Westinghouse Electric Corporation
Water Reactor Divisions

Nuclear Operations Division
Box 355
Pittsburgh Pennsylvania 15230

NS-NRC-85-1325

May 9, 1985

Mr. James M. Taylor, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Phillips Building
7920 Norfolk Avenue
Bethesda, Maryland 20014

Dear Mr. Taylor:

This is to confirm the telephone conversation of May 9, 1985 between Messrs. C. Draughon and B. Monty of Westinghouse and Mr. George Lanik of the NRC. In that conversation, Westinghouse notified the NRC of a reportable item associated with the Westinghouse supplied safety grade core exit thermocouple (T/C) system. This item was reported under 10CFR 21.

Background and Description

Westinghouse has been performing environmental qualification tests on the various components of the safety grade core exit T/C system as part of our IEEE 323-1974 qualification program described in WCAP 8587. These equipment components include the thermocouples, connectors, potting adaptors, splices and the reference junction box. Evaluation of test results obtained through early May of this year indicate that the thermocouple signal will be maintained although some errors could be experienced in the system during and following a postulated High Energy Line Break (HELB). These errors are postulated to be caused by a combination of moisture ingression and thermal expansion but are not completely understood at this time. The thermocouples have satisfactorily completed the qualification program. The recent testing on connectors, splices, etc., have led to a potential total system error that exceeds the allowance for certain functions in the Emergency Response Guidelines that are the basis for plant specific Emergency Operating Procedures (EOP) implementation. Simply adding the estimated errors from the test results for each separate component yields a total of approximately 75°F. Each utility may have a different combination of splices and connectors so an estimate of 75°F has been used to evaluate the safety significance of the recently completed tests.

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Utilization of Safety Grade Core Exit Thermocouple Information

Core exit T/C information is utilized in the generic Westinghouse Owners Group (WOG) Emergency Response Guidelines (ERG) in two particular areas: reactor coolant system (RCS) subcooling margin; and the detection of inadequate core cooling (ICC). This T/C information is also used in some plants as an input to the density compensation signal for the Westinghouse Reactor Vessel Level Indication System (RVLIS). Table I provides a list of plants which utilize the safety grade core exit T/C system which is the subject of this report.

RCS Subcooling Margin

The generic WOG ERG's recommend the use of core exit T/C temperature in the calculation of RCS subcooling margin. Actions that are taken in the ERG's based wholly or in part on the RCS subcooling margin include safety injection (SI) termination; SI reinitiation; and manual reactor coolant pump (RCP) trip. Plant specific application of the generic ERG's require each utility to determine the plant specific temperature uncertainty contribution to the RCS subcooling calculation based on that utility's system configuration. Information previously supplied to some utilities assumed less than a 30°F uncertainty allowance.

Potential consequences of exceeding the assumed temperature channel accuracy requirements include the following: (1) delay in terminating SI following a secondary high energy line rupture or small LOCA which could potentially result in water relief through the pressurizer safety and/or relief valves; (2) inappropriate SI termination following a small LOCA necessitating operator action to reinitiate SI: and (3) failure of the operator to trip the RCP's following a small LOCA if subcooling margin is utilized as the criterion.

Occurrence of any of the above consequences due to increased temperature uncertainty in the RCS subcooling margin could result in consequences more severe than currently described in a plant Final Safety Analysis Report (FSAR) accident analyses. This potential condition was deemed reportable under 10CFR 21. Additional areas which were not deemed reportable under 10CFR 21 are provided below for your information.

Inadequate Core Cooling Detection

The generic WOG ERG's utilize core exit T/C temperature for the detection of the advent of inadequate core cooling situations. In particular, for the Core Cooling Critical Safety Function Status Tree, the two decision points exhibited are core exit T/C temperature greater than 1200°F and core exit T/C temperature greater than 700°F in conjunction with a RVLIS indication below the core midplane.

An uncertainty of up to 200°F is acceptable in the 1200°F setpoint on the core cooling status tree, i.e., the actual core exit temperature could be between 1000°F and 1400°F. However, the 700°F setpoint only allocated a maximum core exit T/C temperature inaccuracy of approximately 30°F. Assuming the RCS pressure is at a maximum pressure corresponding to the

relief setpoint of the pressurizer safety valves (approximately 2500 psia), the 700°F setpoint minus the temperature uncertainty ensures that the core exit temperature is indeed superheated prior to entering an ICC mitigating guideline.

