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

MAY 1 4 2003

TVA-WBN-TS-03-10

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

10 CFR 50.90

Gentlemen:

In the Matter of)
Tennessee Valley Authority)

Docket No. 50-390

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

Pursuant to 10 CFR 50.90, TVA is submitting a request for an amendment to WBN's License NPF-90 to change the Technical Specifications (TS) for Unit 1.

The proposed change 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 (Δp). The use of elbow tap Δp improves RCS flow measurement by eliminating hot leg temperature streaming effects present using the current flow calorimetric method. In addition, changes to Reactor Coolant Flow – Low reactor trip function Allowable Values are necessary to reflect revised instrument uncertainty calculations arising from use of the elbow tap methodology.

This methodology is described in detail in Westinghouse Electric Company report, "WCAP-16067-P, Revision 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003," provided by Enclosure 5 (Proprietary), and Enclosure 6 (Non-Proprietary). The methodology is similar to that reviewed and approved by the NRC for other utilities.

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MATERIALS TRANSMITTED HEREWITH
CONTAINS 2.790 INFORMATION

Enclosure 1 to this letter provides the description and evaluation of the proposed TS change. This includes TVA's determination that the proposed change does not involve a significant hazards consideration, and is exempt from environmental review. Enclosures 2 and 3 contain copies of the appropriate Unit 1 TS and TS Bases pages, respectively, marked-up to show the proposed changes. Enclosure 4 forwards the revised TS and TS Bases pages for Unit 1 which incorporate the proposed changes.

TVA has evaluated a similar request made by Pacific Gas and Electric Company for Diablo Canyon Units 1 and 2 (License Amendment Request, LAR-02-05), PG&E Letter dated August 27, 2002, which remains under NRC review. NRC has posed several questions pertaining to the Diablo Canyon LAR which are potentially generic to WBN's request. TVA is following the PG&E effort on these issues. Accordingly, once the PG&E issues are formalized, TVA intends to supplement the enclosed amendment request with a WBN response to the Diablo Canyon questions that are relevant to WBN Unit 1.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the TS change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). In accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and enclosures to the Tennessee State Department of Public Health.

Enclosure 7 provides the Westinghouse Request for Withholding Proprietary Information from Public Disclosure, and an accompanying affidavit signed by Westinghouse, the owner of the information.

The above affidavit sets forth the basis on which the requested information may be withheld from public disclosure by the Commission, and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR 2.790 of the Commission's regulations. Accordingly, TVA requests that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR 2.790.

Correspondence regarding the proprietary aspects of the Westinghouse information listed above, or the supporting affidavit, should reference CAW-03-1625 and should be addressed to H. A. Sepp, Manager of Regulatory Compliance and Plant Licensing, Westinghouse Electric Company, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

TVA requests approval of this amendment in support of the Fall 2003 Cycle 5 Refueling Outage, following which, the alternate flow measurement methodology will be implemented. Further, TVA requests that implementation of the revised TS be effective within 60 days of approval. TVA is prepared to meet with the Staff if necessary, to facilitate the NRC's review.

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 14th day of May, 2003.

Sincerely,

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

Enclosures

1. Description and Evaluation of Proposed Change
2. Proposed Technical Specification Changes (mark-up)
3. Proposed Technical Specification Bases Changes (mark-up)
4. Proposed Technical Specification and TS Bases Changes (revised pages)
5. "WCAP-16067-P (Proprietary), Revision 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003."
6. "WCAP-16067-NP (Non-Proprietary), Revision 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003."
7. Westinghouse letter "Application for Withholding Proprietary Information from Public Disclosure," (CAW-03-1625), April 10, 2003.

cc: See page 4

MAY 1 4 2003

cc (Enclosures):

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
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Rockville, Maryland 20852-2738

U.S. Nuclear Regulatory Commission
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61 Forsyth St., SW, Suite 23T85
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Mr. Lawrence E. Nanny, Director (w/o Enclosures 5-7)
Division of Radiological Health
3rd Floor
L & C Annex
401 Church Street
Nashville, Tennessee 37243

ENCLOSURE 7

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1

WESTINGHOUSE LETTER "APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE" (CAW-03-1625), APRIL 10, 2003.

Westinghouse Electric Company
Nuclear Services
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Direct tel: (412) 374-5282
Direct fax: (412) 374-4011
e-mail: Sepp1ha@westinghouse.com

Our ref: CAW-03-1625

April 10, 2003

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-16067-P, Revision 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003 (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-03-1625 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Tennessee Valley Authority (TVA).

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-03-1625 and should be addressed to the undersigned.

Very truly yours,

H. A. Sepp, Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: S. J. Collins
G. Shukla/NRR

CAW-03-1625

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared H. A. Sepp, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC ("Westinghouse"), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

H A Sepp

H. A. Sepp, Manager
Regulatory Compliance and Plant Licensing

Engineering

Sworn to and subscribed
before me this 10th day
of April, 2003

Sharon L. Fiori
Notary Public

SHARON L. FIORI
COMMONWEALTH OF PENNSYLVANIA
NOTARY PUBLIC

Notarial Seal
Sharon L. Fiori, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires January 29, 2007
Member, Pennsylvania Association Of Notaries

(1) I am Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC ("Westinghouse"), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Electric Company LLC.

(2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Electric Company LLC in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WCAP-16067-P, Revision 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003 (Proprietary), being transmitted by TVA letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted for use by Westinghouse Electric Company LLC for Watts Bar Unit 1 is expected to be applicable for other submittals in response to certain NRC requests for information to support the application of Elbow Tap Methodology.

This information is part of that which will enable Westinghouse to:

(a) Justify the use of Elbow Tap Methodology for RCS Flow Measurement.

(b) Assist the customer to respond to NRC requests for information.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for licensing documentation.

(b) Westinghouse can sell support and justification for the use of elbow tap methodology.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar support documentation and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(b)(1).

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ENCLOSURE 1

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

PROPOSED LICENSE AMENDMENT REQUEST WBN-TS-03-10 - REACTOR COOLANT SYSTEM (RCS) FLOW MEASUREMENT USING ELBOW TAP METHODOLOGY

DESCRIPTION AND EVALUATION OF PROPOSED CHANGE

1.0 DESCRIPTION

The purpose of this letter is to request an amendment to the Operating License NPF-90 and Technical Specifications (TS) for Watts Bar Nuclear Plant Unit 1. The proposed TS change will allow WBN Unit 1 to use an alternate method for the measurement of reactor coolant system (RCS) total flow rate via measurement of the RCS elbow tap differential pressures (Δp). The use of elbow tap Δp correlated to flow calorimetrics performed for WBN in baseline operating cycles (Cycles 1 through 3) improves RCS flow measurement by eliminating hot leg temperature streaming effects that occur using the flow calorimetric method. In addition, with the proposed use of elbow taps for RCS flow verification, a change to Reactor Coolant Flow – Low reactor trip function is necessary. The change revises the Allowable Values to reflect revised instrument uncertainty calculations arising from use of the elbow tap methodology. Corresponding changes to the TS Bases are also included.

This methodology is described in detail in "WCAP-16067-P, Revision 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003," (Reference 1) provided by Enclosure 5. The methodology is similar to that reviewed and approved by the NRC for other utilities.

2.0 PROPOSED CHANGE

The proposed amendment would revise the WBN Unit 1 TS, Table 3.3.1-1 (Reactor Trip System Instrumentation) and Surveillance Requirement (SR) 3.4.1.4 (18 month RCS precision heat balance flow verification) to reflect use of the elbow tap methodology as an alternate method of determining RCS total flow. Corresponding TS Bases changes are also proposed. The TS and TS Bases changes affect the following sections and are illustrated by marked-up and revised pages provided in Enclosures 2 through 4:

Tech Spec:

Section 3.4.1 (Page 3.4-2)	RCS Pressure, Temperature, and Flow Limits - Revise SR 3.4.1.4 to add the elbow tap Δp method as an alternative to the precision heat balance calorimetric method for verifying total RCS flow rate.
Section 3.3.1 (Page 3.3-17)	Revise Table 3.3.1-1 (Reactor Trip System (RTS) Instrumentation), Functions 10.a and 10.b (Reactor Coolant Flow – Low), Allowable Values from "89.6% flow" to "89.7% flow." The Allowable Values are changed to reflect a change in calculated uncertainties using the elbow tap methodology.

