TVA

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

JUN 2 4 2003

TVA-WBN-TS-03-10

10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

In the Matter of) Docket No. 50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) - UNIT 1 - TECHNICAL SPECIFICATION (TS) CHANGE NO. TS-03-10 - REACTOR COOLANT SYSTEM (RCS) FLOW MEASUREMENT USING ELBOW TAP METHODOLOGY - RESPONSE TO NRC QUESTIONS FOR DIABLO CANYON APPLICABLE TO WBN (TAC-MB 8992)

References:

1. TVA Letter to NRC, "WBN UNIT 1 - Technical Specification (TS) Change No. TS-03-10 - Reactor Coolant System (RCS) Flow Measurement Using Elbow Tap Methodology," May 14, 2003.

2. Pacific Gas and Electric Company (PG&E) Letter to NRC, "Response to NRC Request for Additional Information Regarding License Amendment Request 02-05,'Revision to Technical Specification Table 3.3.1-1, Reactor Trip System Instrumentation, and Revised Reactor Coolant System Flow Measurement," May 15, 2003.

In Reference 1, TVA submitted a proposed TS change which would allow an alternate method for the measurement of reactor coolant system (RCS) total flow rate via measurement of the RCS elbow tap differential pressures. The letter noted that TVA had evaluated a similar TS change request made by PG&E for Diablo Canyon Units 1 and 2, which remained under NRC review. Since NRC had asked several questions of PG&E that were potentially generic to WBN's methodology, TVA committed to supplement Reference 1 with a WBN response to the Diablo Canyon questions that were relevant to WBN Unit 1. The PG&E formal responses were provided by Reference 2. Enclosure 1 provides TVA's responses to the Diablo Canyon questions that are applicable to WBN.

JUN 2 4 2003

There are no regulatory commitments associated with this submittal. If you have any questions about this proposed change, please contact me at (423) 365-1824.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 24th day of June, 2003.

Sincerely,

P. L. Pace
Manager, Site Licensing
and Industry Affairs

Enclosure

WBN-TS-03-10 - RESPONSES TO NRC QUESTIONS FOR DIABLO CANYON APPLICABLE TO WBN

cc (Enclosure):

NRC Resident Inspector
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

Mr. K. N. Jabbour, Senior Project Manager
U.S. Nuclear Regulatory Commission
MS 08G9
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, Georgia 30303

ENCLOSURE

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1
DOCKET NO. 390

WBN-TS-03-10 - REACTOR COOLANT SYSTEM (RCS) FLOW MEASUREMENT USING ELBOW TAP METHODOLOGY
RESPONSES TO NRC QUESTIONS FOR DIABLO CANYON APPLICABLE TO WBN

Questions received by PG&E dated March 11, 2003

NRC QUESTION 1

Page 16 of Enclosure 1, the first full paragraph identifies two significant differences between the uncertainty calculation used in WCAP-15113 and NUREG/CR-3659 and justifies the differences by making a general statement. Provide the detailed justification on how the differences in the methodology used by WCAP-15113 meets the intent of NUREG/CR-3659 methodology.

WBN RESPONSE TO QUESTION 1

TVA provided a discussion on how the methodology used by WCAP-16067, Revision 0, meets the intent of NUREG/CR-3659, *A Mathematical Model for Assessing the Uncertainties of Instrumentation Measurements for Power and Flow For PWR Reactors,* methodology in the amendment request letter dated May 14, 2003. Please refer to Enclosure 1 of that letter, Section 4.4, "*Flow Measurement Uncertainty.*"

NRC QUESTION 2

Appendix A of WCAP-15113 list the assumptions used in the uncertainty calculation without providing any justification. Provide the basis and justification for the acceptability of these assumptions.

WBN RESPONSE TO QUESTION 2

The purpose of the three assumptions listed in WCAP-16067, Revision 0, Appendix A, was for Westinghouse to make TVA aware of certain important assumptions in the uncertainty calculations that may require tracking in-plant documentation. These assumptions are discussed below.

Assumption 1 is provided to identify that there are no allowances provided in the calculation for the effects of reduced power on the elbow tap differential pressure measurements. If the correlation is performed at approximately 90-100 percent rated thermal power (RTP), then no additional affects need to be accounted. For power levels between 85-90 percent RTP the effect is sufficiently small as to have no significant effect on the final calculated uncertainties. If the correlation is performed below 85 percent RTP, the uncertainties should account for the additional effects. Control of this assumption is maintained through compliance with the WBN Technical Specification Surveillance Requirement (SR) 3.4.1.4, which requires the 18 month reactor coolant system (RCS) total flow rate measurement surveillance to be performed at or above 90 percent RTP.

