Turkey Point Units 3 and 4

RESPONSE TO NRC RAI REGARDING EPU LAR NO. 205
AND EICB INSTRUMENTATION AND CONTROLS ISSUES
(NON-PROPRIETARY)

ATTACHMENT 2

WCAP-17070-NP, Revision 1,
Westinghouse Setpoint Methodology for
Protection Systems
Turkey Point Units 3 and 4 Power
Uprate to 2644 MWt Core Power
June 2011

This coversheet plus 60 pages

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Westinghouse Setpoint Methodology for Protection Systems Turkey Point Units 3 & 4 (Power Uprate to 2644 MWt – Core Power)

Westinghouse

WCAP-17070-NP
Revision 1

Westinghouse Setpoint Methodology for Protection Systems

Turkey Point Units 3 & 4
(Power Uprate to 2644 MWt – Core Power)

C. R. Tuley*
Setpoints and Uncertainty Analysis

J. R. Reagan*
Setpoints and Uncertainty Analysis

June 2011

Reviewer: T. P. Williams*
Setpoints and Uncertainty Analysis

Approved: D. C. Olinski*, Manager
Setpoints and Uncertainty Analysis

** Electronically Approved Records Are Authenticated in the Electronic Document Management System*

Westinghouse Electric Company, LLC
1000 Westinghouse Drive
Cranberry Township, PA 16066

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1.0 INTRODUCTION

This report has been prepared to document the instrument uncertainty calculations for the Reactor Trip System (RTS) and Engineered Safety Features Actuation System (ESFAS) trip functions identified on Table 3-12 of this report for Turkey Point Units 3 and 4 Nuclear Power Stations (FPL/FLA) for a power uprate to 2644 MWt.

This document is divided into four sections. Section 2.0 identifies the general algorithm used as a base to determine the overall instrument uncertainty for an RTS/ESFAS trip function. This approach is defined in a Westinghouse paper presented at an Instrument Society of America/Electric Power Research Institute (ISA/EPRI) conference in June, 1992[1]. This approach is consistent with American National Standards Institute (ANSI), ANSI/ISA-67.04.01-2006[2]. The basic uncertainty algorithm is the Square-Root-Sum-of-the-Squares (SRSS) of the applicable uncertainty terms, which is endorsed by the ISA standard. All appropriate and applicable uncertainties, as defined by a review of the plant baseline design input documentation, have been included in each RTS/ESFAS trip function uncertainty calculation. ISA-RP67.04.02-2000[3] was utilized as a general guideline, but each uncertainty and its treatment is based on Westinghouse methods which are consistent or conservative with respect to this document. The latest version of NRC Regulatory Guide 1.105 (Revision 3[4]) endorses the 1994 version of ISA S67.04, Part I. Westinghouse has evaluated this NRC document and has determined that the RTS/ESFAS trip function uncertainty calculations contained in this report are consistent with the guidance contained in Revision 3[4]. It is believed that the total channel uncertainty (Channel Statistical Allowance or CSA) represents a 95/95 value as requested in Regulatory Guide 1.105[4].

Section 3.0 of this report provides a list of the defined terms and associated acronyms used in the RTS/ESFAS trip function uncertainty calculations. Appropriate references to industry standards have been provided where applicable. Included in this section are detailed descriptions of the uncertainty terms and values for each RTS/ESFAS trip function uncertainty calculation performed by Westinghouse. Provided on each table is the function specific uncertainty algorithm which notes the appropriate combination of instrument uncertainties to determine the CSA. A summary Table (3-12) is provided which includes a listing of the Safety Analysis Limit (SAL), the Nominal Trip Setpoint (NTS), the Total Allowance (the difference between the SAL and NTS, in % span), margin, and the Allowable Value (AV). In all cases, it was determined that positive margin exists between the SAL and the NTS after accounting for the channel instrument uncertainties.

Section 4.0 provides a description of the methodology utilized in the determination of Turkey Point Units 3 and 4 Technical Specifications with regards to an explanation of the relationship between a trip setpoint and the allowable value.

1.1 References / Standards

1. Tuley, C. R., Williams, T. P., "The Significance of Verifying the SAMA PMC 20.1-1973 Defined Reference Accuracy for the Westinghouse Setpoint Methodology," Instrumentation, Controls and Automation in the Power Industry, Vol. 35, Proceedings of the Thirty-Fifth Power Instrumentation Symposium (2nd Annual ISA/EPRI Joint Controls and Automation Conference), Kansas City, Mo., June 1992, p. 497.

2. ANSI/ISA-67.04.01-2006, "Setpoints for Nuclear Safety-Related Instrumentation," May 2006.

3. ISA-RP67.04.02-2000, "Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation," January 2000.

4. Regulatory Guide 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," 1999.

2.0 COMBINATION OF UNCERTAINTY COMPONENTS

This section describes the Westinghouse setpoint methodology for the combination of the uncertainty components utilized for Turkey Point Units 3 and 4. The methodology used in the determination of the overall CSA, for the functions listed in Table 3-12 of this report, is in Section 2.1 below. All appropriate and applicable uncertainties, as defined by a review of Turkey Point Units 3 and 4 baseline design input documentation have been included in each RTS/ESFAS trip function CSA calculation.

2.1 Methodology

The methodology used to combine the uncertainty components for a channel is an appropriate combination of those groups which are statistically and functionally independent. Those uncertainties which are not independent are conservatively treated by arithmetic summation and then systematically combined with the independent terms.

The basic methodology used is the SRSS technique. This technique, or others of a similar nature, has been used in WCAP-10395 [1] and WCAP-8567 [2]. WCAP-8567 is approved by the NRC noting acceptability of statistical techniques for the application requested. Also, various ANSI, American Nuclear Society (ANS), and ISA standards approve the use of probabilistic and statistical techniques in determining safety-related setpoints [3,4]. The basic methodology used in this report is essentially the same as that identified in a Westinghouse paper presented at an ISA/EPRI conference in June, 1992[5]. Differences between the algorithm presented in this paper and the equations presented in Tables 3-1 through 3-11 are due to Turkey Point Units 3 and 4 specific characteristics in design and should not be construed as differences in approach.

The generalized relationship between the uncertainty components and the calculated uncertainty for a channel is noted in Eq. 2.1:

$$CSA = \sqrt{\begin{array}{l} PMA^2 + PEA^2 + SRA^2 + (SMTE + SD)^2 + (SMTE + SCA)^2 + \\ SPE^2 + STE^2 + (RMTE + RD)^2 + (RMTE + RCA)^2 + \\ RTE^2 \end{array}} \\ + EA + Bias \qquad \text{Eq. 2.1}$$

where,

CSA	=	Channel Statistical Allowance
PMA	=	Process Measurement Accuracy
PEA	=	Primary Element Accuracy
SRA	=	Sensor Reference Accuracy
SCA	=	Sensor Calibration Accuracy
SMTE	=	Sensor Measurement and Test Equipment Accuracy
SPE	=	Sensor Pressure Effects
STE	=	Sensor Temperature Effects
SD	=	Sensor Drift
RCA	=	Rack Calibration Accuracy
RMTE	=	Rack Measurement and Test Equipment Accuracy
RTE	=	Rack Temperature Effects
RD	=	Rack Drift
EA	=	Environmental Allowance
BIAS	=	One directional, known magnitude allowance

Each of the above terms is defined in Section 3.2, Definitions for Protection System Setpoint Tolerances.

Eq. 2.1 is based on the following: 1) The sensor and rack measurement and test equipment uncertainties are treated as dependent parameters with their respective drift and calibration accuracy allowances. 2) While the environmental allowances are not considered statistically dependent with all other parameters, the equipment qualification testing generally results in large magnitude, non-random terms that are conservatively treated as limits of error which are added to the statistical summation. Westinghouse generally considers a term to be a limit of error if the term is a bias with an unknown sign. The term is added to the SRSS in the direction of conservatism. 3) Bias terms are one directional with known magnitudes (which may result from several sources, e.g., drift or calibration data evaluations) and are also added to the statistical summation. 4) The calibration terms are treated in the same radical with the other terms based on an assumption of trending, i.e., drift and calibration data are evaluated on a periodic and timely basis. This evaluation should confirm that the distribution function characteristics assumed as part of the treatment of the terms are still applicable. 5) Turkey Point Units 3 and 4 will monitor the "as left" and "as found" data for the sensors and process racks. This process provides performance information that results in a net reduction of the CSA magnitude (over that which would be determined if data review were not performed). Consistent with the request of Regulatory Guide 1.105[6], the CSA value from Eq. 2.1 is believed to have been determined at a 95 % probability and at a 95 % confidence level (95/95).

2.2 Sensor Allowances

Seven parameters are considered to be sensor allowances: SRA, SCA, SMTE, SD, STE, SPE and EA. Three of these parameters are considered to be independent, two-sided, unverified (by plant calibration or drift determination processes), vendor supplied terms (SRA, STE and SPE). Based on vendor supplied data, typically product data sheets and qualification reports, these parameters are treated as 95/95 values unless specified otherwise by the vendor. Three of the remaining parameters are considered dependent with at least one other term, are two-sided, and are the result of the plant calibration and drift determination process (SCA, SMTE and SD).

The EA term is associated with the sensor exposure to adverse environmental conditions (elevated temperature and radiation) due to mass and energy loss from a break in the primary or secondary side piping, or adverse effects due to seismic events. Where appropriate, e.g., steamline break, only the elevated temperature term may be used for this uncertainty. The EA term magnitudes are conservatively treated as limits of error.

SRA is the manufacturer's reference accuracy that is achievable by the device. This term is introduced to address repeatability and hysteresis effects when performing only a single pass calibration, i.e., one up and one down[5,7]. STE and SPE are considered to be independent due to the manner in which the instrumentation is checked; i.e., the instrumentation is calibrated and drift determined under conditions in which pressure and temperature are assumed constant. For example, assume a sensor is placed in some position in the containment during a refueling outage. After placement, an instrument technician calibrates the sensor at ambient pressure and temperature conditions. Sometime later with the plant shutdown, an instrument technician checks for sensor drift using the same technique as was previously used for calibrating the sensor. The conditions under which this drift determination is made are again ambient pressure and temperature. The temperature and pressure should be essentially the same at both measurements. Thus, they should have no significant impact on the drift determination and are, therefore, independent of the drift allowance.

