December 10, 1982

TO: ALL LICENSEES OF OPERATING WESTINGHOUSE AND CE PWRs (EXCEPT ARKANSAS NUCLEAR ONE - UNIT 2 AND SAN ONOFRE UNITS 2 AND 3)

SUBJECT: INADEQUATE CORE COOLING INSTRUMENTATION SYSTEM (GENERIC LETTER NO. 82-28)

Gentlemen:

On November 4, 1982, the Commission determined that an instrumentation system for detection of inadequate core cooling (ICC) consisting of upgraded subcooling margin monitors, core-exit thermocouples, and a reactor coolant inventory tracking system is required for the operation of pressurized water reactor facilities.

On the basis of analysis of information provided by licensees, meetings with industry groups and independent studies by the NRC Staff, the Commission has found that during a small LOCA, there is a period of time before the core has boiled dry (indicated by core exit thermocouples) when the operators have insufficient information to clearly indicate a void formation in the reactor vessel head or to track the inventory of coolant in the vessel and primary system. The Subcooling Margin Monitor gives early indication of a problem but does not indicate whether the condition is getting worse or better.

The addition of a reactor coolant inventory system will improve the reliability of plant operators in diagnosing the approach of ICC and in assessing the adequacy of responses taken to restore core cooling. The benefit will be preventive in nature in that the instrumentation will assist the operator in avoidance of ICC when voids in the reactor coolant system and saturation conditions result from over cooling events, steam generator tube ruptures, and small break loss of coolant events. The addition of a reactor coolant inventory system, coupled with upgraded in-core thermocouple instruments and a subcooling margin monitor, provides an ICC instrumentation package which could significantly reduce the likelihood of human misdiagnosis and errors for events such as steam generator tube ruptures, loss of instrument bus or control system upsets, pump seal failures, or overcooling events originating from disturbances in the secondary coolant side of the plant. For less frequent events, involving coincidental multiple faults or more rapidly developing small break LOCA conditions, the ICC could also reduce the probability of human misdiagnosis and subsequent errors leading to ICC.

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NRC FORM 318 (10-80) NRCM 0240 OFFICIAL RECORD COPY USGPO: 1981—335-960

The Nuclear Regulatory Commission has completed its review of several generic reactor level or inventory system instrumentation systems which have been proposed for the detection of ICC in PWRs. The Combustion Engineering Heated Junction Thermocouple (HJTC) system and the Westinghouse Reactor Vessel Level Instrumentation System (RVLIS) are acceptable for tracking reactor coolant system inventory and provide an enhanced ICC instrument package when used in conjunction with core exit thermocouple systems and subcooling margin monitors designed in accordance with NUREG-0737 and operated within approved Emergency Operating Procedure Guidelines. The details of the NRC Staff review of these generic systems are reported in NUREG/CR-2627 and NUREG/CR-2628 for the Combustion Engineering and Westinghouse systems, respectively.

Other differential pressure (d/p) measurement techniques for reactor coolant system inventory tracking are acceptable provided that they meet NUREG-0737 design requirements and monitor the coolant inventory over the range from the vessel upper head to the bottom of the hot leg as a minimum.

In order for the Commission to complete its review of your ICC system to assure that an acceptable system is installed as soon as practicable, the NRC requires additional information.

Accordingly, in order to determine whether your license should be modified, you are required to submit to the Director, Division of Licensing, NRR, the following information in writing and under oath or affirmation pursuant to Section 182 of the Atomic Energy Act and 10 CFR 50.54(f) of the Commission's regulations.

1. Within 90 days of the date of this letter, identify to the Director, Division of Licensing, the design for the reactor coolant inventory system selected and submit to the Director, Division of Licensing, detailed schedules for its engineering, procurement and installation. References to generic design descriptions and to prior submittals containing the required information, where applicable, are acceptable.

2. Within 90 days of the date of this letter review the status of conformance of all components of the ICC instrumentation system, including subcooling margin monitors, core-exit thermocouples, and the reactor coolant inventory tracking system, with NUREG-0737, Item II.F.2 and submit a report on the status of such conformance.

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3. The installation of the ICC instrumentation system shall be completed during the earliest refueling shutdown consistent with the existing status of the plant and practical design and procurement considerations. It has become apparent, through discussions with owners' groups and individual licensees, that schedules must adequately consider the integration of these requirements with other TMI related activities. In recognition of this and the difficulty in implementing generic deadlines, the Commission has adopted a plan to establish realistic plant-specific schedules that take into account the unique aspects of the work at each plant. Each licensee is to develop and submit its own plant-specific schedule which will be reviewed by the assigned NRC Project Manager. The NRC Project Manager and licensee will reach an agreement on the final schedule and in this manner provide for prompt implementation of these important improvements while optimizing the use of utility and NRC resources.