Assumption 2 is provided to describe the basis for the number of channels assumed for the statistical averaging of the indication channels. It is assumed that the twelve channels (three channels per loop) will be available for averaging during startup when the correlation is performed. However, the calculations were based on a statistical average of eight channels (two channels per loop), which allows for indication channels to be out of service. It is typical that all twelve channels are operable for the correlation. Therefore, an assumption of eight provides for additional conservatism in the calculation. Control of this assumption is also maintained through compliance with the WBN technical specification.

Assumption 3 is provided to define the accuracy of the two control systems that affect the calculation. The specified values are bounding uncertainties consistent with initial conditions assumed in the Final Safety Analysis Report (FSAR) Chapter 15 accident analyses. Changes to the control systems that could affect these values are subject to WBN change control processes and would be evaluated for impact on the RCS flow calculations.

NRC QUESTION 3

Appendix A of WCAP-15113 list the instrument uncertainties used in determining the acceptability of the analysis. Confirm that these numbers are based on the 24±6 (25% allowance provided in the TS) months and are determined using 95/95 criteria.

WBN RESPONSE TO QUESTION 3

WBN operates on an 18 month ± 4.5 (25 percent allowance provided in the technical specifications) fuel cycle. Therefore, the drift allowances used in the calculation for those devices calibrated on the refueling basis are based on 18 ±4.5 months. Drift values for other equipment such as the process racks, which are calibrated on a 92-day interval, are based on the appropriate surveillance interval. A 95/95 basis is used for all inputs to the flow uncertainty calculations.

Questions received by PG&E dated March 18, 2003

NRC QUESTION 1

You stated several times that removal of the RTD bypass system had no effect on total reactor coolant system (RCS) flow rate, but that the elimination increased flow rate through the elbows by about 0.15 percent. The staff agrees that elbow tap flow rate is not equal to loop flow rate at the reactor vessel nozzles when the manifolds are installed, and a correction is therefore necessary for that effect. However, the staff also believes there are several effects that combine to reduce total RCS flow rate at the reactor vessel nozzles by 250 gpm to 300 gpm when the bypass is removed. These include (1) removal of the cold leg bypass, thus forcing additional reactor coolant pump (RCP) flow to pass through the reactor vessel and steam generators and (2) removal of the hot leg bypass, thus forcing additional hot leg flow to pass through the steam generators. Further, the staff believes your model may involve a convergence process where you (1) assume loop flow rates at the reactor vessel nozzles and compute pressure drop through the RCS, (2) use the pressure drop with a RCP flow rate correlation to compute flow rate provided by the RCP, and (3) correct the assumed flow rates until agreement is obtained between the assumed flow rates and the calculated RCP flow rates. Without the manifolds installed, the converged assumed flow rates and RCP flow rates should be equal. However, if manifolds are installed, the RCP flow rate must be decreased by the cold leg bypass flow rate before making the comparison to the assumed loop flow rate. This affects the predicted effect of removing manifolds. Please discuss your model and your conclusions with respect to the above staff discussion.

WBN RESPONSE TO QUESTION 1

At WBN, the resistance temperature detector (RTD) bypass manifolds were removed prior to startup of Cycle 1. Therefore, a correction to elbow tap flow measurements to account for the bypass flows was not required, and the question is not applicable to WBN.

NRC QUESTION 2

Please substantiate your use of a 0.3 percent flow rate change in correcting for impeller smoothing when adjusting Cycle 2 flow rates to Cycle 1. Why, for example, isn't the correction 0.5 percent? 0.1 percent? Zero? Why does your assumption differ from that of WCAP-14750-P-A, Revision 1 on Page 26 where impeller smoothing is stated to reduce flow rate by about 0.6 to 0.8 percent with an assumed smoothing reduction of 0.6 percent prior to flow measurement for the second fuel cycle. The staff's concern is that providing any correction to compensate for smoothing by adding flow is in the non-conservative direction. For example, if all smoothing occurred prior to entering Cycle 2, *then no compensation should be made. Therefore, any compensation should be based on substantiation that impeller smoothing continued into Cycle 2.*

<u>WBN RESPONSE TO QUESTION 2</u>

As discussed in WCAP-16067, Revision 0, since WBN RCPs operated (in support of preoperational testing) for a considerable time prior to the Cycle 1 startup, it was concluded that the impeller smoothing flow reduction had occurred prior to the Cycle 1 baseline elbow tap differential pressure (Δp) measurements. Therefore, the usual adjustment of 0.6 percent was not applied to the best estimate flow trend or to the Cycle 2 and Cycle 3 calorimetric flows, thereby, resulting in a lower, more conservative baseline calorimetric flow. Comparison of elbow tap flows and the best estimate flow trend through Cycle 5 at WBN shows very little difference between measured and predicted flows, thus confirming this conclusion on impeller smoothing.