TS Bases:

Section B 3.4.1 (Page B 3.4-2)
: Revise Bases to describe the elbow tap Δp measurement as an alternate method of determining RCS total flow rate, and provide a reference to WCAP-16067-P, Revision 0. The following Insert is provided:

Insert A:
"Use of the elbow tap Δp methodology to measure RCS flow rate results in a measurement uncertainty of ±1.7 % flow (process computer) or ±1.9 % flow (control board indication) based on the utilization of eight elbow taps correlated to the three baseline precision heat balance measurements of Cycles 1, 2, and 3. Correlation of the flow indication channels with this previously performed heat balance measurement is documented in Reference 3. Use of this elbow tap Δp method provides an alternative to performance of a precision RCS flow calorimetric."

Section B 3.4.1 (Page B 3.4-5)
: Revise Bases for SR 3.4.1.4 to reflect use of elbow tap Δp methodology as an alternative to the precision heat balance calorimetric method for verifying total RCS flow rate as described WCAP-16067-P, Revision 0.

Section B 3.4.1 (Page B 3.4-5)
: Editorial correction for Reference 1, FSAR title for Section 15.2 to: "Condition II - Faults of Moderate Frequency."

Section B 3.4.1 (Page B 3.4-5)
: Added a reference to WCAP-16067-P, Revision 0. The following Insert is provided:

Insert B:
"3. WCAP-16067-P, Rev. 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003."

Section B 3.3.1 (Page B 3.3-4)
: Revise Bases for TS 3.3.1, Trip Setpoints and Allowable Values, to reflect that uncertainties for the Reactor Coolant Flow-Low function are based on WCAP-16067-P, Revision 0, when using elbow tap Δp methodology. The following sentence is inserted:

"The uncertainties for Reactor Coolant Flow - Low function using the elbow tap Δp flow measurement methodology are provided in Reference 13."

Section B 3.3.1 (Page B 3.3-5) (Page B 3.3-63)	Revise Bases for TS 3.3.1, to add Reference 13 (WCAP-16067-P, Revision 0.) on page B 3.3-5. Also, added to page B 3.3-63, as follows:

Insert C:

"13. WCAP-16067-P, Rev. 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003."

Section B 3.3.1 (Page B 3.3-24) (Page B 3.3-25)	Revise Bases for RTS Instrumentation, Function 10.a and 10.b (Reactor Coolant Flow –Low), to clarify that the Trip Setpoint and Allowable Value are specified in "% indicated loop flow" instead of "% thermal design flow adjusted for uncertainties (95,000 gpm)."

3.0 BACKGROUND AND SUMMARY

3.1 Purpose for Proposed Amendment

The proposed change allows an alternate method for the measurement of RCS total flow rate to meet SR 3.4.1.4. Currently, the only acceptable method for measurement of the RCS total flow is by performance of a precision heat balance (calorimetric) flow measurement. The change would allow the measurement of the RCS elbow tap Δp to be an acceptable method for measurement of the RCS total flow rate. The use of elbow tap Δp correlated to a baseline precision flow calorimetric improves RCS flow measurement by eliminating the erroneously high temperature effects of hot leg temperature streaming. If an alternate RCS flow measurement method is not provided, a non-representative flow measurement due to hot leg streaming in combination with any actual flow reduction due to potential steam generator plugging could result in failure to meet the TS minimum limit of 380,000 gpm resulting in an inappropriate shutdown of the unit.

Many plants in recent cycles, including WBN Unit 1 have experienced apparent decreases in flow rates determined by the calorimetric methodology. These decreases have been attributed to variations in hot leg temperature streaming. The streaming effects directly impact the hot leg temperatures used in the precision calorimetric, resulting in the calculation of apparently low RCS flow rates. The apparent flow reduction has become more pronounced in fuel cycles that have implemented aggressive low leakage loading patterns (LLLPs). To address this issue, Watts Bar intends to begin using an alternate method of measuring flow using the elbow tap Δp measurements, as described in WCAP-16067-P, Revision 0. In using the elbow tap Δp method, the RCS loop elbow tap measurements are correlated to precision calorimetric measurements performed during Cycles 1 to 3 when hot leg streaming had little impact on RCS flow calorimetric measurement. Because of this inherent limitation of the calorimetric flow method, the use of the RCS elbow tap Δp measurement as an alternate method for RCS flow surveillance has been approved by NRC for a number of Westinghouse 3-loop and 4-loop plants. (Refer to Section 7.1 of this letter for a discussion of relevant precedents to WBN's request).

The change in the allowable value for the Reactor Coolant Flow-Low reactor trip functions 10.a and 10.b reflects a change in calculated uncertainties using the elbow tap Δp methodology for RCS flow rate measurement.

3.2 RCS Flow Rate (LCO 3.4.1)

WBN Unit 1 TS Limiting Condition for Operation (LCO) 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits," requires the RCS total volumetric flow rate at the reactor vessel inlet to be within specified limits (380, 000 gpm). A lower RCS flow could cause the DNB limits to be approached. Operation for significant periods of time outside the RCS flow limit increases the likelihood of a fuel cladding failure if a DNB event were to occur. The minimum RCS flow limit corresponds to the RCS flow initial conditions for the safety analyses of the DNB limited transients. The DNB limited transients include the FSAR Chapter 15.2, "Condition II - Faults of Moderate Frequency," events and the FSAR chapter 15.3.4, "Complete Loss of Forced Reactor Coolant Flow," event. The safety analyses for the DNB limited transients demonstrate that transients initiated from the RCS flow limits will result in meeting the DNB limits defined in WBN FSAR Section 4.4, "Thermal Hydraulic Design." The RCS total flow rate limit includes an allowance for a measurement error of 2.0 percent of flow.

SR 3.4.1.4

Measurement of RCS total flow by performance of a precision calorimetric heat balance every 18 months (22.5 months maximum surveillance interval) is currently required by WBN TS surveillance requirement SR 3.4.1.4. Performance of this surveillance verifies that the actual RCS flow rate is greater than or equal to the minimum required flow rate and allows the installed RCS elbow tap flow instrumentation to be normalized. (Normalizing involves scaling the elbow tap flow instrumentation such that an indication of 100 percent flow corresponds with the flow measured during performance of SR 3.4.1.4). The frequency of 18 months for the measurement of RCS total flow rate reflects the importance of verifying flow at the beginning of the operating cycle after a refueling outage when the core has been altered, which may have caused a change in flow resistance.

SR 3.4.1.3

WBN TS surveillance requirement SR 3.4.1.3 requires verification of RCS total flow every 12 hours during Mode 1. This surveillance verifies that the RCS total flow rate is greater than or equal to the minimum required flow rate and is performed using the main control board indicators or the plant computer. The plant computer and main control board flow rate indications are based on the Δp from the RCS elbow taps which, as discussed above, are normalized to measured flow during performance of SR 3.4.1.4, once every 18 months.

Elbow Tap Configuration

WCAP-16067-P, Revision 0, Figure 4-1, shows the typical elbow tap locations in the RCS cross-over leg piping elbow between the steam generator and the reactor coolant pump. This configuration is applicable to WBN Unit 1. The elbow taps are installed in a plane 22.5 degrees around the first 90 degree elbow in each of the RCS cross-over legs. Each elbow has three low-pressure taps spaced 15 degrees apart on the inside pipe radius and one high-pressure tap on the outside pipe radius used as the common tap. The pressure taps are connected to three calibrated Δp transmitters in each loop to provide three channels of indicated flow rate for each RCS loop.

3.3 Precision Flow Calorimetric Method / Hot Leg Streaming

The precision flow calorimetric method for measuring RCS flow and normalizing the RCS elbow tap flow indicators uses secondary side calorimetric measurements of feedwater flow, feedwater temperature, and steam pressure together with primary side loop temperatures as indicated by the hot and cold leg resistance temperature detectors (RTDs). The RCS loop flows are calculated from the steam generator thermal output and the enthalpy rise of the primary coolant. Each hot leg has three thermowell RTDs installed around a cross-section to determine the bulk hot leg temperature.