SCA and SD are considered to be dependent with SMTE due to the manner in which the instrumentation is evaluated. A transmitter is calibrated by providing a known process input (measured with a high accuracy gauge) and evaluating the electrical output with a digital multimeter (DMM) or digital voltmeter (DVM). The gauge and DVM accuracies form the SMTE terms. The transmitter response is known, at best, to within the accuracy of the measured input and measured output. Thus the calibration accuracy (SCA) is functionally dependent with the measurement and test equipment (SMTE). Since the gauge and DVM are independent of each other (they operate on two different physical principles), the two SMTE terms may be combined by SRSS prior to addition with the SCA term. Transmitter drift is determined using the same process used to perform a transmitter calibration.

That is, a known process input (measured with a high accuracy gauge) is provided and the subsequent electrical output is measured with a DMM or DVM. In most cases the same measurement and test equipment is used for both calibration and drift determination. Thus the drift value (SD) is functionally dependent with the measurement and test equipment (SMTE) and is treated in the same manner as SMTE and SCA.

While the data is gathered in the same manner, SD is independent of SCA in that they are two different parameters. SCA is the difference between the "as left" value and the desired value. SD is the difference between the "as found" value of the current calibration and the "as left" value of the previous calibration. It is assumed that a mechanistic cause and effect relationship between SCA and SD is not demonstrated and that any data evaluation will determine the distribution function characteristics for both SCA and SD and confirms that SD is random and independent of SCA.

2.3 Rack Allowances

Four parameters are considered to be rack allowances: RCA, RMTE, RTE and RD. Rack Reference Accuracy (RRA) is the manufacturer's reference accuracy that is achievable by the process rack instrument string. This term is introduced to address repeatability and hysteresis effects when performing only a single pass calibration, i.e., one up and one down[5]. Review of a sample of Turkey Point Units 3 and 4 specific calibration procedures has concluded that the calibration tolerance identified in the procedures is sufficient to encompass "as left" deviation and the hysteresis and repeatability effects without an additional allowance. Thus this term has been included in the RCA term in the uncertainty calculations. RTE is considered to be an independent, two-sided, unverified (by plant calibration or drift determination processes), vendor supplied parameter. The process racks are located in an area with ambient temperature control, making consistency with the rack evaluation temperature easy to achieve. Based on Westinghouse Eagle process rack data and Hagan rack data, this parameter is treated as a 95/95 value.

RCA and RD are considered to be two-sided terms dependent with RMTE. The functional dependence is due to the manner in which the process racks are evaluated. To calibrate or determine drift for the process rack portion of a channel, a known input (in the form of a voltage, current or resistance) is provided and the point at which the trip bistable changes state is measured. The input parameter is either measured by the use of a DMM or DVM (for a current or voltage signal) or is known to some degree of precision by use of precision equipment, e.g., a precision decade box for a resistance input. For simple channels, only a DMM or DVM is necessary to measure the input and the state change is noted by a light or similar device. For more complicated channels, multiple DVMs may be used or a DVM in conjunction with a decade box. The process rack response is known at best to within the accuracy of the measured input and indicated output. Thus the calibration accuracy (RCA) is functionally dependent with the measurement and test equipment (RMTE).

In those instances where multiple pieces of measurement and test equipment are utilized, the uncertainties are combined via SRSS when appropriate.

The RCA term represents the total calibration uncertainty for the channels which are calibrated as a single string. Drift for the process racks is determined using the same process used to perform the rack calibration and in most cases utilizes the same measurement and test equipment. Thus the drift value (RD) is also functionally dependent with the measurement and test equipment (RMTE) and is treated in the same manner as RMTE and RCA.

While the data is gathered in the same manner, RD is independent of RCA in that they are different parameters. RCA is the difference between the "as left" value and the desired value. RD is the difference between the "as found" of the current calibration and the "as left" values of the previous calibration. The RD term represents the drift for all process rack modules in an instrument string, regardless of the channel complexity. For multiple instrument strings there may be multiple RD terms, e.g., Overtemperature ΔT. It is assumed that a mechanistic cause and effect relationship between RCA and RD is not demonstrated and that any data evaluation will determine the distribution function characteristics for both RCA and RD and will confirm that RD is random and independent of RCA.

2.4 Process Allowances

The PMA and PEA parameters are considered to be independent of both sensor and rack parameters. The PMA terms provide allowances for the non-instrument related effects; e.g., neutron flux, calorimetric power uncertainty assumptions and fluid density changes. There may be more than one independent PMA uncertainty allowance for a channel if warranted. The PEA term typically accounts for uncertainties due to metering devices, such as elbows, venturis, and orifice plates. In this report, this type of uncertainty is limited in application by Westinghouse to RCS Flow (Cold Leg Elbow Taps), high steam flow, and steam flow / feedwater flow mismatch. In these applications, the PEA term has been determined to be independent of the sensors and process racks. It should be noted that treatment as an independent parameter does not preclude determination that a PMA or PEA term should be treated as a bias. If that is determined appropriate, Eq. 2.1 would be modified such that the affected term would be treated by arithmetic summation with appropriate determination and application of the sign of the uncertainty.

2.5 References / Standards

1. Grigsby, J. M., Spier, E. M., Tuley, C. R., "Statistical Evaluation of LOCA Heat Source Uncertainty," WCAP-10395 (Proprietary), WCAP-10396 (Non-Proprietary), November 1983.

2. Chelemer, H., Boman, L. H., and Sharp, D. R., "Improved Thermal Design Procedure," WCAP-8567 (Proprietary), WCAP-8568 (Non-Proprietary), July 1975.

3. ANSI/ANS Standard 58.4-1979, "Criteria for Technical Specifications for Nuclear Power Stations."

4. ANSI/ISA-67.04.01-2006, "Setpoints for Nuclear Safety-Related Instrumentation," May 2006.

5. Tuley, C. R., Williams, T. P., "The Significance of Verifying the SAMA PMC 20.1-1973 Defined Reference Accuracy for the Westinghouse Setpoint Methodology," Instrumentation, Controls and Automation in the Power Industry, Vol. 35, Proceedings of the Thirty-Fifth Power Instrumentation Symposium (2nd Annual ISA/EPRI Joint Controls and Automation Conference), Kansas City, Mo., June 1992, p. 497.

6. Regulatory Guide 1.105 Revision 3, "Setpoints for Safety Related Instrumentation," 1999.

7. ANSI/ISA-51.1-1979 (R1993), "Process Instrumentation Terminology," Reaffirmed May 26, 1995, p. 61.

3.0 PROTECTION SYSTEM SETPOINT METHODOLOGY

This section contains a list of defined terms used in the Turkey Point Units 3 and 4 RTS/ESFAS trip function uncertainty calculations. Also included in this section are detailed tables and a summary table of the uncertainty terms and values for each calculation that Westinghouse performed. It was determined that in all cases sufficient margin exists between the nominal trip setpoint and the safety analysis limit after accounting for uncertainties.

3.1 Instrument Channel Uncertainty Calculations

Tables 3-1 through 3-11 provide individual component uncertainties and CSA calculations for the protection functions noted in Tables 2.2-1 and Table 3.3-3 of Turkey Point Units 3 and 4 Technical Specifications. Table 3-12 of this report provides a summary of the Reactor Trip System / Engineered Safety Features Actuation System Channel Uncertainty Allowances for Turkey Point Units 3 and 4. This table lists the Safety Analysis Limit, Nominal Trip Setpoint, and Allowable Value (in engineering units), and Channel Statistical Allowance, Margin, Total Allowance, As Left Tolerance, As Found Tolerance, and uncertainty terms (in % span). Westinghouse reports the values in Tables 3-1 through 3-11 and Table 3-12 to one decimal place using the technique of rounding down values less than 0.05 % span and rounding up values greater than or equal to 0.05 % span. Parameters reported as "0.0" have been identified as having a value of ≤ 0.04 % span. Parameters reported as "0" or "---" in the tables are not applicable (i.e., have no value) for that channel.

3.2 Definitions for Protection System Setpoint Tolerances

For the channel uncertainty values used in this report, the following definitions are provided in alphabetical order:

- As Found

  The condition in which a transmitter, process rack module, or process instrument loop is found after a period of operation. For example, after one cycle of operation, a Steam Generator Level transmitter's output at 50 % span was measured to be 12.05 mA. This would be the "as found" condition. For the process racks, the As Found Tolerance (AFT) is equal to the process rack As Left Tolerance (ALT), which is equal to the magnitude of the Rack Calibration Accuracy (RCA), i.e., AFT = ALT = RCA. The AFT is a two-sided parameter (+/-) about the Nominal Trip Setpoint (NTS).

- As Left

  The condition in which a transmitter, process rack module, or process instrument loop is left after calibration or bistable trip setpoint verification. This condition is typically better than the calibration accuracy for that piece of equipment. For example, the calibration point for a Steam Generator Level transmitter at 50 % span is 12.0 ± 0.04 mA. A measured "as left" condition of 12.03 mA would satisfy this calibration tolerance. In this instance, if the calibration was stopped at this point (i.e., no additional efforts were made to decrease the deviation) the "as left" error would be + 0.03 mA or + 0.19 % span, assuming a 16 mA (4 to 20 mA) instrument span. For the process racks, the As Left Tolerance (ALT) is equal to the magnitude of the Rack Calibration Accuracy (RCA), i.e., ALT = RCA. The ALT is a two-sided parameter (+/-) about the Nominal Trip Setpoint (NTS).