<u>NRC QUESTION 3</u>

An audit calculation performed by the staff showed behavior due to steam generator plugging similar to that described in Section 6.5.1 and the staff believes the effect of steam generator plugging can be accurately predicted. This appears to contradict your discussion in the first paragraph where you apparently cannot differentiate between flow reduction behavior due to steam generator tube plugging and due to changes within the reactor vessel. This, in turn, reflects on your conclusion that you can use the elbow tap flow measurements in future cycles because of observed conservative behavior relative to the calculations. Consequently, please expand your discussion of Section 6.5.1 in WCAP-15113 Revision 1 to better describe the agreements and differences and to address the above staff comments.

<u>WBN RESPONSE TO QUESTION 3</u>

As discussed in Section 6 of WCAP-16067, Revision 0, there has been little or no change in the WBN RCS flow resistance due to tube plugging and fuel design. Comparison of elbow tap flows and the best estimate flow trend through Cycle 5 shows very little difference between measured and predicted flows. Differences have been well within the repeatability allowance as stated in Section 6.5 of WCAP-16067, Revision 0. Therefore, the concerns raised in the question have not been experienced at WBN.

<u>NRC QUESTION 4</u>

If the staff accepts the presumption that elbow tap results are correct, then the behavior illustrated in Figures 6-1 and 6-2 of WCAP-15113, Revision 1 appears to lead to a conclusion that the calculated behavior may be missing important phenomena.

Conversely, if the calculated results are correct, then something would appear to be incorrect with the elbow tap data. The staff notes it has also observed that such disagreements at another plant were due, in part, to failure to properly calibrate and process the elbow tap data and, in part, due to the need for analysis modeling changes. Please provide an explanation of the differences illustrated in these figures or, if you do not have an explanation, then describe your investigation that led to the conclusion that you could not explain the differences and assess these differences with respect to your elbow tap conclusions.

WBN RESPONSE TO QUESTION 4

The response to Question 3 addresses this question. Elbow tap flows and the best estimate flow trend have been in good agreement through Cycle 5 at WBN, so changes to measurement procedures or to the hydraulic methodology are not needed.

NRC QUESTION 5

Please discuss the effect of fuel assembly/core fouling and boric acid concentration changes on RCS flow rate during operating cycles. Include an assessment of the effect on the four calorimetrics you selected from Cycles 1 and 2 as summarized in Table 6-5 of WCAP-15113 Revision 1.

WBN RESPONSE TO QUESTION 5

The effects of fuel assembly fouling and boric acid concentration are not included in calorimetric or elbow tap measurement procedures. Elbow tap data is compared to the hydraulic flow model at the beginning of cycle when minimal fuel crud buildup exists. The effect of fuel crud buildup on the three baseline calorimetrics is conservative and does not require additional modeling.

The calorimetric flow measurements used to define the baseline calorimetric flow and elbow tap flow for WBN were obtained at 90 to 100 percent power and at the beginning of the cycle when the RCS boric acid concentration is near its peak. RCS boric acid concentration will change during the cycle, approaching zero at the end of the cycle. As discussed in WCAP-16067-P, Revision 0 elbow tap flow meters are not affected by a fouling condition, so elbow taps would detect a change in flow during a cycle if it were to occur. Thus, the effects of RCS boric acid concentration during cycle operation can be monitored by the elbow tap flow data. Technical Specification SR 3.4.1.3 requires verification that the RCS total flow rate is within limits every 12 hours. Verification that SR 3.4.1.3 is met is performed by using indicated RCS loop flow rate which is based on the Δp from the elbow taps. It is noted that there is no correction required to the indicated RCS loop flow to account for RCS boron concentration changes during verification that SR 3.4.1.3 is met.

NRC QUESTION 6

If you determine that any of the above result in changes in your determinations, then please assess the impact on your uncertainty evaluations.

WBN RESPONSE TO QUESTION 6

None of the considerations discussed in the above questions and responses result in the need to revise the evaluation of the WBN elbow tap flow measurements or to revise the measurement uncertainties.

NRC QUESTION 7

The proposed technical specifications (TSs) in Table 3.3.1-1 (page 3 of 7) contain the term "measured loop flow" and percentages of this are used as an allowable value and a nominal trip setpoint. The existing TSs contained a footnote that defined measured loop flow as 89,800 gpm per loop for Unit 1 and 90,625 gpm per loop for Unit 2. The footnote is deleted in the proposed TSs. What is the definition of "measured loop flow" in the proposed TSs and where is this definition located? (The staff's concern is that, without clarification, "measured loop flow" could be taken as the indicated value although that is not the intent.)

WBN RESPONSE TO QUESTION 7

The proposed TS changes provided in WBN's amendment request letter dated May 14, 2003, did not include the change described above for Diablo Canyon. Therefore, this question is not applicable to WBN. The changes proposed for WBN did, however, include a change to the Technical Specification Bases to clarify that the Trip Setpoint and Allowable Value are specified in "percent indicated flow." The basis for this clarification was provided in WBN's amendment request, Enclosure 1, Section 4.5 and in WCAP-16067, Revision 0.