The phenomenon of increased hot leg temperature streaming has been observed in many plants due to the implementation of low neutron leakage core fuel loading patterns that result in changes in the core radial power distribution. Hot leg temperature streaming is a temperature gradient within the hot leg pipe resulting from incomplete mixing of the coolant leaving fuel assemblies at different temperatures. The magnitude of the hot leg temperature streaming is a function of the core radial power distribution. The use of a low neutron leakage loading pattern reduces core power in the outer assemblies and results in an increase in the hot leg temperature streaming. As a result of the increased hot leg temperature streaming, the indicated bulk hot leg temperature as measured by the three RTDs in each hot leg is erroneously high, resulting in a calculated RCS flow lower than the actual value.

3.4 Reactor Coolant Flow-Low Reactor Trip Function

TS 3.3.1 contains the requirements for reactor trip system (RTS) instrumentation. The RTS initiates a unit shutdown, based on the values of selected unit parameters, to protect against violating the core fuel design limits and RCS pressure boundary during anticipated operational occurrences (AOOs). The reactor trip system functions are identified in TS Table 3.3.1-1. Each reactor trip system function contains an allowable value and a nominal trip setpoint. Setpoints in accordance with the allowable values ensure that the safety limits of TS 2.0, "Safety Limits (SLs)," are not violated during AOOs and that the consequences of design basis accidents (DBAs) will be acceptable, provided the unit is operated from within the TS LCO at the onset of the AOO or DBA and the equipment functions as designed. The nominal trip setpoints are the nominal values at which the comparators are set, and are based on the safety analysis analytical limits described in Chapters 7 and 15 of the WBN FSAR (Reference 2). To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors, the allowable values and trip setpoints are conservatively adjusted with respect to the safety analysis analytical limits. The actual nominal trip setpoint is more conservative than that specified by the allowable value to account for errors such as drift and measuring and test equipment uncertainties. The trip setpoints are selected such that adequate protection is provided when all sensor and processing time delays are taken into account. A detailed description of the methodology used to calculate the trip setpoints, including their explicit uncertainties, is provided in Reference 3.

The TS Table 3.3.1-1, function 10, "Reactor Coolant Flow-Low" reactor trip ensures that protection is provided against violating the DNB limit due to low flow in one or more RCS loops while avoiding reactor trips due to normal variations in loop flow. Each RCS loop has three channels to monitor flow, deriving their input from the three elbow tap Δp transmitters on each loop. The current Reactor Coolant Flow-Low function allowable values and nominal trip setpoints in TS Table 3.3.1-1 are as follows:

Function:		Allowable Value	Nominal Trip Setpoint
10.a	Single Loop	89.6% flow	90% flow
10.b	Two Loops	89.6% flow	90% flow

The proposed TS change would revise the above allowable values for functions 10.a and 10.b from 89.6% to 89.7% flow to reflect a change in calculated uncertainties using the elbow tap methodology. In addition, the TS Bases for the Reactor Coolant Flow-Low function is revised to clarify that the trip setpoint is based on indicated flow.

4.0 TECHNICAL ANALYSIS

TVA is proposing to revise the WBN Unit 1 TS to allow an alternative to the prescriptive requirements of WBN SR 3.4.1.4 for determining the RCS flow rate via a precision heat balance. The alternate test method is proposed in Westinghouse report WCAP-16067-P, Revision 0 (Enclosures 5 and 6, proprietary and non-proprietary, respectively). This report describes a methodology of using the RCS elbow tap Δp measurements for the RCS flow rate surveillance verification. The following provides a summary of the elements included within this topical report. Refer to WCAP-16067-P for additional detail.

4.1 Use of Elbow Tap Δp for RCS Flow Measurement

WCAP-16067-P, Section 4.0 "Elbow Tap Flow Measurement Application," describes the procedure for determining the RCS flow rate from elbow tap Δp measurements based on the repeatability of the elbow taps without performing a precision calorimetric at the beginning of a cycle. Two calculated ratios are compared and the more conservative ratio is used to calculate the current cycle flow. One ratio correlates current cycle elbow tap Δp to baseline cycle elbow tap Δp. The second ratio correlates best estimate hydraulic flow analyses for the current cycle to the baseline cycle based on known RCS hydraulic changes such as steam generator tube plugging or core differential pressures. The more conservative ratio is applied to a baseline calorimetric flow to determine current cycle

RCS flow. The baseline values were derived from calorimetric measurements performed during WBN Unit 1 Cycles 1 to 3. This methodology ensures a conservative value for total RCS flow. The specific procedure is defined in Section 4.2 of WCAP-16067-P.

The confirmation of elbow tap flow measurement repeatability is addressed in Section 4.1 of WCAP-16067-P which provides an evaluation of RCS flow measurement data using elbow taps and ultrasonic leading edge flow meters (LEFM) from the Hydraulic Test Program at Prairie Island Unit 2. The Prairie Island Unit 2 Hydraulic Test Program test data covered 11 years of plant operation, during which a significant change in system hydraulics was made due to the change of a reactor coolant pump impeller. The program test data showed that the average difference between the elbow tap measurements and ultrasonic LEFM flow measurements was less than 0.3 percent flow.

WCAP-16067-P, Section 4.1.4 evaluated elbow tap flow measurements against a hydraulic best-estimate flow analysis described in WCAP-16067-P, Section 5. The comparisons showed that elbow tap and best estimate flow trends were in close agreement, including plants with changes in flow due to RCS hydraulic changes such as pump impeller replacement, steam generator tube plugging, and steam generator replacement. The close agreement between elbow tap total flow and best estimate total flow occurred even where steam generator tube plugging and loop flows were significantly imbalanced. These comparisons of plant RCS flow data provide confirmation of the elbow tap flow measurement repeatability.

WCAP-16067-P, Sections 4.1.1, 4.1.2, and 4.1.3, evaluated the effects of fouling, erosion, upstream velocity distribution, and replacement steam generators on the elbow tap flow measurements. Based on these evaluations, the elbow tap flow meter coefficients remain constant and therefore the relative changes of flow rate through the cold leg elbows can be correlated with the relative changes in the elbow tap Δp.

4.2 Best Estimate Flow Confirmation

As discussed, the determination of current cycle flow involves a comparison with best estimate hydraulic flow analyses of the current and baseline cycles based on known RCS hydraulic changes. The hydraulic analysis evaluates the impact on the RCS flow rate of plant system hydraulic changes, such as plugging and sleeving of steam generator tubes and fuel design changes. Section 5.0 of WCAP-16067-P describes the procedure for calculating best estimate flow applicable to WBN. This procedure was developed by Westinghouse in 1974 to estimate RCS flow at all Westinghouse-designed plants. The procedure uses RCS component flow resistances based on calculations and special test measurements, and RCP performance estimates based on calculations and model test measurements with no margins applied to define a true best estimate of the actual flow. The flow resistance of the reactor vessel, steam generators, and RCS piping are used in conjunction with the reactor coolant pump head-flow performance to define individual loop and total RCS flows. The component hydraulic design data and hydraulic coefficients are determined from analyses of the test data. As discussed in Section 5.1 of WCAP-16067-P, the uncertainty in the best estimate hydraulic analysis-calculated flow is $\pm$ 2 percent of actual flow based on both plant and component test data. The test data included component differential pressures and concurrent ultrasonic LEFM flows collected at Prairie Island Unit 2.

The best estimate flow based on the hydraulic analysis is used to limit the elbow tap flow measurement to a maximum value corresponding to the best estimate flow plus an allowance for the elbow tap flow repeatability. This results in a conservative determination of current cycle flow. The best estimate flow is not used as a substitute for the TS surveillance requirement for flow measurement.

4.3 RCS Flow Performance Evaluation

RCS elbow tap flow and calorimetric flow measurement data from WBN Unit 1 have been evaluated and compared with calculated best estimate flows to determine RCS flow performance. The determination of the best estimate flow predictions, evaluation of the elbow tap flows and calorimetric flows, comparison of best estimate and elbow tap flow, and power/flow correlation are discussed in Section 6 of WCAP-16067-P, Revision 0. The evaluations determined that flow changes measured by elbow taps over several fuel cycles are consistent with, and conservative relative to predicted flow changes due to changes in RCS hydraulics, as shown in WCAP-16067-P, Figure 6-1. Therefore, it was determined that RCS flow can conservatively be determined from elbow tap flow measurements in future cycles of WBN Unit 1.