- Channel

  The sensing and process equipment, i.e., transmitter to bistable, for one input to the voting logic of a protection function. Westinghouse designs protection functions with voting logic made up of multiple channels, e.g. 2 out of 3 Steam Generator Level - Low-Low channels for one steam generator must have their bistables in the tripped condition for a Reactor Trip to be initiated.

- Channel Statistical Allowance (**CSA**)

  The combination of the various channel uncertainties via SRSS and algebraic techniques. It includes instrument (sensor and process rack) uncertainties and non-instrument related effects (Process Measurement Accuracy), see Eq. 2.1. This parameter is compared with the Total Allowance for determination of instrument channel margin. The uncertainties and conservatism of the CSA algorithm (Eq. 2.1) result in a CSA magnitude that is believed to be determined on a two-sided 95/95 basis.

- Environmental Allowance (**EA**)

  The change in a process signal (transmitter or process rack output) due to adverse environmental conditions from a limiting accident condition or seismic event. Typically this value is determined from a conservative set of enveloping conditions and may represent the following:

· Temperature effects on a transmitter
· Radiation effects on a transmitter
· Seismic effects on a transmitter
· Temperature effects on a level transmitter reference leg
· Temperature effects on signal cable insulation
· Seismic effects on process racks

- Margin

  The calculated difference (in % instrument span) between the Total Allowance (TA) and the CSA.

  Margin = TA – CSA

  Margin is defined to be a non-negative number i.e., Margin ≥ 0 % span.

- Nominal Trip Setpoint (NTS)

  A bistable trip setpoint in plant procedures. This value is the nominal value to which the bistable is set, as accurately as reasonably achievable. The NTS is based on engineering judgment (to arrive at a Margin ≥ 0 % span), or a historical value, that has been demonstrated over time to result in adequate operational margin.

- Normalization

  The process of establishing a relationship, or link, between a process parameter and an instrument channel. This is in contrast with a calibration process. A calibration process is performed with independent known values, i.e., a bistable is calibrated to change state when a specific voltage is reached. This voltage corresponds to a process parameter magnitude with the relationship established through the scaling process. A normalization process typically involves an indirect measurement, e.g., determination of Steam Flow via the ΔP drop across a flow restrictor. The flow coefficient for this device, (effectively an orifice which has not been calibrated in a laboratory setting), is not known. Therefore a mass balance between Feedwater Flow and Steam Flow must be made. The mass Feedwater Flow is known through measurement via the ΔP across the venturi, Feedwater Pressure and Feedwater Temperature. Presuming no mass losses prior to the measurement of the Steam Flow, the mass Steam Flow can be claimed to equal the mass Feedwater Flow. Measurement of the Steam Flow ΔP and the Steam Pressure (to correct for density) can then be utilized to translate to a volumetric flow.

- Primary Element Accuracy (**PEA**)

  Uncertainty due to the use of a metering device. In Westinghouse calculations, this parameter is limited to use on a venturi, orifice, elbow or potential transformer. Typically, this is a calculated or measured accuracy for the device.

- Process Loop (Instrument Process Loop)

  The process equipment for a single channel of a protection function.

- Process Measurement Accuracy (**PMA**)

  Allowance for non-instrument related effects which have a direct bearing on the accuracy of an instrument channel's reading, e.g., temperature stratification in a large diameter pipe, fluid density in a pipe or vessel.

- Process Racks

  The analog modules downstream of the transmitter or sensing device, which condition a signal and act upon it prior to input to a voting logic system. For Hagan analog process systems, this includes all the equipment contained in the process equipment cabinets, e.g., conversion resistor, loop power supply, lead/lag, rate, lag functions, function generator, summator, control/protection isolator, and bistable. The go/no go signal generated by the bistable is the output of the last module in the analog process rack instrument loop and is the input to the voting logic.

- Rack Calibration Accuracy (**RCA**)

  Rack calibration accuracy is defined as the two-sided (+/-) calibration tolerance about the NTS of the process racks.

  It is assumed that the individual modules in a loop are calibrated to a particular tolerance and that the process loop as a string is verified to be calibrated to a specific tolerance. The tolerance is typically less than the arithmetic sum or SRSS of the individual module tolerances. This forces calibration of the process loop in such a manner as to exclude a systematic bias in the individual module calibrations, i.e., as left values for individual modules must be compensating in sign and magnitude when considered as an instrument string.

  Review of a sample of Turkey Point Units 3 and 4 specific calibration procedures concluded that the calibration process and the identified RCA allowance is sufficient to encompass the as left deviation and the hysteresis and repeatability effects without an additional RRA allowance.

- Rack Drift (**RD**)

  The change in input-output relationship over a period of time at reference conditions, e.g., at constant temperature. For example, assume that a Water Level channel at 50 % span (presuming a 1 to 5 V span) has an "as found" value of 3.01 V for the current calibration and an "as left" value of 2.99 V from the previous calculation. The magnitude of the drift would be {(3.01 – 2.99)(100/4) = + 0.5 % span} in the positive direction. For Turkey Point Units 3 and 4 plant specific surveillance procedures, Florida Power and Light will implement an additional requirement to compare the as found to the previous as left value to determine if drift allowance assumptions were exceeded since the last calibration activity.

- Rack Measurement & Test Equipment Accuracy (**RMTE**)

  The accuracy of the test equipment (typically a transmitter simulator, voltage or current power supply, and DVM) used to calibrate a process loop in the racks. When the magnitude of RMTE meets the requirements of SAMA Standard PMC 20.1-1973[9] or ANSI/ISA-51.1-1979 (R1993)[10] it is considered an integral part of RCA. Uncertainties due to M&TE that are 10 times more accurate than the device being calibrated are considered insignificant and are not included in the uncertainty calculations.

- Rack Reference Accuracy (**RRA**)

  Rack Reference Accuracy is the reference accuracy, as defined by SAMA Standard PMC 20.1-1973[1] for a process loop string. It is defined as the reference accuracy or accuracy rating that is achievable by the instrument string as specified in the manufacturer's specification sheets. Inherent in this definition is the verification of the following under a reference set of conditions; 1) conformity[2 or 6], 2) hysteresis[3 or 7] and 3) repeatability[4 or 8]. An equivalent to the SAMA definition of reference accuracy is the ANSI/ISA-51.1-1979 (R1993)[5] term "accuracy rating," specifically as applied to Note 2 and Note 3.

  Review of a sample of Turkey Point Units 3 and 4 specific calibration procedures and calibration assumptions concludes that the identified calibration allowance is sufficient to encompass the Rack Reference Accuracy without an additional allowance.

- Rack Temperature Effects (**RTE**)

  Change in input-output relationship for the process rack module string due to a change in the ambient environmental conditions (temperature, humidity), and voltage and frequency from the reference calibration conditions. It has been determined that temperature is the most significant,

with the other parameters being second order effects. For process instrumentation, a typical value of [ ]^{a,c} is used for analog channel temperature effects which allows for a ± 50 °F ambient temperature deviation.

- Range

  The upper and lower limits of the operating region for a device, e.g., for a Steamline Pressure transmitter, 0 to 1400 psig. This is not necessarily the calibrated span of the device, although quite often the two are close. For further information see ANSI/ISA-51.1-1979 (R1993)[10].

- Safety Analysis Limit (**SAL**)

  The parameter value in the UFSAR safety analysis or other plant operating limit at which a reactor trip or actuation function is assumed to be initiated.

- Sensor Calibration Accuracy (**SCA**)

  The two-sided (+/-) calibration accuracy for a sensor or transmitter as defined by the plant calibration procedures. For transmitters, this accuracy is typically [ ]^{a,c}. Utilizing Westinghouse recommendations for Resistance Thermal Detector (RTD) cross-calibration, this accuracy is typically [ ]^{a,c} for the Hot and Cold Leg RTDs.

- Sensor Drift (**SD**)

  The change in input-output relationship over a period of time at reference calibration conditions, e.g., at constant temperature. For example, assume a Water Level transmitter at 50 % level (presuming a 4 to 20 mA span) has an "as found" value of 12.05 mA from the current calibration and an "as left" value of 12.01 mA from the previous calibration. The magnitude of the drift would be {(12.05 - 12.01)(100/16) = + 0.25 % span} in the positive direction.

- Sensor Measurement & Test Equipment Accuracy (**SMTE**)

  The accuracy of the test equipment (typically a high accuracy local readout gauge and DVM) used to calibrate a sensor or transmitter in the field or in a calibration laboratory. When the magnitude of SMTE meets the requirements of ANSI/ISA-51.1-1979 (R1993)[10] it is considered an integral part of SCA. Uncertainties due to M&TE that are 10 times more accurate than the device being calibrated are considered insignificant and are not included in the uncertainty calculations.

- Sensor Pressure Effects (**SPE**)

  The change in input-output relationship due to a change in the static head pressure from the calibration conditions or the accuracy to which a correction factor is introduced for the difference between calibration and operating conditions for a Δp transmitter.

- Sensor Reference Accuracy (**SRA**)

  The reference accuracy that is achievable by the device as specified in the manufacturer's specification sheets. This term is introduced into the uncertainty calculation to address repeatability effects when performing only a single pass calibration, i.e., one up and one down, or repeatability and hysteresis when performing a single pass calibration in only one direction.

- Sensor Temperature Effects (**STE**)

  The change in input-output relationship due to a change in the ambient environmental conditions (temperature, humidity), and voltage and frequency from the reference calibration conditions. It has been determined that temperature is the most significant, with the other parameters being second order effects. Note that the ambient temperature effects were evaluated using ± 60 °F.

- Span

  The region for which a device is calibrated and verified to be operable, e.g., for a Steamline Pressure transmitter, 1400 psi.

- Square-Root-of-the-Sum-of-the-Squares (**SRSS**)

  That is,

  $$\varepsilon = \sqrt{(a)^2 + (b)^2 + (c)^2}$$

  as approved for use in setpoint calculations by ANSI/ISA-67.04.01-2006[11].