Licensees who have completed installation of an approved generic ICC instrumentation system are authorized to make their system operable prior to final NRC approval for purposes of operator training and familiarization. However, the ICC instrumentation system should not be turned on until the licensee has completed the task analysis portion of the control room design review, and should be used with prudence in relation to any operator actions or decisions until the plant specific design and installation has been approved by the staff and instructions on its use and operation have been incorporated in accordance with the Emergency Operating Procedure Guidelines into approved emergency operating procedures.

For your convenience in performing the status review (Item 2) of your conformance with NUREG-0737, a check list of the nine items of documentation cited on pp. II.F.2 - 3 and 4 of that document is provided in an appendix to this letter. Even though you may have provided much of the information required for our review, we have not yet received all of the information required to complete our review of plant specific installations for any licensee. In addition, some licensees have modified their positions during the period when NRC was re-reviewing the II.F.2 requirements. Therefore, your status report should review for completeness and reference those earlier submittals, including generic submittals, which remain valid in response to documentation items on the check list. In addition, you should include a proposed schedule for the remaining submittals. Information items to be addressed in the submittal regarding your review of core exit thermocouples for conformance to NUREG-0737, II.F.2, Attachment 1, and your review of the ICC instrumentation for conformance to NUREG-0737, Appendix B, are also listed in the appendix to this letter. The staff review will focus on deviations from the design criteria.

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This request for information was approved by OMB under clearance number 3150-0065 which expires May 31, 1983. Comments on burden and duplication may be directed to the Office of Management and Budget, Reports and Management, Room 3208, New Executive Office Building, Washington, D.C.

Sincerely,

Darrell G. Eisenhut, Director
Division of Licensing

Enclosure:
As stated

cc w/enclosure
Service Lists
Westinghouse Electric Corp.
Combustion Engineering

* See previous concurrence page for concurrences:

OFFICE	DL:ORB#5	DL:ORB#5	ORAB	DL:ORB#5	OELD	DL:AD:SA	DL:AD:OR	DL:DIR
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This request for information was approved by OMB under clearance number 31650-0065 which expires May 31, 1983. Comments on burden and duplication may be directed to the Office of Management and Budget, Reports and Management, Room 3208, New Executive Office Building, Washington, D.C.

Sincerely,

Darrell G. Eisenhut, Director
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Westinghouse Electric Corp.
Combustion Engineering

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APPENDIX

Checklist
for Plant Specific Review of
Inadequate Core Cooling (ICC) Instrumentation System

For _____ Docket No. _____

Operated by: _____

_____

_____

The following items for review are taken from NUREG-0737, pp II.F.2-3, and 4. Responses should be made to full requirements in NUREG-0737, not abbreviated forms below. Applicants should provide reference to either the applicant's submittal or the generic description under the column labled "Reference." These items are required to be reviewed on a plant specific basis by NUREG-0737 for all plants. Differences from the generic descriptions provided by Westinghouse, the Westinghouse Owner's Group, Combustion Engineering, or Combustion Engineering Owner's Group must be indicated by "yes or no" in the column labled deviations and must be justified. Under the Column labeled schedule, either indicate that your documentation of the item is complete or provide a proposed schedule for your submittal.

	Reference	Deviations	Schedule
1. Description of the proposed final system including: a. a final design description of additional instrumentation and displays; b. detailed description of existing instrumentation systems. c. description of completed or planned modifications.			
2. A design analysis and evaluation of inventory trend instrumentation, and test data to support design in item 1.			
3. Description of tests planned and results of tests completed for evaluation, qualification, and calibration of additional instrumentation.			

4. Provide a table or description covering the evaluation of conformance with NUREG-0737: II.F.2, Attachment 1, and Appendix B (to be reviewed on a plant specific basis)* _____
5. Describe computer, software and display functions associated with ICC monitoring in the plant. _____
6. Provide a proposed schedule for installation, testing and calibration and implementation of any proposed new instrumentation or information displays. _____
7. Describe guidelines for use of reactor coolant inventory tracking system, and analyses used to develop procedures. _____
8. Operator instructions in emergency operating procedures for ICC and how these procedures will be modified when final monitoring system is implemented. _____
9. Provide a schedule for additional submittals required** _____

*II.F.2 Attachment 1 (for Core Exit Thermocouples)

In response to item 4 in the above checklist, the following materials should be included to show that the proposed system meets the design and qualification criteria for the core exit thermocouple system.