4.4 Flow Measurement Uncertainty

The uncertainty calculations for the elbow tap Δp methodology are contained in Appendix A of WCAP-16067-P, Revision 0. The calculations are documented in Tables A-1 through A-6.

Use of the elbow tap Δp method to determine RCS total flow requires that the Δp measurements for the present cycle be correlated to the precision calorimetric flow measurement which was performed during the baseline cycles (Cycles 1, 2, and 3). A calculation has been performed to determine the uncertainty in the RCS total flow using this method. This calculation includes the uncertainty associated with the Cycle 1 measurement, which had slightly larger uncertainties than the average of the three RCS total flow baseline calorimetric measurements, as well as uncertainties associated with Δp transmitters and indication via control board meters or the plant process computer. The uncertainty calculation performed for this method of flow measurement is consistent with the methodology recommended by NRC (NUREG/CR-3659, Reference 4), with the exception of two principle differences, discussed below.

The first difference is the utilization of multiple precision flow calorimetric measurements. NUREG/CR-3659 identifies a process and terms that should be considered in determining the measurement uncertainty of reactor coolant system (RCS) Flow. It limits the discussion to the performance of a single precision calorimetric measurement for RCS Flow. The process described in WCAP-16067-P, utilizes the process and terms identified in NUREG/CR-3659 and extends it to encompass the additional uncertainties required by the use of the Elbow Tap Methodology. The elbow tap process utilizes elbow tap data and precision flow calorimetric measurements over several cycles. Specifically for WBN Unit 1, the individual cycle uncertainties, as well as the average of the uncertainties were determined for the RCS flow measurement for the baseline cycles. For conservatism, an election was made to use the cycle 1 uncertainties instead of the average of the three cycles since the uncertainties for cycle 1 were larger than the average. Therefore, this difference from NUREG/CR-3659 is acceptable.

A second difference is that NUREG/CR-3659 assumes that elbow taps are normalized to the single cycle specific precision flow calorimetric measurement each cycle, and therefore, the elbow tap uncertainties may be zeroed out. WCAP-16067-P, identifies a process by which the baseline measurements are utilized to establish a correlation between elbow tap differential pressure and the previously performed precision flow calorimetric measurements. This process requires the appropriate inclusion of additional uncertainties associated with the elbow tap differential pressure measurement each cycle. The additional uncertainties may be determined by a comparison of Table 3-9 of WCAP-12096, Revision 8, and Table A-6 of WCAP-16067-P. Since WCAP-16067-P conservatively includes additional uncertainties previously considered to be zeroed out, this difference from NUREG/CR-3659 is acceptable.

Based on these calculations, the uncertainty of the RCS flow measurement using the elbow tap method is 1.9% flow (control board indication) and 1.7% flow (process computer) which results in a minimum RCS total flow of 379,500 gpm. This is less than the current TS requirement of 380,000 gpm, which must be verified by the control board indicators or the plant process computer at 90% – 100% RTP. The calculated uncertainties are bounded by the uncertainties assumed in the Westinghouse Revised Thermal Design Procedure (RTDP, Reference 5) instrumentation uncertainties (currently 2.0% flow), which are used in deriving the TS reactor core safety limits and the corresponding DNB limits. Therefore, the elbow tap method is acceptable relative to the currently required minimum measured flow (MMF). Since the flow uncertainty did not increase over the currently analyzed value, no additional evaluations of the reactor core safety limits must be performed.

The uncertainty associated with the RCS Flow - Low trip setpoint increased slightly. It was determined that due to the availability of margin in the uncertainty calculation, no change was necessary to either the Trip Setpoint (90.0% flow) or to the current Safety Analysis Limit (87.0% flow) to accommodate this increase. As a result of the increased uncertainties, a change is proposed to the Allowable Values as noted in Section 2.0 of this document.

These uncertainty calculations have confirmed the acceptability of the Watts Bar plant specific safety analyses and associated protection system setpoints when periodic surveillance is performed via use of control board or plant process computer indication on a 22.5 month surveillance interval basis. Therefore, the change to SR 3.4.1.4 to invoke the elbow tap Δp measurement as an alternate method of determining RCS total flow rate, in accordance with WCAP-16067-P, Revision 0, is acceptable.

4.5 TS 3.3.1 - Reactor Coolant Flow-Low Reactor Trip Function

Increase in Allowable Value for Functions 10.a and 10.b

As discussed in Section 4.4, the uncertainty associated with the RCS Flow - Low trip setpoint increased slightly. As a result, the allowable values for Functions 10.a and 10.b has been increased from 89.6% to 89.7%. However, it was determined that due to the availability of margin in the uncertainty calculation, no change was necessary to either the Trip Setpoint (90.0% flow) or to the current Safety Analysis Limit (87.0% flow) to accommodate this increase. Since the Trip Setpoint did not change and remains conservative with respect to the revised Allowable Value, it will continue to acceptably account for errors such as drift and measuring and test equipment uncertainties. Further, adequate protection continues to be provided when all sensor and processing time delays are taken into account. Assurance is provided that DNB limits are not violated during reactor coolant low flow events due to anticipated operational occurrences and that the consequences of design basis accidents will be acceptable. Therefore, the changes to the TS Allowable Value and associated changes to the TS Bases to reflect the methodology for RCS Flow-Low settings and uncertainties in accordance with WCAP-16067-P, Revision 0, are acceptable.

Clarify TS Bases for Function 10.a and 10.b

The TS Bases is revised to clarify that the trip setpoint and allowable values are specified in "% indicated loop flow" instead of "% thermal design flow adjusted for uncertainties." As discussed in WCAP-16067-P, this proposed wording is consistent with the wording found in the Technical Specifications for a number of other nuclear plants. The intent is to set the Nominal Trip Setpoint at 90 % of the indicated flow for a given loop. This addresses the potential effect of flow asymmetry that may exist between loops. A setting of 90% indicated loop flow ensures that the low flow reactor trip setpoint remains conservative with respect to the safety analyses.

4.6 Tritium Production Core (TPC) and Robust Fuel Assembly (RFA-2)

TVA has determined that the proposed amendment request is compatible with plans for a WBN tritium production core (TPC) and introduction of Robust Fuel Assemblies (RFA)-2 beginning with Cycle 6. The Staff's approval of WBN's August 20, 2001, TPC request (Reference 6) was provided in Amendment 40, September 23, 2002 (Reference 7). TVA's August 20, 2001, evaluation concluded that tritium production transition and equilibrium core bypass flows were within limits. This conclusion remains valid for the proposed elbow tap flow measurement method. TVA's February 14, 2003, amendment request for RFA-2 (Reference 8) documented the acceptability of an increased core pressure drop for RFA-2 and the acceptability of an increased core bypass flow to 9.6% resulting in a minor reduction in calculated RCS best estimate flow. This conclusion also remains valid for the proposed elbow tap flow measurement. The cycle-specific core bypass flow verifications performed under standard reload evaluations and best estimate flow comparisons in accordance with WCAP-16067-P provide assurance that core hydraulic changes are appropriately considered when using the elbow tap flow measurement methodology.

5.0 REGULATORY SAFETY ANALYSIS

5.1 No Significant Hazards Consideration

TVA is submitting a request for an amendment to the Watts Bar Nuclear Plant (WBN) Unit 1 Operating License NPF-90 and Technical Specifications (TS). The proposed TS change would allow Unit 1 to use an alternate method for the 18 month precision heat balance measurement of reactor coolant system (RCS) total flow rate. The alternate method determines RCS total flow rate via measurement of the RCS elbow tap differential pressures (Δp) in accordance with Westinghouse Report WCAP-16067-P, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1." The use of elbow tap Δp correlated to flow calorimetrics performed for WBN in early operating cycles improves RCS flow measurement by eliminating the effect of hot leg temperature streaming. In addition, changes to Reactor Coolant Flow – Low reactor trip function Allowable Values are necessary to reflect revised instrument uncertainty calculations arising from use of the elbow tap methodology.

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendments(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. **Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Response: No.

