NON-PROPRIETARY

VERSION

OF ATTACHMENT 1

TO AEP:NRC:0942D

AEP - D. C. COOK UNIT 1
RdF RTD INSTALLATION SAFETY EVALUATION
AUGUST 6, 1985

SUMMARY AND CONCLUSION:
This evaluation demonstrates that installation of RdF RTDs (with increased and reallocated uncertainties over the currently installed RTDs) will not impact the Safety Analysis Limits assumed, nor the core limits utilized, in the plant's safety analyses. The only significant changes to the plant are the Allowable Values for several protection functions and the indicated Tavg value in the Unit 1 Technical Specifications. Nominal Trip Setpoints in the Technical Specifications remain unaffected.

INTRODUCTION

At the request of American Electric Power, Westinghouse investigated the impact of the change-out of Rosemount for RdF RTDs on the D. C. Cook Unit 1 plant. This investigation involved two parts, the first being a determination of the uncertainties for those protection and control functions impacted by the use of RTDs. The second was an evaluation of the impact of those instrument uncertainties on the plant's safety analyses. Finally, the Technical Specifications were reviewed for impact and change recommendations were made for the areas affected.

Unit 1 is changing out the existing RTDs for those manufactured by RdF. In the recent months, Westinghouse has performed a considerable amount of work in the determination of revised uncertainties for these RTDs when it was learned that the calibration accuracy used in the setpoint studies for several plants was not being met. As a result of this work, Westinghouse has determined what the calibration of the RTD is under the RdF calibration laboratory conditions and a revised analysis procedure for evaluation of RTD cross calibration data taken during plant heat-up. The end product of the revised analysis procedure is the verification that each RTD installed in the plant meets a total uncertainty assumption of [ ]+a,c.

This uncertainty is composed of [

]+a,c.

For ease of calculation in the Westinghouse methodology, the total uncertainty was split into two parts, an SCA value of [ ]+a,c and an SD value of [ ]+a,c.

These uncertainties were then used in the standard Westinghouse methodology for the calculation of instrument channel uncertainties, i.e., the same methodology used for Westinghouse Statistical Setpoint Studies and ITDP instrument uncertainty calculations. The following protection and control functions' instrument uncertainties were evaluated, Overtemperature Delta-T, Overpower Delta-T, RCS Low Flow Trip, Low-Low Tavg, Rod Control (Tavg input), and RCS Precision Flow Calorimetric measurement uncertainty. For the protection functions it was determined that the Safety Analysis Limit/Nominal Trip Setpoint relationship was sufficient to accomodate the changed uncertainties without causing changes to the SAL or Nominal Trip Setpoint. However the Allowable Values for these functions should be changed to as indicated below:

FUNCTION	OLD ALLOWABLE VALUE	NEW ALLOWABLE VALUE
Overtemperature Delta-T	4 % Delta-T span	2.5 % Delta-T span
Overpower Delta-T	4 % Delta-T span	3.4 % Delta-T span
Loss of Flow	89 % design flow	89.1 % design flow
Tavg-Low-Low	539 °F	538.7 °F

The plant's current Safety Analyses of record utilize the Improved Thermal Design Procedure (ITDP). Several of the instrument uncertainties used in the ITDP changed as a result of the hardware change-out. Listed below are the original ITDP instrument uncertainties and the revised values.

ORIGINAL ITDP INSTRUMENT UNCERTAINTY VALUES

FUNCTION	UNCERTAINTY	SIGMA
Pressurizer Pressure Control		+a,c
random	[	]
bias		
Rod Control (temperature)		
random		
Power Calorimetric		
random		
RCS Flow Calorimetric		
random		
bias		

REVISED ITDP INSTRUMENT UNCERTAINTIES

FUNCTION	UNCERTAINTY	SIGMA
Pressurizer Pressure Control	[	] +a,c (1)
Rod Control (temperature) random		(2)
Power Calorimetric random		(3)
RCS Flow Calorimetric random		(4)

(1) Due to change-out of Barton transmitters for Foxboro
(2) Due to change over to RdF RTDs
(3) Due to a more accurate calculation of instrument uncertainties
(4) Due to change over to RdF RTDs and change over to Foxboro transmitter.

The sigma values actually used in the ITDP analysis are:

Pressurizer Pressure Control	[	] +a,c
Rod Control (temperature)		
Power Calorimetric		
RCS Flow Calorimetric		

Finally, the DNB Parameters specification (Table 3.2-1) limit for Tavg was impacted. Listed below are the current and revised values reflecting the change-out of the RTDs.

MODE OF OPERATION	OLD VALUE	REVISED VALUE
4 loops @ RATED THERMAL POWER	570.5 °F	570.4 °F
4 loops @ DESIGN THERMAL POWER	579.8 °F	579.7 °F

Based on the above information, an evaluation was performed which indicated that the current DNBR design limits are not impacted by the revised sigma values. Since the relationship between the Safety Analysis Limit and the Nominal Trip Setpoint for the affected protection functions is preserved and the DNBR design limits are not impacted, the FSAR Chapter 14 analyses are not affected.

CONCLUSION

In conclusion, it can be stated that the only impact on the plant, due to the installation of RdF RTDs, is the changing of the Allowable Values for the protection functions indicated and the Table 3.2-1 Tavg values in the D. C. Cook Unit 1 Technical Specifications.

NON-PROPRIETARY

VERSION

OF ATTACHMENT 4

TO AEP:NRC:0942D

August 9, 1985

WESTINGHOUSE PROPRIETARY CLASS 3

In regards to the expressed NRC concern of RTD operability prior to return of the evaluation of the RTD cross-calibration results, Westinghouse has determined the following:

1) The instrument uncertainty assumed for the RTD in the safety analyses is [ ]+a,c and any RTD falling within that accuracy is considered to be operable. The method used to determine if a particular RTD meets this accuracy is quite simple; compare the temperature indicated by the RTD with the average of all of the RTDs at the various temperature plateaus. If it is within the required value at all of the temperature plateaus, the RTD is considered to be operable. In this case, even though the cross-calibration results have not been factored into the calibration of the R/E modules, it is not necessary because the RTDs meet the basic analyses' assumption.

2) In the event that the indicated temperature of a particular RTD is not within [ ]a,c of the average temperature at all of the temperature plateaus and the RTD is an input to the protection system the plant has two choices, 1) replace the RTD with one that does meet the accuracy requirement (by changing the input to the protection system to an operable RTD), or 2) recalibrating the R/E such that the output of the RTD and R/E are within the required accuracy. Either of these actions must take place prior to entering MODE 2.

If either of the above are satisfied prior to entering MODE 2, the plant is operating in a manner consistent with the plant's safety analyses and is not in an unanalyzed condition.

Based on the results of previous plant tests and the revised calibration procedure by the RTD vendor, Westinghouse expects the supplied RTDs to be within the required accuracy prior to evaluation of the cross-calibration results. The evaluation is expected to result in fine tuning the RTD and R/E output.