- Total Allowance (**TA**)

  The absolute value of the difference (in % instrument span) between the Safety Analysis Limit (SAL) and the Nominal Trip Setpoint (NTS).

  $$\mathrm{TA} = |\mathrm{SAL} - \mathrm{NTS}|$$

Two examples of the calculation of TA are:

- *Power Range Neutron Flux - High*

SAL	115% RTP
NTS	-108% RTP
TA	| 7% RTP | = 7% RTP

If the instrument span = 120% RTP, then

$$TA = \frac{(7\%\ RTP) * (100\%\ span)}{(120\%\ RTP)} = 5.8\ \%\ span$$

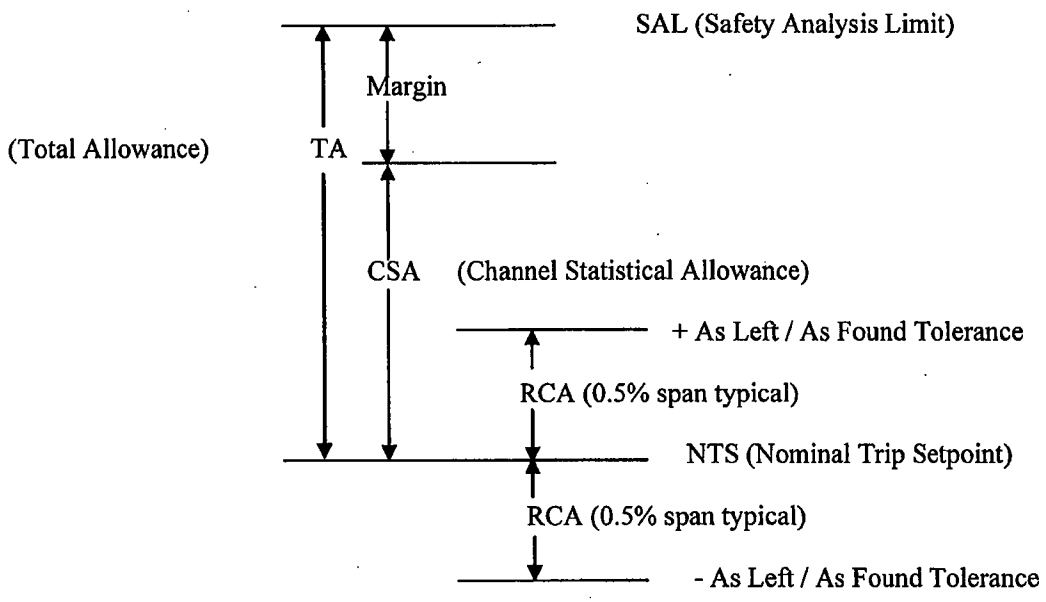
- *Steamline Pressure - Low (SI)*

SAL	566.3 psig
NTS	-614.0 psig
TA	| -47.7 psig | = 47.7 psig

If the instrument span = 1400 psig, then

$$TA = \frac{(47.7\ psig) * (100\%\ span)}{(1400\ psig)} = 3.4\ \%\ span$$

Setpoint Relationships



3.3 References / Standards

1. Scientific Apparatus Makers Association Standard PMC 20.1-1973, "Process Measurement & Control Terminology," p. 4.

2. Ibid, p. 5.

3. Ibid, p. 19.

4. Ibid, p. 28.

5. ANSI/ISA-51.1-1979 (R1993), "Process Instrumentation Terminology," Reaffirmed May 26, 1995, p. 12.

6. Ibid, p. 16.

7. Ibid, p. 36.

8. Ibid, p. 49.

9. Scientific Apparatus Makers Association Standard PMC 20.1-1973, "Process Measurement & Control Terminology," p. 36.

10. ANSI/ISA-51.1-1979 (R1993), "Process Instrumentation Terminology," Reaffirmed May 26, 1995, p. 61.

11. ANSI/ISA-67.04.01-2006, "Setpoints for Nuclear Safety-Related Instrumentation," May 2006.

Table 3-1
Power Range Neutron Flux – High Setpoint

Parameter	Allowance*
Process Measurement Accuracy [ ]a,c [ ]a,c	[ ]a,c
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA) [ ]a,c	
Sensor Reference Accuracy (SRA) [ ]a,c	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
Sensor Drift (SD)	
Rack Calibration Accuracy (RCA)	
Rack Measurement & Test Equipment Accuracy (RMTE)	
Rack Temperature Effect (RTE)	
Rack Drift (RD)	

* In percent span (120 % RTP)

Table 3-1 (continued)
Power Range Neutron Flux - High Setpoint

Channel Statistical Allowance =

$$\sqrt{PMA_1^2 + PMA_2^2 + PEA^2 + (SMTE + SCA)^2 + (SMTE + SD)^2 + SPE^2 + STE^2 + SRA^2 + (RMTE + RCA)^2 + (RMTE + RD)^2 + RTE^2}$$

[ ] a,c

Table 3-2
Overtemperature ΔT

Parameter	**Allowance***
Process Measurement Accuracy (PMA)	[ ]a,c
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA)	
[ ]a,c	
[ ]a,c	
Sensor Reference Accuracy (SRA)	
[ ]a,c	
[ ]a,c	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
[ ]a,c	
[ ]a,c	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
[ ]a,c	
Sensor Drift (SD)	
[ ]a,c	
[ ]a,c	
Bias	
[ ]a,c	

Table 3-2 (continued)
Overtemperature ΔT

Parameter	Allowance*
Rack Calibration Accuracy (RCA)	
[ ]a,c	[ ]a,c
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
Rack Measurement & Test Equipment Accuracy (RMTE)	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
Rack Temperature Effect (RTE)	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
Rack Drift (RD)	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	

* In percent ΔT span (Tavg - 75 °F, Pressure - 1000 psi, ΔT - 100 °F = 159.4% RTP, ΔI - 120% ΔI, ERI – 150 °F)
N_H = # of hot leg RTDs = 2
N_C = # of cold leg RTDs = 1

See Table 3-13 for gain and conversion calculations

Table 3-2 (continued)
Overtemperature ΔT

Channel Statistical Allowance =

$$
\begin{aligned}
&\Bigg| PMA_{\Delta I1}{}^2 + PMA_{\Delta I2}{}^2 + PMA_{PWR\,CAL}{}^2 + PEA^2 + \\
&\left(\sqrt{\frac{(SCA_{\Delta T} + SMTE_{\Delta T})^2 + (SD_{\Delta T} + SMTE_{\Delta T})^2 + SRA_{\Delta T}{}^2}{N_H}} + \sqrt{\frac{(SCA_{\Delta T} + SMTE_{\Delta T})^2 + (SD_{\Delta T} + SMTE_{\Delta T})^2 + SRA_{\Delta T}{}^2}{N_C}}\right)^2 + \\
&(SMTE_P + SD_P)^2 + SRA_P{}^2 + SPE_P{}^2 + STE_P{}^2 + (SMTE_P + SCA_P)^2 + \\
&\left(\sqrt{\frac{(RMTE_{ERI} + RD_{ERI})^2 + RTE_{ERI}{}^2 + (RMTE_{ERI} + RCA_{ERI})^2}{N_H}} + \sqrt{\frac{(RMTE_{ERI} + RD_{ERI})^2 + RTE_{ERI}{}^2 + (RMTE_{ERI} + RCA_{ERI})^2}{N_C}}\right)^2 + \\
&(RMTE_P + RD_P)^2 + (RMTE_P + RCA_P)^2 + RTE_P{}^2 + \\
&2 \times \left[(RMTE_{\Delta I} + RD_{\Delta I})^2 + (RMTE_{\Delta I} + RCA_{\Delta I})^2 + RTE_{\Delta I}{}^2\right] + \\
&(RMTE_{NIS} + RD_{NIS})^2 + RTE_{NIS}{}^2 + (RMTE_{NIS} + RCA_{NIS})^2 \Bigg| \\
&+ PMA_{bu\Delta T} + PMA_{buTavg} + BIAS_{pressure}
\end{aligned}
$$

Table 3-2 (continued)
Overtemperature ΔT

[ ] a,c

Table 3-3
Overpower ΔT

Parameter	Allowance*
Process Measurement Accuracy (PMA)	[ ]a,c
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
[ ]a,c	
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA)	
[ ]a,c	
Sensor Reference Accuracy (SRA)	
[ ]a,c	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
[ ]a,c	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
Sensor Drift (SD)	
[ ]a,c	
Environmental Allowance (EA)	
[ ]a,c	
Rack Calibration Accuracy (RCA)	
[ ]a,c	
[ ]a,c	

Table 3-3 (continued)
Overpower ΔT

Parameter	Allowance*
Rack Measurement & Test Equipment Accuracy (RMTE)	
[ ]a,c	[ ]a,c
Rack Temperature Effect (RTE)	
[ ]a,c	
Rack Drift (RD)	
[ ]a,c	

* In percent ΔT span (T_{avg} - 75 °F, ΔT - 100 °F = 159.4 % RTP, ERI – 150 °F)
N_H = # of hot leg RTDs = 2
N_C = # of cold leg RTDs = 1

See Table 3-14 for gain and conversion calculations

Table 3-3 (continued)
Overpower ΔT

Channel Statistical Allowance =

$$\sqrt{PMA_{PWR\ CAL}^{2} + PEA^{2} + \left(\sqrt{\frac{(SCA_{\Delta T} + SMTE_{\Delta T})^2 + (SD_{\Delta T} + SMTE_{\Delta T})^2 + SRA_{\Delta T}^{2}}{N_H} + \frac{(SCA_{\Delta T} + SMTE_{\Delta T})^2 + (SD_{\Delta T} + SMTE_{\Delta T})^2 + SRA_{\Delta T}^{2}}{N_C}}\right)^2 + \left(\frac{(RMTE_{ERI} + RD_{ERI})^2 + RTE_{ERI}^{2} + (RMTE_{ERI} + RCA_{ERI})^2}{N_H} + \frac{(RMTE_{ERI} + RD_{ERI})^2 + RTE_{ERI}^{2} + (RMTE_{ERI} + RCA_{ERI})^2}{N_C}\right)^2} + PMA_{buΔT} + PMA_{buTavg} + EA$$

a,c

[ ]