   TVA's evaluation for WBN Unit 1 determined that the probability of an accident will not increase since adequate RCS flow will still be assured. Sufficient margin exists to account for all reasonable instrument uncertainties; therefore, no changes to installed equipment or hardware in the plant are required, thus the probability of an accident occurring remains unchanged. The initial conditions for all accident scenarios modeled are the same and the conditions at the time of trip, as modeled in the various safety analyses are the same. Therefore, the consequences of an accident will be the same as those previously analyzed.

   Therefore, since the actual plant configuration, performance of systems, and initiating event mechanisms are not being changed, TVA has concluded that the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   Response: No.

There are no changes in operation of the plant that could introduce a new failure mode. No new accident scenarios have been identified. Operation of the plant will be consistent with that previously modeled, i.e., the time of reactor trip in the various safety analyses is the same, thus plant response will be the same and will not introduce any different accident scenarios that have not been evaluated.

Therefore, TVA concludes that this proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Does the proposed change involve a significant reduction in a margin of safety?**

Response: No.

The proposed change reflects changes due to the method used to verify RCS flow at the beginning of each cycle. However, no changes to the Safety Analysis assumptions were required; therefore, the margin of safety will remain the same. Therefore, TVA concludes that the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

The RCS DNB temperature, pressure, and flow parameters satisfy Criterion 2 of 10 CFR 50.36(c)(2)(ii) and thus are included in TS 3.4.1. This change does not remove or modify the DNB parameters in TS 3.4.1 and therefore the requirements of Criterion 2 of 10 CFR 50.36(c)(2)(ii) continue to be met.

The change allows an alternate method for the measurement of the RCS total flow to meet TS SR 3.4.1.4 through measurement of the elbow tap differential pressure. The uncertainty calculation performed to support this alternate flow measurement method is consistent with the methodology recommended by NRC in NUREG/CR-3659 (Reference 4), except for two differences, which are justified in Section 4.4 of this report. The differences from the NUREG/CR-3659 uncertainty methodology are considered to be properly accounted for to meet the intent of the NUREG/CR-3659 methodology.

Standard 279-1971 "IEEE Standard: Criteria for Protection Systems for Nuclear Power Generating Stations" (Reference 9) establishes requirements for Reactor Trip System (RTS) Instrumentation. WBN FSAR Section 7.1.2 establishes the design bases for the RTS and defines the associated conformance with applicable regulatory guides. The proposed changes herein do not decrease the level of conformance with these criteria.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 ENVIRONMENTAL IMPACT CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

7.1 Precedent

Similar submittals have been made by a number of other utilities. In particular, TVA reviewed submittals made by Pacific Gas and Electric Company for Diablo Canyon Units 1 and 2, dated August 27, 2002 (Reference 10), and North Atlantic Energy Service Corporation for the Seabrook Station, dated June 20, 2000, as supplemented by a letter dated September 25, 2000 (Reference 11). Both of these submittals requested approval of the use of elbow tap differential pressure for RCS flow measurement based on similar methodology utilized for WBN's WCAP-16067-P, Rev. 0.

The Seabrook submittal was approved by the NRC by License Amendment 77, dated October 26, 2000 (Reference 12). TVA has reviewed NRC's Safety Evaluation for Seabrook to confirm the WBN approach is consistent.

TVA's review of the PG&E submittal determined that it remains under NRC staff review. NRC has posed several questions pertaining to the Diablo Canyon LAR which are potentially generic to WBN's request. TVA is following the PG&E effort on these issues. Accordingly, once the PG&E issues are formalized, TVA intends to supplement the enclosed LAR with a WBN response to the Diablo Canyon questions that are relevant to the generic methodology utilized by WBN Unit 1.

7.2 References

1. "WCAP-16067-P (Proprietary) and WCAP-16067-NP (Non-Proprietary), Revision 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003."

2. WBN Final Safety Analysis Report (FSAR), Chapter 7, "Instrumentation and Controls," and Chapter 15, "Accident Analyses."

3. WCAP-12096, Rev. 8, "Westinghouse Setpoint Methodology for Protection Systems Watts Bar Unit 1 Eagle 21 Version," March 1998.

4. NUREG/CR-3659, "A Mathematical Model for Assessing the Uncertainties of Instrumentation Measurements for Power and Flow of PWR Reactors," February, 1985 (PNL-4973).

5. WCAP-14738, Rev. 1, "Westinghouse Revised Thermal Design Procedure Instrument Uncertainty Methodology for Tennessee Valley Authority - Watts Bar Unit 1 - 1.4% Uprate to 3475 MW NSSS Power," August 2000.

6. TVA Letter to NRC, "WBN - Unit 1 - Revision of Boron Concentration Limits and Reactor Core Limitations for Tritium Production Cores (TPCs) - TS Change No. TVA-WBN-TS-00-015," August 20, 2001.

7. NRC Letter to TVA, "WBN - Unit 1 - Issuance of Amendment to Irradiate up to 2304 Tritium-Producing Burnable Absorber Rods in the Reactor Core (TAC No. MB1884)," September 23, 2002.

8. TVA Letter to NRC, "WBN - Unit 1 - TS Change No. TS-02-13 - Revise Section 5.9.5 to Incorporate Analytical Methods for Robust Fuel Assembly (RFA)-2 Upgrade," February 14, 2003.

9. The Institute of Electrical and Electronic Engineers, Inc., "IEEE Standard: Criteria for Protection Systems for Nuclear Power Generating Systems," IEEE Standard 279-1971.

10. Pacific Gas and Electric Company Letter to NRC, "Diablo Canyon Units 1 and 2 - License Amendment Request 02-05 - Revision to TS Table 3.3.1-1, Reactor Trip System Instrumentation," August 27, 2002.

11. North Atlantic Energy Service Corporation Letter to NRC, "Seabrook Station - License Amendment Request 00-04, Reactor Coolant System Flow Measurement," June 20, 2000, as supplemented September 25, 2000.

12. NRC Letter to North Atlantic, "Seabrook Station, Unit 1 - Issuance of Amendment RE: Reactor Coolant System Flow Measurement (TAC No. MA9301), October 26, 2000."

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1

PROPOSED TECHNICAL SPECIFICATION CHANGES - TS-03-10
MARK-UP

AFFECTED PAGE LIST:

3.3-17
3.4-2

Table 3.3.1-1 (page 3 of 9)
Reactor Trip System Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
9.	Pressurizer Water Level-High	1(f)	3	X	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10	≤ 92.7% span	92% span
10.	Reactor Coolant Flow-Low					$\boxed{\geq 89.7\%}$	
	a. Single Loop	1(g)	3 per loop	N	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	~~≥ 89.6%~~ flow	90% flow
	b. Two Loops	1(h)	3 per loop	X	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	~~≥ 89.6%~~ flow	90% flow
11.	Undervoltage RCPs	1(f)	1 per bus	M	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.15	≥ 4734 V	4830 V
12.	Underfrequency RCPs	1(f)	1 per bus	M	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.15	≥ 56.9 Hz	57.5 Hz

(continued)

(f) Above the P-7 (Low Power Reactor Trips Block) interlock.

(g) Above the P-8 (Power Range Neutron Flux) interlock.

(h) Above the P-7 (Low Power Reactor Trips Block) interlock and below the P-8 (Power Range Neutron Flux) interlock.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	Verify pressurizer pressure is ≥ 2214 psig.	12 hours
SR 3.4.1.2	Verify RCS average temperature is ≤ 593.2°F.	12 hours
SR 3.4.1.3	Verify RCS total flow rate is ≥ 380,000 gpm (process computer or control board indication).	12 hours
SR 3.4.1.4	------------------NOTE------------------ Required to be performed within 24 hours after ≥ 90% RTP. -- Verify by precision heat balance that RCS total flow rate is ≥ 380,000 gpm.	18 months

or elbow tap Δp method

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1

PROPOSED TS BASES CHANGES - TS-03-10
MARK-UP

AFFECTED PAGE LIST:

List of Inserts for Bases
B 3.3-4
B 3.3-5
B 3.3-24
B 3.3-25
B 3.3-63
B 3.4-2
B 3.4-5

TS BASES INSERTS

INSERT "A" (Page B 3.4-2)

Use of the elbow tap Δp methodology to measure RCS flow rate results in a measurement uncertainty of ± 1.7 % flow (process computer) or ± 1.9 % flow (control board indication) based on the utilization of eight elbow taps correlated to the three baseline precision heat balance measurements of Cycles 1, 2, and 3. Correlation of the flow indication channels with this previously performed heat balance measurement is documented in Reference 3. Use of this elbow tap Δp method provides an alternative to performance of a precision RCS flow calorimetric.

