additional ICC instruments to the criteria set forth under Item II.F.2 This report documents the degree to which the reactor vessel level instrument system (RVLIS) conforms to these criteria:

We conclude that the RVLIS meets the intent of the criteria set forth in item II.F.2 with the following clarifications:

1) the criteria for unambiguous indication requires that core exit thermocouple indications be used. Full evaluation of the suitability of core exit thermocouples will not be complete until July 1, 1981, as stated in our December 31, 1980 response to NUREG 0737.

2) Classification Item No. 5 of Appendix B evaluation check list is not specifically complied with but an alternative which we believe is acceptable is set forth in the attachment.

3) Classification Item No. 18 (periodic testing) invokes IEEE-338-1977 whereas our implementation of RVLIS will incorporate IEEE-338-1971.

REFERENCES

1. Duquesne Light Company letter to the NRC, dated December 30, 1980 with attachment titled: "Response to NUREG 0737"

2. Westinghouse Electric Corporation summary report: Westinghouse Reactor Vessel Level Instrumentation System for Monitoring Inadequate Core Cooling (Microprocessor System), dated December, 1980 (Submitted with Reference 1)

3. Westinghouse letter to DLC, DLWPO-18: "Reactor Vessel Level Indication," dated October 10, 1980

4. Westinghouse letter to DLC, Mr. R. C. Schopper: "Reactor Vessel Level System" dated July 9, 1980

ITEM II.F.2 NUREG 0737

Inadequate Core Cooling Instrument System
Evaluation Checklist

Attachment 1: Design and Qualification Criteria for Pressurized Water Reactor Incore Thermocouple

Classification Item No. (Page No.)	Requirement	Conformance: Yes or No (Specify Ref. No., Page No., Para. No., or Explanation & Justification for Planned Actions)
Gen'l Req't (3-113)	Easy-to-interpret indication	Yes. (Ref. 2, para. 1.1) "RVLIS provides a relatively simple and straightforward means to monitor vessel level."
1	Unambiguous Indication	No. Ref. 2, para. 4.5.3 indicates need to use in conjunction with core exit thermocouples.
4	Unambiguous Indication	
	(a) ICC caused by	
	(1) Hi-void fraction	Yes. (Ref. 2, para. 1 & 4.4) "... to indicate...relative void content of the circulating primary coolant.."
	(2) Stagnant Boil-off	No. (Ref. 3, Item 6 and Ref. 2, para. 1.1 and 4.4). Vessel level measured is the collapsed liquid level. Core Exit T/C's required.
	(b) Must not erroneously indicate ICC due to unrelated phenomena	No. (Ref. 3, Item 7) Westinghouse indicates that it is possible that an erroneous indication of ICC could occur; however, the time period would be brief (approx. 1 min.)
5	Give advanced warning of approach of ICC	Yes. (Ref. 2, para. 2.2 & 4.5) "...accuracy requirements...assure that the vessel level reading can be reasonably used to aid in the detection of the onset of ICC conditions."
6	Cover full range from Normal Operation to Complete Uncovery	Yes. (Ref. 2, para 2.2 & 4.5) "...instrument will cover the full range of expected differential pressures..."

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Classification Item No. (Page No.)	Requirement	Conformance: Yes or No (Specify Ref. No., Page No., Para. No., or Explanation & Justification for Planned Actions)
7	Evaluate all instrumentation in final ICC per Appendix B.	See Appendix B evaluation.
8	If computer used, it must be accessible for maint. following accident.	To be met. Plant specific design and installation will assure accessibility of the microprocessor and remote CRT display.
	(a) Beyond isolation device need not be Class 1E	To be met.
	(b) Energized with Hi-reliability power source	Yes. (Ref. 2, Table 4.1) Class 1E power source indicated.
	(c) Battery backed power source	To be met.
	(d) QA of App. B, Item 5 is not required.	Noted.
9	Evaluate In-core &/or Core Exit Thermocouples in ICC Det. Sys. per Attach. 1	As indicated in the DLC Response of 12/31/80 to NUREG 0737 Item II.F.2, para. 9.1, this evaluation will be performed and recommended changes will be submitted to the NRC on July 1, 1981.
10	Human Factors Analysis should be performed to determine: (a) Types of displays (b) Types of Alarms (c) Locations of Displays (D) Locations of Alarms Considering: (a) Use during normal and abnormal plant conditions (b) Integration into Emergency Procedures	To be met. The final design layout will be based on human factors analysis for locations of Displays and Alarms for the types of displays and alarms design by W and considering the criteria specified in this item. Confirmation of Westinghouse human factors analysis and alarms for their system will be obtained or performed, if necessary.