Table 3-4
High Steam Line Flow – SI, Steam Line Isolation

Parameter	Allowance*
Process Measurement Accuracy (PMA)	[ ]a,c
[ ]a,c	
[ ]a,c	
[ ]a,c	
Primary Element Accuracy (PEA)	
Steam Flow [ ]a,c	
Sensor Calibration Accuracy (SCA)	
Steam Flow [ ]a,c	
Turbine Pressure [ ]a,c	
Sensor Reference Accuracy (SRA)	
Steam Flow [ ]a,c	
Turbine Pressure [ ]a,c	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
Steam Flow [ ]a,c	
Turbine Pressure [ ]a,c	
Sensor Pressure Effects (SPE)	
Steam Flow [ ]a,c	
Sensor Temperature Effects (STE)	
Steam Flow [ ]a,c	
Turbine Pressure [ ]a,c	
Sensor Drift (SD)	
Steam Flow [ ]a,c	
Turbine Pressure [ ]a,c	
Environmental Allowances (EA)	
Steam Flow	
Turbine Pressure	
Bias	
Steam Flow – static pressure correction [ ]a,c	

Table 3-4 (continued)
High Steam Line Flow – SI, Steam Line Isolation

Parameter		Allowance*
Rack Calibration Accuracy (RCA)		[ ]a,c
Steam Flow	[ ]a,c	
Turbine Pressure	[ ]a,c	
Rack Measurement & Test Equipment Accuracy (RMTE)		
Steam Flow	[ ]a,c	
Turbine Pressure	[ ]a,c	
Rack Temperature Effect (RTE)		
Steam Flow	[ ]a,c	
Rack Drift (RD)		
Steam Flow	[ ]a,c	
Turbine Pressure	[ ]a,c	

* In percent flow span (135.9 % Span). Values are converted to flow via Equation 3-15.8 where F_{max} = 135.9 % and F_N = 114 %; therefore, gain = (1/2)(135.9/114) = 0.60.

Table 3-4 (continued)
High Steam Line Flow – SI, Steam Line Isolation

Channel Statistical Allowance =

$$\sqrt{\begin{array}{l} PEA_{SF}{}^2 + \\ (SMTE_{SF} + SCA_{SF})^2 + SRA_{SF}{}^2 + (SMTE_{SF} + SD_{SF})^2 + SPE_{SF}{}^2 + STE_{SF}{}^2 + \\ (RMTE_{SF} + RCA_{SF})^2 + (RMTE_{SF} + RD_{SF})^2 + RTE_{SF}{}^2 + \\ (SMTE_{TP} + SCA_{TP})^2 + SRA_{TP}{}^2 + (SMTE_{TP} + SD_{TP})^2 + SPE_{TP}{}^2 + STE_{TP}{}^2 + \\ (RMTE_{TP} + RCA_{TP})^2 + (RMTE_{TP} + RD_{TP})^2 + RTE_{TP}{}^2 \end{array}}$$
$$+ PMA_{1SF} + PMA_{2SF} + PMA_{TP} + Bias_1 + EA$$

[ ] a,c

Table 3-5
Steam Flow / Feedwater Flow Mismatch

Parameter		Allowance*
Process Measurement Accuracy (PMA)		[ ]a,c
[ ]a,c		
[ ]a,c		
[ ]a,c		
Primary Element Accuracy (PEA)		
Steam Flow	[ ]a,c	
Feed Flow		
Sensor Calibration Accuracy (SCA)		
Steam Flow	[ ]a,c	
Feed Flow	[ ]a,c	
Steam Pressure	[ ]a,c	
Sensor Reference Accuracy (SRA)		
Steam Flow	[ ]a,c	
Feed Flow	[ ]a,c	
Steam Pressure	[ ]a,c	
Sensor Measurement & Test Equipment Accuracy (SMTE)		
Steam Flow	[ ]a,c	
Feed Flow	[ ]a,c	
Steam Pressure	[ ]a,c	
Sensor Pressure Effects (SPE)		
Steam Flow	[ ]a,c	
Feed Flow	[ ]a,c	
Sensor Temperature Effects (STE)		
Steam Flow	[ ]a,c	
Feed Flow	[ ]a,c	
Steam Pressure	[ ]a,c	
Sensor Drift (SD)		
Steam Flow	[ ]a,c	
Feed Flow	[ ]a,c	
Steam Pressure	[ ]a,c	

Table 3-5 (continued)
Steam Flow / Feedwater Flow Mismatch

Parameter		Allowance*
Environmental Allowances (EA)		[ ]a,c
Bias		
Steam Flow - static pressure correction ($Bias_1$)	[ ]a,c	
Feedwater Flow - static pressure correction ($Bias_2$)	[ ]a,c	
Rack Calibration Accuracy (RCA)		
Steam Flow		
Feed Flow		
Rack Measurement & Test Equipment Accuracy (RMTE)		
Steam Flow		
Feed Flow		
Rack Temperature Effect (RTE)		
Feed Flow		
Rack Drift (RD)		
Steam Flow		
Feed Flow		

* In percent flow span (135.9 % Span). Values are converted to flow span via Equation 3-15.8 where F_{max} = 135.9 %, F_N (steam flow) = 100 %, and F_N (feedwater flow) = 80 %; therefore, gain (steam flow) = (1/2)(135.9/100) = 0.68 and gain (feedwater flow) = (1/2)(135.9/80) = 0.85. The gain for steam pressure = 1.2

Table 3-5 (continued)
Steam Flow / Feedwater Flow Mismatch

Channel Statistical Allowance =

$$\sqrt{\begin{array}{l}(SMTE_{SP}+SCA_{SP})^2+SRA_{SP}{}^2+(SMTE_{SP}+SD_{SP})^2+STE_{SP}{}^2+\\ PEA_{SF}{}^2+(SMTE_{SF}+SCA_{SF})^2+SRA_{SF}{}^2+(SMTE_{SF}+SD_{SF})^2+SPE_{SF}{}^2+STE_{SF}{}^2+\\ (RMTE_{SF}+RCA_{SF})^2+(RMTE_{SF}+RD_{SF})^2+\\ PEA_{FF}{}^2+(SMTE_{FF}+SCA_{FF})^2+SRA_{FF}{}^2+(SMTE_{FF}+SD_{FF})^2+SPE_{FF}{}^2+STE_{FF}{}^2+\\ (RMTE_{FF}+RCA_{FF})^2+(RMTE_{FF}+RD_{FF})^2+RTE_{FF}{}^2\end{array}}$$
$$+PMA_{1SF}+PMA_{2SF}+PMA_{FF}+Bias_1+Bias_2+EA$$

a,c

[ ]

Table 3-6
Steam Generator Water Level – Low, Low-Low

Parameter	Allowance*
Process Measurement Accuracy** [ ]a,c	[ ]a,c
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA)	
Sensor Reference Accuracy (SRA)	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
Sensor Drift (SD)	
Environmental Allowance** (EA)	
Bias** [ ]a,c	
Rack Calibration Accuracy (RCA)	
Rack Measurement & Test Equipment Accuracy (RMTE)	
Rack Temperature Effect (RTE)	
Rack Drift (RD)	

* In percent span (100 %)
** [ ]a,c

Table 3-6 (continued)
Steam Generator Water Level – Low, Low-Low

Channel Statistical Allowance =

$$\sqrt{PEA^2 + (SMTE + SCA)^2 + SRA^2 + SPE^2 + STE^2 + (SMTE + SD)^2 + (RMTE + RCA)^2 + RTE^2 + (RMTE + RD)^2}$$

$$+ Bias_1 + Bias_2 + EA + PMA_{PP} + PMA_{RL} + PMA_{FV} + PMA_{SC} + PMA_{MD}$$

[ ]a,c

Table 3-7
Steam Generator Water Level – High-High

Parameter	Allowance*
Process Measurement Accuracy** [ ]a,c	[ ]a,c
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA)	
Sensor Reference Accuracy (SRA)	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
Sensor Drift (SD)	
Environmental Allowance** (EA)	
Bias** [ ]a,c	
Rack Calibration Accuracy (RCA)	
Rack Measurement & Test Equipment Accuracy (RMTE)	
Rack Temperature Effect (RTE)	
Rack Drift (RD)	

* In percent span (100 %)
** [ ]a,c

Table 3-7 (continued)
Steam Generator Water Level – High-High

Channel Statistical Allowance =

$$-\sqrt{PEA^2 + (SMTE + SCA)^2 + SRA^2 + SPE^2 + STE^2 + (SMTE + SD)^2 + (RMTE + RCA)^2 + RTE^2 + (RMTE + RD)^2}$$

$$+ Bias_1 + Bias_5 + EA + PMA_{PP} + PMA_{RL} + PMA_{FV} + PMA_{SC} + PMA_{MD} + PMA_{DL}$$

[ ]a,c

Note: Negative sign (–) denotes direction (i.e. indicated lower than actual).