INSERT "B" (Page B 3.4-5)

3. WCAP-16067-P, Rev. 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003.

INSERT "C" (Page B 3.3-63)

13. WCAP-16067-P, Rev. 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003.

BACKGROUND

Signal Process Control and Protection System (continued)

input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Again, a single failure will neither cause nor prevent the protection function actuation. These requirements are described in IEEE-279-1971 (Ref. 4). The actual number of channels required for each unit parameter is specified in Reference 2.

Two logic trains are required to ensure no single random failure of a logic train will disable the RTS. The logic trains are designed such that testing required while the reactor is at power may be accomplished without causing trip.

Trip Setpoints and Allowable Values

The Trip Setpoints are the nominal values at which the bistables, setpoint comparators, or contact trip outputs are set. Any bistable or trip output is considered to be properly adjusted when the "as left" value is within the band for CHANNEL CALIBRATION accuracy.

The Trip Setpoints used in the bistables, setpoint comparators, or contact trip outputs are based on the analytical limits stated in Reference 6. The selection of these Trip Setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RTS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), the Trip Setpoints specified in Table 3.3.1-1 in the accompanying LCO are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the Trip Setpoints, including their explicit uncertainties, is provided in the "Westinghouse Setpoint Methodology for Protection Systems, Watts Bar 1 and 2" (Ref. 6). The Source Range and Intermediate Range Neutron detector setpoints are based on the requirements and recommendations of ISA 67.04 (Reference 10) standard and recommended practice. The actual nominal

The uncertainties for Reactor Coolant Flow - Low function using the elbow tap Δp flow measurement methodology are provided in Reference 13.

(continued)

BACKGROUND

Trip Setpoints and Allowable Values (continued)

Trip Setpoint entered into the bistable/comparator is more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a COT. One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.

Setpoints in accordance with the Allowable Value ensure that SLs are not violated during AOOs (and that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed). Note that in the accompanying LCO 3.3.1, the Trip Setpoints of Table 3.3.1-1 are the LSSS.

Each channel of the process control equipment can be tested on line to verify that the signal or setpoint accuracy is within the specified allowance requirements of Reference 2. Once a designated channel is taken out of service for testing, a simulated signal is injected in place of the field instrument signal. The process equipment for the channel in test is then tested, verified, and calibrated. SRs for the channels are specified in the SRs section.

The Process Protection System is designed to permit any one channel to be tested and maintained at power in a bypassed mode. If a channel has been bypassed for any purpose, the bypass is continuously indicated in the control room.

References 6 and 13,

The Trip Setpoints and Allowable Values listed in Table 3.3.1-1 are based on the methodology described in ~~Reference 6~~ and ISA 67.04 (Ref. 10), which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each Trip Setpoint. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.

(continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

a. Reactor Coolant Flow-Low (Single Loop) (continued)

in the core. In MODE 1 below the P-8 setpoint, a loss of flow in two or more loops is required to actuate a reactor trip (Function 10.b) because of the lower power level and the greater margin to the design limit DNBR.

The Reactor Coolant Flow-Low Trip Setpoint and Allowable Value are specified in % indicated loop ~~thermal design~~ flow ~~adjusted for uncertainties (95,000 gpm)~~, however, the Eagle-21™ values entered through the MMI are specified in an equivalent % differential pressure.

b. Reactor Coolant Flow-Low (Two Loops)

The Reactor Coolant Flow—Low (Two Loops) trip Function ensures that protection is provided against violating the DNBR limit due to low flow in two or more RCS loops while avoiding reactor trips due to normal variations in loop flow.

Above the P-7 setpoint and below the P-8 setpoint, a loss of flow in two or more loops will initiate a reactor trip. Each loop has three flow detectors to monitor flow. The flow signals are not used for any control system input.

The LCO requires three Reactor Coolant Flow-Low channels per loop to be OPERABLE.

In MODE 1 above the P-7 setpoint and below the P-8 setpoint, the Reactor Coolant Flow—Low (Two Loops) trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on low flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the reactor trip on low flow in two or more RCS loops is automatically enabled. Above the P-8 setpoint, a loss of flow in any one loop will actuate a reactor trip because of the higher power level and the reduced margin to the design limit DNBR.

(continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b. Reactor Coolant Flow-Low (Two Loops) (continued)

The Reactor Coolant Flow-Low Trip Setpoint and Allowable Value are specified in % indicated loop ~~thermal design~~ flow ~~adjusted for uncertainties (95,000 gpm)~~, however, the Eagle-21™ values entered through the MMI are specified in an equivalent % differential pressure.

11. Undervoltage Reactor Coolant Pumps

The Undervoltage RCPs reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS loops. The voltage to each RCP is monitored. Above the P-7 setpoint, a loss of voltage detected on two or more RCP buses will initiate a reactor trip. This trip Function will generate a reactor trip before the Reactor Coolant Flow—Low (Two Loops) Trip Setpoint is reached. The loss of voltage in two loops must be sustained for a length of time equal to or greater than that set in the time delay. Time delays are incorporated into the Undervoltage RCPs channels to prevent reactor trips due to momentary electrical power transients.

The LCO requires one Undervoltage RCP channel per bus to be OPERABLE.

In MODE 1 above the P-7 setpoint, the Undervoltage RCP trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on loss of flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the reactor trip on loss of flow in two or more RCS loops is automatically enabled.

12. Underfrequency Reactor Coolant Pumps

The Underfrequency RCPs reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS loops from a major network frequency disturbance. An underfrequency condition will slow down the pumps,

(continued)

REFERENCES

1. Watts Bar FSAR, Section 6.0, "Engineered Safety Features."

2. Watts Bar FSAR, Section 7.0, "Instrumentation and Controls."

3. Watts Bar FSAR, Section 15.0, "Accident Analysis."

4. Institute of Electrical and Electronic Engineers, IEEE-279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," April 5, 1972.

5. 10 CFR Part 50.49, "Environmental Qualifications of Electric Equipment Important to Safety for Nuclear Power Plants."

6. WCAP-12096, Rev. 7, "Westinghouse Setpoint Methodology for Protection System, Watts Bar 1 and 2," March 1997.

7. WCAP-10271-P-A, Supplement 1, and Supplement 2, Rev. 1, "Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System," May 1986 and June 1990.

8. Watts Bar Technical Requirements Manual, Section 3.3.1, "Reactor Trip System Response Times."

9. Evaluation of the applicability of WCAP-10271-P-A, Supplement 1, and Supplement 2, Revision 1, to Watts Bar.

10. ISA-DS-67.04, 1982, "Setpoint for Nuclear Safety Related Instrumentation Used in Nuclear Power Plants."

11. WCAP-13632-P-A Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements," January 1996

12. WCAP-14036-P-A, Revision 1, "Elimination of Periodic Protection Channel Response Time Tests," October 1998.

INSERT C

BASES

APPLICABLE SAFETY ANALYSES (continued)

result in meeting the DNBR criterion. This is the acceptance limit for the RCS DNB parameters. Changes to the unit that could impact these parameters must be assessed for their impact on the DNBR criteria. The transients analyzed for include loss of coolant flow events and dropped or stuck rod events. A key assumption for the analysis of these events is that the core power distribution is within the limits of LCO 3.1.7, "Control Bank Insertion Limits;" LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD);" and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)."

The pressurizer pressure limit of 2214 psig and the RCS average temperature limit of 593.2°F correspond to analytical limits of 2185 psig and 594.2°F used in the safety analyses, with allowance for measurement uncertainty.

The RCS DNB parameters satisfy Criterion 2 of the NRC Policy Statement.

LCO

This LCO specifies limits on the monitored process variables—pressurizer pressure, RCS average temperature, and RCS total flow rate—to ensure the core operates within the limits assumed in the safety analyses. Operating within these limits will result in meeting the DNBR criterion in the event of a DNB limited transient.