Inadequate Core Cooling Instrument System
Evaluation Checklist

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Classification Item No. (Page No.)	Requirement	Conformance: Yes or No (Specify Ref. No., Page No., Para. No., or Explanation & Justification for Planned Actions)
10 (cont.)	(c) Integration into Operator Training (d) Other Alarms Occurring (e) Need for Prioritization of Alarms	

ITEM II.F.2 NUREG 0737

Inadequate Core Cooling Instrument System
Evaluation Checklist

Appendix B: Design and Qualification Criteria for Accident Monitoring Instrumentation

Classification Item No. (Page No.)	Requirement	Conformance: Yes or No (Specify Ref. No., Page No., Para. No., or Explanation & Justification for Planned Actions)
1	Instrument Environmentally Qualified IAW R.G.1.89 (NUREG 0588)	Yes. R.G. 1.89 Invokes IEEE 323-1974 W indicates equipment will meet IEEE 323-1974 except for Microprocessor and Display (Ref. 4)
	(a) Seismic Portion per R.G. 1.100	Yes. R.G. 1.100 Invokes IEEE 344-1975 when used with R.G. 1.89. W indicated equipment will meet IEEE 344-1975 (Ref. 4).
	(b) Extended Range Instrumentation (as identified in R.G. 1.97):	
	(1) Qual. Environment - Design Basis Accident in FSAR	To be met. Final installation design requires some instruments to be installed outside containment and outside high energy break areas (Ref. 2, para. 2.3)
	(2) Monitored variable range equal to Max. Range per R.G. 1.97	Yes. R.G. 1.97 requires top of vessel to bottom of core. (See Part I Clar. It. 6)
	(3) Computer Req'ts	(See Part I, Clar. It. 8)
2	Single Failure (No single failure of monitoring instrument, its aux. supporting features, or its power source, should result in loss of indication.	Yes. (Ref. 2, Table 4.1)
	(a) Backup required if one channel results in ambiguity	Yes. (Ref. 2, para. 4.5.5) In instances where ambiguity may result, W analysis concludes that core exit thermocouples should be checked.
	(b) Redundant Channels:	Yes. (Ref. 2, para. 4.2.2.3)
	(1) electrically independent	Yes. System is designed to meet IEEE-384-1977 (Ref. 2, para. 2.4)

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Classification Item No. (Page No.)	Requirement	Conformance: Yes or No (Specify Ref. No., Page No., Para. No., or Explanation & Justification for Planned Actions)
2 (cont.)	(2) Class 1E Power Source	Yes. (Ref. 2, Table 4.1)
	(3) Physically Separated per R.G. 1.75 up to any isolation device	Yes. (Ref. 2, para. 2.4) Compliance with R.G. 1.75 is specified.
	(4) At least one channel displayed on a direct-indicating or recording device.	Yes. (Ref. 2, Table 4.1 & para. 4.2.2.3) "Redundant displays are provided for the two sets...The System includes...strip chart recorder."
3	Class 1E Power Source energizing instrument	Yes. (Ref. 2, Table 4.1)
4	Instrument Channel Available prior to accident (except per para. 4.11 IEEE-279	Yes. See response to criteria 6 and 10 below.
5	QA recommendations of R.G's should be followed (a) 1.28 (b) 1.30 (c) 1.38 (d) 1.58 (e) 1.64 (f) 1.74 (g) 1.88 (h) 1.123 (i) 1.144 (j) Task RS 810-5	No. System is generically designed to meet 10 CFR 50 Appendix B (Ref. 2, para. 2.4). Plant specific design and installation will also be in accordance with 10 CFR 50 Appendix B and approved DLC Operations QA Program. No other action is planned.
6	Continuous indication (Instrument overlap, if required)	Yes. Indication will be continuous as described in ref. 2, para. 4.4. Note that there is d/p detector overlap which is provided for additional accuracy while venting the head (Ref. 2, para. 4.4)