Table 3-8
Steamline Pressure – Low (SI)
Outside Containment Steam Break

Parameter	Allowance*
Process Measurement Accuracy (PMA)	[ ] a,c
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA)	
Sensor Reference Accuracy (SRA)	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
Sensor Drift (SD)	
Environmental Allowances (EA) [ ] a,c	
Bias [ ] a,c [ ] a,c	
Rack Calibration Accuracy (RCA)	
Rack Measurement & Test Equipment Accuracy (RMTE)	
Rack Temperature Effect (RTE)	
Rack Drift (RD)	

* In percent span (1400 psig)

Table 3-8 (continued)
Steamline Pressure – Low (SI)
Outside Containment Steam Break

Channel Statistical Allowance =

$$\sqrt{PMA^2 + PEA^2 + (SMTE + SCA)^2 + SRA^2 + (SMTE + SD)^2 + SPE^2 + STE^2 + (RMTE + RCA)^2 + (RMTE + RD)^2 + RTE^2}$$

$$+ EA + Bias_1 + Bias_2$$

a,c

[ ]

Table 3-9
Steamline Pressure – Low (SI)
Inside Containment Steam Break

Parameter	Allowance*
Process Measurement Accuracy (PMA)	[ ] a,c
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA)	
Sensor Reference Accuracy (SRA)	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
Sensor Drift (SD)	
Environmental Allowances (EA) [ ] a,c	
Bias [ ] a,c [ ] a,c	
Rack Calibration Accuracy (RCA)	
Rack Measurement & Test Equipment Accuracy (RMTE)	
Rack Temperature Effect (RTE)	
Rack Drift (RD)	

* In percent span (1400 psig)

Table 3-9 (continued)
Steamline Pressure – Low (SI)
Inside Containment Steam Break

Channel Statistical Allowance =

$$\sqrt{PMA^2 + PEA^2 + (SMTE + SCA)^2 + SRA^2 + (SMTE + SD)^2 + SPE^2 + STE^2 + (RMTE + RCA)^2 + (RMTE + RD)^2 + RTE^2}$$

$$+ EA + Bias_1 + Bias_2$$

[ ] a,c

Table 3-10
Reactor Coolant Flow - Low

Parameter	Allowance*
Process Measurement Accuracy (PMA) [ ]a,c [ ]a,c	[ ]a,c
Primary Element Accuracy (PEA) [ ]a,c	
Sensor Calibration Accuracy (SCA) [ ]a,c	
Sensor Reference Accuracy (SRA) [ ]a,c	
Sensor Measurement & Test Equipment Accuracy (SMTE) [ ]a,c	
Sensor Pressure Effects (SPE) [ ]a,c	
Sensor Temperature Effects (STE) [ ]a,c	
Sensor Drift (SD) [ ]a,c	
Rack Calibration Accuracy (RCA) [ ]a,c	
Rack Measurement & Test Equipment Accuracy (RMTE) [ ]a,c	
Rack Temperature Effect (RTE) [ ]a,c	
Rack Drift (RD) [ ]a,c	

* In % flow span (120 % Thermal Design Flow). Percent ΔP span converted to flow span via Equation 3-15.8, with Fmax = 120 % and FN = 90 %, therefore, gain = (1/2) (120% / 90%) = 0.67.

Table 3-10 (continued)
Reactor Coolant Flow - Low

Note the CSA equation for this function has been defined by FPL as:

Channel Statistical Allowance =

$$\sqrt{\begin{array}{l} PMA_1^{\,2} + PMA_2^{\,2} + PEA^2 + \\ \left\{\sqrt{PEA^2 + (SMTE + SCA)^2 + (SMTE + SD)^2 + STE^2 + SPE^2 + SRA^2}\right\}^2 + \\ (SMTE + SCA)^2 + (SMTE + SD)^2 + STE^2 + SPE^2 + SRA^2 + \\ (RMTE + RCA)^2 + (RMTE + RD)^2 + RTE^2 \end{array}}$$

[ ] a,c

Table 3-11
Emergency Trip Header Low Pressure

Parameter	Allowance*
Process Measurement Accuracy (PMA)	[ ] a,c
Primary Element Accuracy (PEA)	
Sensor Calibration Accuracy (SCA)	
Sensor Reference Accuracy (SRA)	
Sensor Measurement & Test Equipment Accuracy (SMTE)	
Sensor Pressure Effects (SPE)	
Sensor Temperature Effects (STE)	
Sensor Drift (SD)	
Rack Calibration Accuracy (RCA)	
Rack Measurement & Test Equipment Accuracy (RMTE)	
Rack Temperature Effect (RTE)	
Rack Drift (RD)	

* In percent span (3300 psig)

Table 3-11 (continued)
Emergency Trip Header Low Pressure

Channel Statistical Allowance =

$$\sqrt{PMA^2 + PEA^2 + (SMTE + SCA)^2 + SRA^2 + (SMTE + SD)^2 + SPE^2 + STE^2 + (RMTE + RCA)^2 + (RMTE + RD)^2 + RTE^2}$$

a,c

[ ]

Table 3-12
Reactor Trip System / Engineered Safety Features Actuation System Channel Error Allowances
Turkey Point Units 3 & 4 (FPL/FLA)

		SENSOR									INSTRUMENT RACK												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
	PROTECTION CHANNEL	PROCESS MEASUREMENT ACCURACY (1)	PRIMARY ELEMENT ACCURACY (1)	CALIBRATION ACCURACY (1)	REFERENCE ACCURACY (1)	MEASUREMENT & TEST EQUIPMENT ACCURACY (1)	PRESSURE EFFECTS (1)	TEMPERATURE EFFECTS (1)	DRIFT (1)	ENVIRONMENTAL ALLOWANCE (1)	CALIBRATION ACCURACY (1)	MEASUREMENT & TEST EQUIPMENT ACCURACY (1)	TEMPERATURE EFFECTS (1)	DRIFT (1)	SAFETY ANALYSIS LIMIT (2 or 3)	ALLOWABLE VALUE (4)	NOMINAL TRIP SETPOINT (4)	TOTAL ALLOWANCE (1)	CHANNEL STATISTICAL ALLOWANCE (1)	MARGIN (1)	AS LEFT TOLERANCE (ALT) (35)	AS FOUND TOLERANCE (AFT) (35)	
1	POWER RANGE NEUTRON FLUX – HIGH SETPOINT	[												]a,c	115% RTP	108.6% RTP	106% RTP	5.8	[			]a,c	1
2	OVERTEMPERATURE ΔT ΔT CHANNEL TAVG CHANNEL PRESSURIZER PRESSURE CHANNEL f(ΔI) CHANNEL NIS CHANNEL														FUNCTION (11)	FUNCTION (12)	FUNCTION (12)	8.8ΔT Span					2
3	OVERPOWER ΔT ΔT CHANNEL Tavg CHANNEL														FUNCTION (11)	FUNCTION (13)	FUNCTION (13)	3.8ΔT Span					3
4	HIGH STEAMLINE FLOW – SI, STEAM LINE ISOLATION STEAM FLOW TURBINE PRESSURE														60% / 129% full steam flow	41.2% / 114.4% full steam flow	40% / 114% full steam flow	14.7 / 11.0 flow span					4
5	STEAM FLOW / FEEDWATER FLOW MISMATCH STEAM FLOW FEEDWATER FLOW STEAM PRESSURE														---	20.7% below rated steam flow	20% below rated steam flow	---					5
6	STEAM GENERATOR WATER LEVEL – LOW, LOW-LOW														4% span	15.5% span	16% span	12.0					6
7	STEAM GENERATOR WATER LEVEL – HIGH-HIGH														98.8% span (30)	80.5% span	80% span	16.8					7
8	STEAMLINE PRESSURE – LOW (SI) OUTSIDE CONTAINMENT STEAM BREAK														432.3 psig	607 psig	614 psig	13.0					8
9	STEAMLINE PRESSURE – LOW (SI) INSIDE CONTAINMENT STEAM BREAK														568.3 psig	607 psig	614 psig	3.4					9
10	REACTOR COOLANT FLOW – LOW														84.5% thermal design flow	89.6% thermal design flow	90% thermal design flow	4.6 flow span					10
11	EMERGENCY TRIP HEADER LOW PRESSURE	[												]a,c	(36)	901 psig	1000 psig	---	[			]a,c	11

NOTES:

1. All values percent of span unless otherwise noted.
2. As noted in Chapter 14 of the UFSAR.
3. Not included in Chapter 14 of UFSAR but used in Safety Analysis.
4. As noted in Tables 2.2-1 and 3.3-3 of the Plant Technical Specifications.
5. [ ]a,c
6. [ ]a,c
7. [ ]a,c
8. [ ]a,c
9. [ ]a,c
10. [ ]a,c
11. As noted in Figure 7.2-1 of the UFSAR.
12. As noted in Table 2.2-1, Notes 1 and 2 of the Plant Technical Specifications.
13. As noted in Table 2.2-1, Notes 3 and 4 of the Plant Technical Specifications.
14. [ ]a,c
15. [ ]a,c
16. [ ]a,c
17. Incore/Excore f(ΔI) comparison as noted in Table 4.3-1 of Plant Technical Specifications.
18. [ ]a,c
19. [ ]a,c
20. [ ]a,c
21. [ ]a,c
22. [ ]a,c
23. [ ]a,c
24. [ ]a,c
25. [ ]a,c
26. [ ]a,c
27. [ ]a,c
28. [ ]a,c
29. [ ]a,c
30. [ ]a,c
31. [ ]a,c
32. [ ]a,c
33. [ ]a,c
34. [ ]a,c
35. Based on Rack Calibration Accuracy (RCA) in % span.
36. Not used in the safety analysis.