RCS total flow rate contains a measurement error of 1.6% (process computer) or 1.8% (control board indication) based on performing a precision heat balance and using the result to calibrate the RCS flow rate indicators. Potential fouling of the feedwater venturi, which might not be detected, could bias the result from the precision heat balance in a nonconservative manner. Therefore, a penalty of 0.1% for undetected fouling of the feedwater venturi raises the nominal flow measurement allowance to 1.7% (process computer) or 1.9% (control board indication).

Any fouling that might bias the flow rate measurement greater than 0.1% can be detected by monitoring and trending various plant performance parameters. If detected, either the effect of the fouling shall be quantified and compensated for in the RCS flow rate measurement or the venturi shall be cleaned to eliminate the fouling. The LCO numerical values for pressure, temperature, and flow rate are given for the measurement location and have been adjusted for instrument error.

INSERT A

(continued)

or by using the elbow tap Δp method described in Reference 3

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.1.4 *

Measurement of RCS total flow rate by performance of a precision calorimetric heat balance once every 18 months allows the installed RCS flow instrumentation to be calibrated and verifies the actual RCS flow rate is greater than or equal to the minimum required RCS flow rate.

The Frequency of 18 months reflects the importance of verifying flow after a refueling outage when the core has been altered, which may have caused an alteration of flow resistance.

This SR is modified by a Note that allows entry into MODE 1, without having performed the SR, and placement of the unit in the best condition for performing the SR. The Note states that the SR is not required to be performed until 24 hours after ≥ 90% RTP. This exception is appropriate since the heat balance requires the plant to be at a minimum of 90% RTP to obtain the stated RCS flow accuracies. The Surveillance shall be performed within 24 hours after reaching 90% RTP.

or elbow tap Δp method

*Note: The accuracy of the instruments used for monitoring RCS pressure, temperature and flow rate is discussed in this Bases section under LCO (Ref. 2).

REFERENCES

1. Watts Bar FSAR, Section 15.0, "Accident Analysis," Section 15.2, ~~"Normal Operation and Anticipated Transients,"~~ and Section 15.3.4, "Complete Loss Of Forced Reactor Coolant Flow."

2. Watts Bar Drawing 1-47W605-243, "Electrical Tech Spec Compliance Tables."

INSERT B

"Condition II - Faults of Moderate Frequency,"

ENCLOSURE 4

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1

PROPOSED TS AND TS BASES CHANGES TS-03-10
REVISED PAGES

AFFECTED PAGE LIST:

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3.3-17
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B 3.3-63
B 3.4-2
B 3.4-3
B 3.4-5

Table 3.3.1-1 (page 3 of 9)
Reactor Trip System Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
9.	Pressurizer Water Level-High	1[(f)]	3	X	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10	≤ 92.7% span	92% span
10.	Reactor Coolant Flow-Low						
	a. Single Loop	1[(g)]	3 per loop	N	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≥ 89.7% flow	90% flow
	b. Two Loops	1[(h)]	3 per loop	X	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≥ 89.7% flow	90% flow
11.	Undervoltage RCPs	1[(f)]	1 per bus	M	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.15	≥ 4734 V	4830 V
12.	Underfrequency RCPs	1[(f)]	1 per bus	M	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.15	≥ 56.9 Hz	57.5 Hz

(continued)

(f) Above the P-7 (Low Power Reactor Trips Block) interlock.

(g) Above the P-8 (Power Range Neutron Flux) interlock.

(h) Above the P-7 (Low Power Reactor Trips Block) interlock and below the P-8 (Power Range Neutron Flux) interlock.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	Verify pressurizer pressure is ≥ 2214 psig.	12 hours
SR 3.4.1.2	Verify RCS average temperature is ≤ 593.2°F.	12 hours
SR 3.4.1.3	Verify RCS total flow rate is ≥ 380,000 gpm (process computer or control board indication).	12 hours
SR 3.4.1.4	-------------------NOTE------------------ Required to be performed within 24 hours after ≥ 90% RTP. --- Verify by precision heat balance or elbow tap Δp method that RCS total flow rate is ≥ 380,000 gpm.	18 months

BACKGROUND

Signal Process Control and Protection System (continued)

input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Again, a single failure will neither cause nor prevent the protection function actuation. These requirements are described in IEEE-279-1971 (Ref. 4). The actual number of channels required for each unit parameter is specified in Reference 2.

Two logic trains are required to ensure no single random failure of a logic train will disable the RTS. The logic trains are designed such that testing required while the reactor is at power may be accomplished without causing trip.

Trip Setpoints and Allowable Values

The Trip Setpoints are the nominal values at which the bistables, setpoint comparators, or contact trip outputs are set. Any bistable or trip output is considered to be properly adjusted when the "as left" value is within the band for CHANNEL CALIBRATION accuracy.

The Trip Setpoints used in the bistables, setpoint comparators, or contact trip outputs are based on the analytical limits stated in Reference 6. The selection of these Trip Setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RTS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), the Trip Setpoints specified in Table 3.3.1-1 in the accompanying LCO are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the Trip Setpoints, including their explicit uncertainties, is provided in the "Westinghouse Setpoint Methodology for Protection Systems, Watts Bar 1 and 2" (Ref. 6). The uncertainties for Reactor Coolant Flow - Low function using the elbow tap Δp flow measurement methodology are provided in Reference 13. The Source Range and Intermediate Range Neutron detector setpoints are based on the requirements and recommendations of ISA 67.04 (Reference 10) standard and recommended practice. The actual nominal

(continued)

BACKGROUND

Trip Setpoints and Allowable Values (continued)

Trip Setpoint entered into the bistable/comparator is more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a COT. One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.

Setpoints in accordance with the Allowable Value ensure that SLs are not violated during AOOs (and that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed). Note that in the accompanying LCO 3.3.1, the Trip Setpoints of Table 3.3.1-1 are the LSSS.

Each channel of the process control equipment can be tested on line to verify that the signal or setpoint accuracy is within the specified allowance requirements of Reference 2. Once a designated channel is taken out of service for testing, a simulated signal is injected in place of the field instrument signal. The process equipment for the channel in test is then tested, verified, and calibrated. SRs for the channels are specified in the SRs section.

The Process Protection System is designed to permit any one channel to be tested and maintained at power in a bypassed mode. If a channel has been bypassed for any purpose, the bypass is continuously indicated in the control room.

The Trip Setpoints and Allowable Values listed in Table 3.3.1-1 are based on the methodology described in References 6 and 13, and ISA 67.04 (Ref. 10), which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each Trip Setpoint. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.

(continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

a. Reactor Coolant Flow-Low (Single Loop) (continued)

in the core. In MODE 1 below the P-8 setpoint, a loss of flow in two or more loops is required to actuate a reactor trip (Function 10.b) because of the lower power level and the greater margin to the design limit DNBR.

The Reactor Coolant Flow-Low Trip Setpoint and Allowable Value are specified in % indicated loop flow, however, the Eagle-21™ values entered through the MMI are specified in an equivalent % differential pressure.

b. Reactor Coolant Flow-Low (Two Loops)

The Reactor Coolant Flow—Low (Two Loops) trip Function ensures that protection is provided against violating the DNBR limit due to low flow in two or more RCS loops while avoiding reactor trips due to normal variations in loop flow.

Above the P-7 setpoint and below the P-8 setpoint, a loss of flow in two or more loops will initiate a reactor trip. Each loop has three flow detectors to monitor flow. The flow signals are not used for any control system input.

The LCO requires three Reactor Coolant Flow-Low channels per loop to be OPERABLE.

In MODE 1 above the P-7 setpoint and below the P-8 setpoint, the Reactor Coolant Flow—Low (Two Loops) trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on low flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the reactor trip on low flow in two or more RCS loops is automatically enabled. Above the P-8 setpoint, a loss of flow in any one loop will actuate a reactor trip because of the higher power level and the reduced margin to the design limit DNBR.

(continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b. Reactor Coolant Flow-Low (Two Loops) (continued)

The Reactor Coolant Flow-Low Trip Setpoint and Allowable Value are specified in % indicated loop flow, however, the Eagle-21™ values entered through the MMI are specified in an equivalent % differential pressure.