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Inadequate Core Cooling Instrument System
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Classification Item No. (Page No.)	Requirement	Conformance: Yes or No (Specify Ref. No., Page No., Para. No., or Explanation & Justification for Planned Actions)
7	Recording of Instrument Readout--where trend information essential. (Intermittent displays permissible if no transient information to be lost)	Yes. Trend information is incluied in microprocessor and display design (Ref. 2, para. 4.2.2.3, 4.2.2.2.3.1, 4.5.3.1 & Fig. 4-5b). Also the system includes digital to analog converters to provide three analog signals for a single three-pen strip chart recorder (Ref. 2, para. 4.4 & 4.4.2.3).
8	Instruments Specifically Identified on Control Panels so operator can easily discern their use under accident conditions.	Yes. (Ref. 2, Table 4.1).
9	Isolation Devices for accident monitoring signals should meet requirements.	To be met. Westinghouse indicates qualification of electronic isolation devices are included and that Plant Specific design must permit access (Ref. 2, para. 2.3)
10	Operational Availability Checking provided for during Reactor Operation	Yes. System meets R.G. 1.22 "Periodic Testing of Protection System Actuation Functions (Ref. 2, para. 2.4)
11	Servicing, testing and calibrating programs to maintain instruments are required	To be met. Such programs are being developed by Westinghouse as indicated in Ref. 2, para. 4.3
12	Design should facilitate Admin. Control of Access to removal means	Yes. See response to item 13.
13	Design should facilitate Admin. Control of Access to set points and adjustments	Yes. Since remote display at control board will indicate operator disabled inputs (Ref. 2, para. 4.1.1.3.1), this criteria is considered met.

ITEM II.F.2 NUREG 0737

Inadequate Core Cooling Instrument System
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Classification Item No. (Page No.)	Requirement	Conformance: Yes or No (Specify Ref. No., Page No., Para. No., or Explanation & Justification for Planned Actions)
14	Monitoring Instrument Design should minimize conditions that would cause meters, alarms, etc. to give confusing indications	Yes. (See response to item 15 below and to Clar. It. 1 & 4 in Part I)
15	Design should facilitate recognition, location, repair replacement, or adjustment of malfunctioning components.	Yes. (Ref. 2, para. 4.2.2.3) "Information displayed is intended to be unambiguous and reliable to minimize potential for operator error or misinterpretation...Any error conditions such as out of range sensors or hydraulic isolators are automatically displayed on the affected measurement."
16	Instrumentation inputs should be from sensors measuring the variable (to extent practical)	Yes. Inputs are from d/p transmitters which are very basic technique for liquid level measurement. Other inputs are required to achieve desired indication accuracy (Ref. 2, para. 4.1 & 4.2)
17	Instruments should be used for both normal and accident monitoring (to extent practical)	Yes. "Each train of the RVLIS is capable of monitoring coolant mass in the vessel from normal operation to a condition of complete core uncovery." (Ref. 2, para. 4.4)
18	Periodic Testing per R.G. 1.118	No. R.G. 1.118 invokes IEEE 338-1977 with comments. Periodic Testing of the system is being designed to IEEE-338-1971 (Ref. 2, para. 2.4). No further action is planned.