Table 3-13
Overtemperature ΔT Calculations

The equation for Overtemperature ΔT is:

$$\Delta T \frac{(1+\tau_1 S)}{(1+\tau_2 S)}\left(\frac{1}{1+\tau_3 S}\right) \le \Delta T_0 \left\{ K_1 - K_2 \frac{(1+\tau_4 S)}{(1+\tau_5 S)}\left[T \frac{1}{(1+\tau_6 S)} - T' \right] + K_3 (P - P') - f_1(\Delta I) \right\}$$

K_1 (nominal)	≤	1.31
K_1 (max)	=	[ ] a,c
K_2	≥	0.023/°F
K_3	≥	0.00116/psi
ΔT	=	62.74 °F smallest ΔT allowance for uprate conditions
ΔI gain	=	2.37 %

PMA conversions:

ΔI ($PMA_{\Delta I1}$)	=	[ ] a,c
ΔI ($PMA_{\Delta I2}$)	=	
ΔT ($PMA_{bu\Delta T}$)	=	
T_{avg} (PMA_{buTavg}) *	=	
Power Cal. ($PMA_{PWR\ CAL}$)	=	

Pressure gain	=	[ ] a,c
Pressure (SCA_P)	=	
Pressure (SRA_P)	=	
Pressure ($SMTE_P$)	=	
Pressure (STE_P)	=	
Pressure (SD_P)	=	
Pressure (RCA_P)	=	
Pressure ($RMTE_P$)	=	
Pressure (RTE_P)	=	
Pressure (RD_P)	=	
Pressure ($Bias_1$)	=	

Table 3-13 (continued)
Overtemperature ΔT Calculations

ERI conversion	=	[ ]a,c
ERI (RCA_{ERI})	=	
ERI ($RMTE_{ERI}$)	=	
ERI (RTE_{ERI})	=	
ERI (RD_{ERI})	=	

ΔI conversion	=	[ ]a,c
ΔI ($RCA_{\Delta I}$)	=	
ΔI ($RMTE_{\Delta I}$)	=	
ΔI ($RTE_{\Delta I}$)	=	
ΔI ($RD_{\Delta I}$)	=	

NIS conversion	=	[ ]a,c
NIS (RCA_{NIS})	=	
NIS ($RMTE_{NIS}$)	=	
NIS (RTE_{NIS})	=	
NIS (RD_{NIS})	=	

Total Allowance = [ ]a,c = 8.8 % ΔT span

*T_{avg} burndown allowance, T' – T_{ref} mismatch, accounted for in safety analyses

Table 3-14
Overpower ΔT Calculations

The equation for Overpower ΔT is:

$$\Delta T \frac{(1+\tau_1 S)}{(1+\tau_2 S)}\left(\frac{1}{1+\tau_3 S}\right) \le \Delta T_0 \left\{ K_4 - K_5 \frac{\tau_7 S}{1+\tau_7 S}\left(\frac{1}{1+\tau_6 S}\right) T - K_6 \left[T \frac{1}{1+\tau_6 S} - T'' \right] - f_2(\Delta I) \right\}$$

K_4 (nominal)	≤	1.10
K_4 (max)	=	[ ]^{a,c}
K_5	=	0.0/°F
K_6	≥	0.0016/°F for T > T" and K_6 = 0 for T≤ T"
ΔT	≥	62.74 °F smallest ΔT allowance for uprate conditions

PMA conversions:

ΔT ($PMA_{buΔT}$)	=	[ ]^{a,c}
T_{avg} (PMA_{buTavg}) *	=	
Power Cal. ($PMA_{PWR\ CAL}$)	=	

ERI conversion	=	[ ]^{a,c}
ERI (RCA_{ERI})	=	
ERI ($RMTE_{ERI}$)	=	
ERI (RTE_{ERI})	=	
ERI (RD_{ERI})	=	

Total Allowance = [ ]^{a,c} = 3.8 % ΔT span

* T_{avg} burndown allowance, T' – T_{ref} mismatch, accounted for in safety analyses

Table 3-15
ΔP Measurements Expressed in Flow Units

The ΔP accuracy expressed as percent of span of the transmitter applies throughout the measured span, i.e., ± 1.5 % of 100 inches ΔP = ± 1.5 inches anywhere in the span. Because $F^2 = f(\Delta P)$ the same cannot be said for flow accuracies. When it is more convenient to express the accuracy of a transmitter in flow terms, the following method is used:

$$(F_N)^2 = \Delta P_N$$

where N = Nominal Flow

$$2 F_N \partial F_N = \partial \Delta P_N$$

thus

$$\partial F_N = \frac{\partial \Delta P_N}{2 F_N} \qquad \text{Eq. 3-15.1}$$

Error at a point (not in percent) is:

$$\frac{\partial F_N}{F_N} = \frac{\partial \Delta P_N}{2(F_N)^2} = \frac{\partial \Delta P_N}{2 \Delta P_N} \qquad \text{Eq. 3-15.2}$$

and

$$\frac{\Delta P_N}{\Delta P_{max}} = \frac{(F_N)^2}{(F_{max})^2} \qquad \text{Eq. 3-15.3}$$

where max = maximum flow and the transmitter ΔP error is:

$$\frac{\partial \Delta P_N}{\Delta P_{max}}(100) = \text{percent error in Full Scale } \Delta P \text{ (\% } \varepsilon \text{ FS } \Delta P) \qquad \text{Eq. 3-15.4}$$

Table 3-15 (continued)
ΔP Measurements Expressed in Flow Units

Therefore,

$$\frac{\partial F_N}{F_N} = \frac{\Delta P_{max}\left[\frac{\% \varepsilon FS \Delta P}{100}\right]}{2\Delta P_{max}\left[\frac{F_N}{F_{max}}\right]^2} = \left[\frac{\% \varepsilon FS \Delta P}{(2)(100)}\right]\left[\frac{F_{max}}{F_N}\right]^2 \qquad \text{Eq. 3-15.5}$$

Error in flow units is:

$$\partial F_N = F_N\left[\frac{\% \varepsilon FS \Delta P}{(2)(100)}\right]\left[\frac{F_{max}}{F_N}\right]^2 \qquad \text{Eq. 3-15.6}$$

Error in percent nominal flow is:

$$\frac{\partial F_N}{F_N}(100) = \left[\frac{\% \varepsilon FS \Delta P}{2}\right]\left[\frac{F_{max}}{F_N}\right]^2 \qquad \text{Eq. 3-15.7}$$

Error in percent full span is:

$$\frac{\partial F_N}{F_{max}}(100) = \left[\frac{F_N}{F_{max}}\right]\left[\frac{\% \varepsilon FS \Delta P}{(2)(100)}\right]\left[\frac{F_{max}}{F_N}\right]^2(100)$$

$$= \left[\frac{\% \varepsilon FS \Delta P}{2}\right]\left[\frac{F_{max}}{F_N}\right] \qquad \text{Eq. 3-15.8}$$

Equation 3-15.8 is used to express errors in percent full span in this document.

4.0 APPLICATION OF THE SETPOINT METHODOLOGY

4.1 Uncertainty Calculation Basic Assumptions / Premises

The equations noted in Sections 2 and 3 are based on several premises. These are:

1) The instrument technicians make reasonable attempts to achieve the NTS as an "as left" condition at the start of each process rack's surveillance interval.

2) The process rack drift will be evaluated (probability distribution function characteristics and drift magnitude) over multiple surveillance intervals. Process rack drift is defined as the arithmetic difference between previous as left and current as found values.

3) The process rack calibration accuracy will be evaluated (probability distribution function characteristics and calibration magnitude) over multiple surveillance intervals.

4) The process racks, including the bistables, are verified/functionally tested in a string or loop process.

It should be noted for (1) above that it is not necessary for the instrument technician to recalibrate a device or channel if the "as found" condition is not exactly at the nominal condition, but is within the two-sided ALT. As noted above, the uncertainty calculations assume that the ALT (conservative and non-conservative direction) is satisfied on a reasonable, statistical basis, not that the nominal condition is satisfied exactly. This evaluation assumes that the RCA and RD parameter values noted in Tables 3-1 through 3-11 are satisfied on at least a two-sided 95 % probability / 95 % confidence level basis. It is therefore necessary for the plant to periodically reverify the continued validity of these assumptions. This prevents the institution of non-conservative biases due to a procedural basis without the plant staff's knowledge and appropriate treatment.

In summary, a process rack channel is considered to be "calibrated" when the two-sided ALT is satisfied. An instrument technician may determine to recalibrate if near the extremes of the ALT, but it is not required. Recalibration is explicitly required any time the "as found" condition of the device or channel is outside of the ALT. A device or channel may not be left outside the ALT without declaring the channel "inoperable" and appropriate action taken. Thus, an ALT may be considered as an outer limit for the purposes of calibration and instrument uncertainty calculations.

From the above it should be noted that the discussion was limited to the ALT. Nothing was said with respect to the AFT. That is because, for Westinghouse supplied process racks, drift is expected to be small with respect to the ALT. Statistical evaluations of Westinghouse supplied process racks (Hagan, Foxboro, 7100, 7300 and Eagle-21) have determined that an operable process rack channel with an as left condition near the NTS should have an as found condition near the NTS on the next surveillance, and well within the two-sided ALT about the NTS. Thus, Westinghouse has concluded that for operable racks AFT = ALT = RCA.

The above results in the Westinghouse Setpoint Methodology's reliance on the NTS and not the Limiting Trip Setpoint (LTSP) as defined in ISA 67.04.01-2006 [(1)] or the Limiting Setpoint (LSP) as defined in RIS 2006-17 [(2)]. Specific to Reference 2, the LSP is noted as: "... the limiting setting for the channel trip setpoint (TSP) considering all credible instrument errors associated with the instrument channel. The LSP is the limiting value to which the channel must be reset at the conclusion of periodic testing to ensure the safety limit (SL) will not be exceeded if a design basis event occurs before the next periodic surveillance or calibration." As noted on the previous page, with respect to the Westinghouse Setpoint Methodology, operability of the process racks is defined as the ability to be calibrated about the NTS (ALT about the NTS) and subsequent surveillance should find the channel within the AFT = ALT about the NTS. On those rare occasions that the channel is found outside of the AFT = ALT, then operability requirements would be initially satisfied via recalibration, or reset, about the NTS. Operability defined as conservative with respect to a zero margin LSP is a concept that is insufficient for the Westinghouse Setpoint Methodology, and is inconsistent with its basic assumption of the AFT = ALT = RCA definition. In order to have confidence (statistical or otherwise) of appropriate operation of the process racks, it is necessary that the process racks operate within the two-sided limits defined about the NTS. This is particularly true for protection functions that have historical NTS values that generate large Margins. From a Westinghouse Setpoint Methodology perspective, systematic allowance of large drift magnitudes in excess of equipment design – either by large magnitude RD or RMTE terms or utilization of an LSP, generates a false sense of security which is inappropriate for future operation consideration, and which erodes the concept of performance based specifications and limits.