11. Undervoltage Reactor Coolant Pumps

The Undervoltage RCPs reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS loops. The voltage to each RCP is monitored. Above the P-7 setpoint, a loss of voltage detected on two or more RCP buses will initiate a reactor trip. This trip Function will generate a reactor trip before the Reactor Coolant Flow—Low (Two Loops) Trip Setpoint is reached. The loss of voltage in two loops must be sustained for a length of time equal to or greater than that set in the time delay. Time delays are incorporated into the Undervoltage RCPs channels to prevent reactor trips due to momentary electrical power transients.

The LCO requires one Undervoltage RCP channel per bus to be OPERABLE.

In MODE 1 above the P-7 setpoint, the Undervoltage RCP trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on loss of flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the reactor trip on loss of flow in two or more RCS loops is automatically enabled.

12. Underfrequency Reactor Coolant Pumps

The Underfrequency RCPs reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS loops from a major network frequency disturbance. An underfrequency condition will slow down the pumps,

(continued)

REFERENCES

1. Watts Bar FSAR, Section 6.0, "Engineered Safety Features."

2. Watts Bar FSAR, Section 7.0, "Instrumentation and Controls."

3. Watts Bar FSAR, Section 15.0, "Accident Analysis."

4. Institute of Electrical and Electronic Engineers, IEEE-279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," April 5, 1972.

5. 10 CFR Part 50.49, "Environmental Qualifications of Electric Equipment Important to Safety for Nuclear Power Plants."

6. WCAP-12096, Rev. 7, "Westinghouse Setpoint Methodology for Protection System, Watts Bar 1 and 2," March 1997.

7. WCAP-10271-P-A, Supplement 1, and Supplement 2, Rev. 1, "Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System," May 1986 and June 1990.

8. Watts Bar Technical Requirements Manual, Section 3.3.1, "Reactor Trip System Response Times."

9. Evaluation of the applicability of WCAP-10271-P-A, Supplement 1, and Supplement 2, Revision 1, to Watts Bar.

10. ISA-DS-67.04, 1982, "Setpoint for Nuclear Safety Related Instrumentation Used in Nuclear Power Plants."

11. WCAP-13632-P-A Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements," January 1996

12. WCAP-14036-P-A, Revision 1, "Elimination of Periodic Protection Channel Response Time Tests," October 1998.

13. WCAP-16067-P, Rev. 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003.

BASES

APPLICABLE SAFETY ANALYSES (continued)

result in meeting the DNBR criterion. This is the acceptance limit for the RCS DNB parameters. Changes to the unit that could impact these parameters must be assessed for their impact on the DNBR criteria. The transients analyzed for include loss of coolant flow events and dropped or stuck rod events. A key assumption for the analysis of these events is that the core power distribution is within the limits of LCO 3.1.7, "Control Bank Insertion Limits;" LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD);" and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)."

The pressurizer pressure limit of 2214 psig and the RCS average temperature limit of 593.2°F correspond to analytical limits of 2185 psig and 594.2°F used in the safety analyses, with allowance for measurement uncertainty.

The RCS DNB parameters satisfy Criterion 2 of the NRC Policy Statement.

LCO

This LCO specifies limits on the monitored process variables — pressurizer pressure, RCS average temperature, and RCS total flow rate — to ensure the core operates within the limits assumed in the safety analyses. Operating within these limits will result in meeting the DNBR criterion in the event of a DNB limited transient.

RCS total flow rate contains a measurement error of 1.6% (process computer) or 1.8% (control board indication) based on performing a precision heat balance and using the result to calibrate the RCS flow rate indicators. Potential fouling of the feedwater venturi, which might not be detected, could bias the result from the precision heat balance in a nonconservative manner. Therefore, a penalty of 0.1% for undetected fouling of the feedwater venturi raises the nominal flow measurement allowance to 1.7% (process computer) or 1.9% (control board indication).

Any fouling that might bias the flow rate measurement greater than 0.1% can be detected by monitoring and trending various plant performance parameters. If detected, either the effect of the fouling shall be quantified and compensated for in the RCS flow rate measurement or the venturi shall be cleaned to eliminate the fouling. The LCO numerical values for pressure, temperature, and flow rate are given for the measurement location and have been adjusted for instrument error.

Use of the elbow tap Δp methodology to measure RCS flow rate results in a measurement uncertainty of ±1.7% flow (process computer) or ±1.9% flow (control board indication)

(continued)

BASES

LCO (continued)

based on the utilization of eight elbow taps correlated to the three baseline precision heat balance measurements of Cycles 1, 2, and 3. Correlation of the flow indication channels with this previously performed heat balance measurement is documented in Reference 3. Use of this elbow tap Δp method provides an alternative to performance of a precision RCS flow calorimetric.

APPLICABILITY

In MODE 1, the limits on pressurizer pressure, RCS coolant average temperature, and RCS flow rate must be maintained during steady state operation in order to ensure DNBR criteria will be met in the event of an unplanned loss of forced coolant flow or other DNB limited transient. In all other MODES, the power level is low enough that DNB is not a concern.

A Note has been added to indicate the limit on pressurizer pressure is not applicable during short term operational transients such as a THERMAL POWER ramp increase > 5% RTP per minute or a THERMAL POWER step increase > 10% RTP. These conditions represent short term perturbations where actions to control pressure variations might be counterproductive. Also, since they represent transients initiated from power levels < 100% RTP, an increased DNBR margin exists to offset the temporary pressure variations.

Another set of limits on DNB related parameters is provided in SL 2.1.1, "Reactor Core SLs." Those limits are less restrictive than the limits of this LCO, but violation of a Safety Limit (SL) merits a stricter, more severe Required Action. Should a violation of this LCO occur, the operator must check whether or not an SL may have been exceeded.

ACTIONS

A.1

RCS pressure and RCS average temperature are controllable and measurable parameters. With one or both of these parameters not within LCO limits, action must be taken to restore parameter(s).

RCS total flow rate is not a controllable parameter and is not expected to vary during steady state operation. If the indicated RCS total flow rate is below the LCO limit, power must be reduced, as required by Required Action B.1, to restore DNB margin and eliminate the potential for violation of the accident analysis bounds.

The 2 hour Completion Time for restoration of the parameters provides sufficient time to adjust plant parameters, to determine the cause for the off normal condition, and to restore the readings within limits, and is based on plant operating experience.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.1.4 *

Measurement of RCS total flow rate by performance of a precision calorimetric heat balance or by using the elbow tap Δp method described in Reference 3 once every 18 months allows the installed RCS flow instrumentation to be calibrated and verifies the actual RCS flow rate is greater than or equal to the minimum required RCS flow rate.

The Frequency of 18 months reflects the importance of verifying flow after a refueling outage when the core has been altered, which may have caused an alteration of flow resistance.

This SR is modified by a Note that allows entry into MODE 1, without having performed the SR, and placement of the unit in the best condition for performing the SR. The Note states that the SR is not required to be performed until 24 hours after ≥ 90% RTP. This exception is appropriate since the heat balance or elbow tap Δp method requires the plant to be at a minimum of 90% RTP to obtain the stated RCS flow accuracies. The Surveillance shall be performed within 24 hours after reaching 90% RTP.

*Note: The accuracy of the instruments used for monitoring RCS pressure, temperature and flow rate is discussed in this Bases section under LCO (Ref. 2).

REFERENCES

1. Watts Bar FSAR, Section 15.0, "Accident Analysis," Section 15.2, "Condition II - Faults of Moderate Frequency," and Section 15.3.4, "Complete Loss Of Forced Reactor Coolant Flow."

2. Watts Bar Drawing 1-47W605-243, "Electrical Tech Spec Compliance Tables."

3. WCAP-16067-P, Rev. 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003.

ENCLOSURE 5

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1

WCAP-16067-P (PROPRIETARY), REVISION 0, "RCS FLOW MEASUREMENT USING ELBOW TAP METHODOLOGY AT WATTS BAR UNIT 1," APRIL 2003.

ENCLOSURE 6

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1

WCAP-16067-NP (NON-PROPRIETARY), REVISION 0, "RCS FLOW MEASUREMENT USING ELBOW TAP METHODOLOGY AT WATTS BAR UNIT 1," APRIL 2003.