Interim Recommendations

Interim recommendations are being made to those U.S. utilities in Table I. In addition to these utilities, Westinghouse is providing this information separately to the WOG.

Where the safety grade core exit T/C system temperature uncertainty exceeds the minimum required temperature uncertainty, the utilities are recommended to utilize wide range resistance temperature device (RTD) temperature in the RCS subcooling margin calculation. The additional recommendation is being made to each utility to verify that the range and temperature uncertainty of the wide range RCS temperature meets the minimum channel requirements.

Since the currently installed safety grade core exit T/C system meets acceptable channel accuracy requirements for the 1200°F Core Cooling Status Tree setpoint, no modifications are required. However, the 700°F setpoint must be increased to 900°F to reflect increased safety grade core exit T/C system temperature uncertainty (above 30°F) to ensure that the RCS coolant conditions are superheated prior to entering an ICC mitigating guideline. This 200°F increase should serve as a conservative value for the interim until completion of the qualification program establishes the final system accuracies.

Increasing the 700°F Status Tree setpoint to 900°F to accommodate additional temperature uncertainty is acceptable since that particular path on the Core Cooling Status Tree in conjunction with RVLIS indication below core midplane merely provides an anticipatory indication of ICC to the operator. A core exit T/C temperature reading of 1200°F provides the primary indication of the onset of an ICC situation.

RVLIS Temperature Compensation

The only other area in which the safety grade core exit T/C system temperature is utilized is for temperature compensation of the Westinghouse RVLIS. Table I provides a listing of those U.S. plants that utilize the core exit T/C compensation scheme.

The RVLIS indication is utilized in the WOG ERG guidelines for the detection of the advent of an ICC situation. The increased safety grade core exit T/C system temperature uncertainties result in increased RVLIS errors. However, this does not significantly affect the use of RVLIS for detection of the advent of an ICC situation. This is because the only RVLIS reading utilized in directing the operator to an ICC guideline is in the vicinity of the core midplane and because the errors associated with the RVLIS system are positive below the core midplane and negative above the core midplane for a negative temperature uncertainty so that the errors exhibited by the RVLIS system in the vicinity of the core midplane are approximately zero regardless of the temperature compensating signal uncertainty.

As mentioned above, core exit T/C temperature in conjunction with a RVLIS indication directs the operator to proceed to an ICC mitigating guideline. As demonstrated above, the RVLIS indication errors in the vicinity of the core midplane is insensitive to temperature compensating channel inaccuracies. Hence no immediate modifications are necessary to address the increased RVLIS temperature compensation channel inaccuracies.

The RVLIS indication is also utilized in the WOG ERG guidelines for detection of a void in the reactor vessel and for plant recovery guidelines for beyond design basis events. Examples of guidelines in which RVLIS indication is utilized in these applications include: (1) ES-0.3, Natural Circulation Cooldown With Steam Void in Vessel; and (2) ECA-3.3, Steam Generator Tube Rupture Without Pressurizer Pressure Control. For these situations, a harsh containment environment is not expected and, as a result the increased errors should not occur. A recommendation is being made to utilities to modify the RVLIS setpoints to incorporate the applicable RVLIS system errors. In all cases, the modified RVLIS setpoints will result in operator actions that maintain adequate core cooling.

If you have any questions, please call Mr. Clarence Draughon of my staff on 412-374-5761, or myself.

Very truly yours,

for E. P. Rahe, Jr., Manager
Nuclear Safety Department

RBM/GEL

Attachments/KEG

0346G/5-85 & PC/CGDI

Table I

U.S. Plants with Safety Grade Core Exit T/C System

Byron 1* and 2/Braidwood 1 and 2
Shearon Harris**
Vogtle 1 and 2**
Millstone 3
Diablo Canyon 1* and 2*
Callaway*
Wolf Creek*
Comanche Peak 1 and 2
Watts Bar 1 and 2
Beaver Valley Unit 2**
South Texas 1 and 2
Seabrook**

* Operating Plant
** Utilize Safety grade Core Exit T/C Reading as Input to RVLIS Density Compensation