1. Provide diagram of core exit thermocouple locations or reference the generic description if appropriate.
2. Provide a description of the primary operator displays including:
   a. A diagram of the display panel layout for the core map and description of how it is implemented, e.g., hardware or CRT display.
   b. Provide the range of the readouts.
   c. Describe the alarm system.
   d. Describe how the ICC instrumentation readouts are arranged with respect to each other.
3. Describe the implementation of the backup display(s) (including the subcooling margin monitors), how the thermocouples are selected, how they are checked for operability, and the range of the display.
4. Describe the use of the primary and backup displays. What training will the operators have in using the core exit thermocouple instrumentation? How will the operator know when to use the core exit thermocouples and when not to use them? Reference appropriate emergency operating guidelines where applicable.

5. Confirm completion of control room design task analysis applicable to ICC instrumentation. Confirm that the core exit thermocouples meet the criteria of NUREG-0737, Attachment 1 and Appendix B, or identify and justify deviations.

6. Describe what parts of the systems are powered from the 1E power sources used, and how isolation from non-1E equipment is provided. Describe the power supply for the primary display. Clearly delineate in two categories which hardware is included up to the isolation device and which is not.

7. Confirm the environmental qualification of the core exit thermocouple instrumentation up to the isolation device.

Appendix B (of NUREG-0737, II.F.2)

Confirm explicitly the conformance to the Appendix B items listed below for the ICC instrumentation, i.e., the SMM, the reactor coolant inventory tracking system, the core exit thermocouples and the display systems.

	Reference	Deviations
1. Environmental qualification		
2. Single failure analysis		
3. Class 1E power source		
4. Availability prior to an accident		
5. Quality Assurance		
6. Continuous indications		
7. Recording of instrument outputs		
8. Identification of instruments		
9. Isolation		

**For the users of either Combustion Engineering Heated Junction Thermocouple (HJTC) System or Westinghouse Differential Pressure (dp) system a detailed response to the plant specific items stated below should be provided.

	Reference	Deviations
A. Westinghouse dp System		
1. Describe the effect of instrument uncertainties on the measurement of level.		
2. Are the differential pressure transducers located outside containment?		
3. Are hydraulic isolators and sensors included in the impulse lines?		
B. CE HJTC System		
1. Discuss the spacing of the sensors from the core alignment plate to the top of the reactor vessel head. How would the decrease in resolution due to the loss of a single sensor affect the ability of the system to detect an approach to ICC?		

Generic Letter 82-28

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attach to Com C. ltr. 11/23/82

Letter to Licensees

NSSS	Licensee	Operating plant(s)	Docket Number(s)
W	Duquesne Light	Beaver Valley	50-334
W	Indiana & Michigan Electric	Cook 1 & 2	50-315/316
W	Alabama Power Co.	Farley 1 & 2	50-348/364
W	Rochester Gas & Electric	Ginna	50-244
W	Connecticut Yankee Atomic Power	Haddam Neck	50-213
W	Consolidated Edison	Indian Point 2	50-247
W	Power Authority of State of N.Y.	Indian Point 3	50-286
W	Wisconsin Public Service	Kewaunee	50-305
W	Duke Power	McGuire 1 & 2	50-369
W	Virginia Electric & Power	North Anna 1 & 2	50-338/339
W	Wisconsin Electric Power Company	Point Beach 1 & 2	50-266/301
W	Northern States Power	Prairie Island 1 & 2	50-282/306
W	Carolina Power & Light	Robinson 2	50-261
W	Public Service Electric & Gas	Salem 1 & 2	50-272/311
W	Southern California Edison	San Onofre 1	50-206
W	Virginia Electric & Power	Surry 1 & 2	50-280/281
W	Portland General Electric	Trojan	50-344
W	Florida Power & Light	Turkey Point 3 & 4	50-250/251
W	Yankee Atomic Electric	Yankee Rowe 1	50-029
W	Commonwealth Edison	Zion 1 & 2	50-295/304
W	Tennessee Valley Authority	Sequoyah 1 & 2	50-327/328
W	Summer (Circle 12)		
CE	Baltimore Gas & Electric	Calvert Cliffs 1 & 2	50-317/318
CE	Omaha Public Power District	Ft. Calhoun	50-285
CE	Maine Yankee Atomic Power	Maine Yankee	501-309
CE	Northeast Nuclear Energy	Millstone 2	50-336
CE	Consumers Power	Palisades	50-255
CE	Florida Power & Light	St. Lucie 1	50-355