4.2 Process Rack Operability Determination Program and Criteria

The parameter of most interest as a first pass operability criterion is relative drift ("as found" – "as left") found to be within RD, where RD is the two-sided 95/95 drift value assumed for that channel. However, this would require the instrument technician to record both the "as left" and "as found" conditions and perform a calculation in the field. This field calculation requires having the "as left" value for that device at the time of drift determination and Turkey Point Units 3 and 4 have elected to have a plant specific requirement to determine if the drift allowance assumptions were exceeded since the last calibration activity.

An alternative for the process racks is the Westinghouse method for use of a fixed magnitude, two-sided AFT about the NTS. It would be reasonable for this AFT to be RMTE + RD, where RD is the actual statistically determined 95/95 drift value and RMTE is defined in the Turkey Point Units 3 and 4 procedures. However, comparison of this value with the RCA tolerance utilized in the Westinghouse uncertainty calculations would yield a value where the AFT is less than the RCA tolerance (ALT). This is due to RD being defined as a relative drift magnitude as opposed to an absolute drift magnitude and the process racks being very stable, i.e., no significant drift. Thus, it is not reasonable to use this criterion as an AFT in an absolute sense, as it conflicts with the second criterion for operability determination, which is the ability of the equipment to be returned to within its calibration tolerance. That is, a channel could be found outside the absolute drift criterion, yet be inside the calibration criterion. Therefore, a more reasonable approach for the plant staff was determined. An AFT criterion based on an absolute magnitude that is the same as the RCA criterion, i.e., the allowed deviation from the NTS on an absolute indication basis is plus or minus the RCA tolerance (ALT). A process loop found inside the RCA tolerance (ALT) on an indicated basis is considered to be operable. A channel found outside the RCA tolerance (ALT) is evaluated and recalibrated. The channel must be returned to within the ALT, for the channel to be considered operable. This criterion is incorporated into plant, function specific calibration and drift procedures as the defined ALT about the NTS. At a later date, once the "as found" data is compiled, the relative drift ("as found"– "as left") can be calculated and compared against the RD value. This comparison can then be utilized to ensure consistency with the assumptions of the uncertainty calculations documented in Tables 3-1 through 3-11. A channel found to exceed this criterion multiple times should trigger a more comprehensive evaluation of the operability of the channel.

It is believed that a Turkey Point Units 3 and 4 systematic program of drift and calibration review used for the process racks is acceptable as a set of first pass criteria. More elaborate evaluation and monitoring may be included, as necessary, if the drift is found to be excessive or the channel is found difficult to calibrate. Based on the above, it is believed that the total process rack program used at Turkey Point Units 3 and 4 will provide a more comprehensive evaluation of operability than a simple determination of an acceptable "as found."

4.3 Application to the Plant Technical Specifications

The drift operability criteria described for the process racks in Section 4.2 would be based on a statistical evaluation of the performance of the installed hardware. Thus this criterion would change if the M&TE is changed, or the procedures used in the surveillance process are changed significantly and particularly if the process rack modules themselves are changed. Therefore, the operability criteria are not expected to be static. In fact they are expected to change as the characteristics of the equipment change. This does not imply that the criteria can increase due to increasingly poor performance of the equipment over time; but rather just the opposite. As new and better equipment and processes are instituted, the operability criteria magnitudes would be expected to decrease to reflect the increased capabilities of the replacement

equipment. For example, if the plant purchased some form of equipment that allowed the determination of relative drift in the field, it would be expected that the rack operability would then be based on the RD value.

Sections 4.1 and 4.2 are basically consistent with the recommendations of the Westinghouse paper presented at the June 1994, ISA/EPRI conference in Orlando, FL[3]. In addition, the plant operability determination processes described in Sections 4.2 and 4.3 are consistent with the basic intent of the ISA paper [1].

Therefore the AVs for the Turkey Point Units 3 and 4 Technical Specifications are "performance based" and are determined by adding (or subtracting) the calibration accuracy (RCA=ALT) of the device tested during the Channel Operational Test to the NTS in the non-conservative direction (i.e., toward or closer to the SAL) for the application.

Two examples of the AV, ALT and AFT calculations are as follows:

- *Power Range Neutron Flux - High*

<u>Allowable Value Determination</u>

NTS = 108% RTP
SPAN = 120% RTP
RCA = 0.6% RTP [ ]a,c
SAL = 115% RTP

AV = NTS + RCA
AV = 108% RTP + 0.6% RTP
AV = 108.6% RTP

<u>ALT/AFT Determination</u>

NTS = 108% RTP
SPAN = 120% RTP
RCA = 0.6% RTP [ ]a,c

ALT = NTS ± RCA
ALT = 108.6% RTP [ ]a,c
ALT = 107.4% RTP [ ]a,c

AFT = NTS ± RCA
AFT = 108.6% RTP [ ]a,c
AFT = 107.4% RTP [ ]a,c

- *Steamline Pressure - Low (SI)*

Allowable Value Determination

NTS = 614 psig
SPAN = 1400 psig
RCA = 7 psig [ ]^{a,c}
SAL = 432.2 psig

AV = NTS – RCA
AV = 614 psig – 7 psig
AV = 607 psig

ALT/AFT Determination

NTS = 614 psig
SPAN = 1400 psig
RCA = 7 psig [ ]^{a,c}

ALT = NTS ± RCA
ALT = 621 psig [ ]^{a,c}
ALT = 607 psig [ ]^{a,c}

AFT = NTS ± RCA
AFT = 621 psig [ ]^{a,c}
AFT = 607 psig [ ]^{a,c}

4.4 References / Standards

1. ANSI/ISA-67.04.01-2006, "Setpoints for Nuclear Safety-Related Instrumentation," May 2006.

2. NRC Regulatory Issue Summary 2006-17, "NRC Staff Position on the Requirements of 10 CFR 50.36, "Technical Specifications," Regarding Limiting Safety System Settings During Periodic Testing and Calibration of Instrument Channels," August 2006.

3. Tuley, C. R., Williams, T. P., "The Allowable Value in the Westinghouse Setpoint Methodology – Fact or Fiction?" presented at the Thirty-Seventh Power Instrumentation Symposium (4th Annual ISA/EPRI Joint Controls and Automation Conference), Orlando, FL, June 1994.

Turkey Point Units 3 and 4

RESPONSE TO NRC RAI REGARDING EPU LAR NO. 205
AND EICB INSTRUMENTATION AND CONTROLS ISSUES

ATTACHMENT 4

Westinghouse Affidavit CAW-11-3173 for Attachment 3
June 16, 2011

This coversheet plus 8 pages

Westinghouse

Westinghouse Electric Company
Nuclear Services
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Direct tel: (412) 374-4643
Direct fax: (724) 720-0754
e-mail: greshaja@westinghouse.com
Proj letter: FPL-11-139

CAW-11-3173

June 16, 2011

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: FPL-11-139 P-Attachment, "Turkey Point Units 3 and 4 – Response to NRC Request for Additional Information (RAI) from the Instrumentation and Control Engineering Branch (EICB) Related to Extended Power Uprate (EPU) License Amendment Request (LAR) No. 205 (TAC Nos. ME 4907 and ME 4908)" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-11-3173 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 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Florida Power and Light.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-11-3173, and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance

Enclosures

CAW-11-3173

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared J. A. Gresham, 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:

J. A. Gresham, Manager
Regulatory Compliance

Sworn to and subscribed before me
this 16th day of June 2011

Cynthia Olesky
Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory Compliance, 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 Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse 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 2.390 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 10 CFR Section 2.390; 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 FPL-11-139 P-Attachment, "Turkey Point Units 3 and 4 – Response to NRC Request for Additional Information (RAI) from the Instrumentation and Control Engineering Branch (EICB) Related to Extended Power Uprate (EPU) License Amendment Request (LAR) No. 205 (TAC Nos. ME 4907 and ME 4908)" (Proprietary) for submittal to the Commission, being transmitted by Florida Power and Light letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for use by Turkey Point Units 3 and 4 is expected to be applicable for other licensee submittals in response to certain NRC requirements for Extended Power Uprate submittals and may be used only for that purpose.

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

(a) Provide input to the U.S. Nuclear Regulatory Commission for review of the Turkey Point EPU submittals.

(b) Provide results of customer specific calculations.

(c) Provide licensing support for customer submittals.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of the information to its customers for the purpose of meeting NRC requirements for licensing documentation associated with EPU submittals.

(b) Westinghouse can sell support and defense of the technology to its customer in licensing process.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

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 information 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 2.390 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 2.390(b)(1).

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The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.390 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

Turkey Point Units 3 and 4

RESPONSE TO NRC RAI REGARDING EPU LAR NO. 205
AND EICB INSTRUMENTATION AND CONTROLS ISSUES

ATTACHMENT 6

Westinghouse Affidavit CAW-11-3194 for Attachment 5
June 17, 2011

This coversheet plus 7 pages

Westinghouse

Westinghouse Electric Company
Nuclear Services
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Direct tel: (412) 374-4643
Direct fax: (724) 720-0754
e-mail: greshaja@westinghouse.com
Proj letter: FPL-11-146

CAW-11-3194

June 17, 2011

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-17070-P, Revision 1, "Westinghouse Setpoint Methodology for Protection Systems Turkey Point Units 3 & 4 (Power Uprate to 2644 MWt – Core Power)" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-11-3194 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 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Florida Power and Light (FPL).

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-11-3194, and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance

Enclosures

CAW-11-3194

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared J. A. Gresham, 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:

J. A. Gresham, Manager
Regulatory Compliance

Sworn to and subscribed before me
this 17th day of June 2011

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory Compliance, 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 Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse 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 2.390 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 10 CFR Section 2.390; 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-17070-P, Revision 1, "Westinghouse Setpoint Methodology for Protection Systems Turkey Point Units 3 & 4 (Power Uprate to 2644 MWt – Core Power)" (Proprietary), dated June 2011, for submittal to the Commission, being transmitted by Florida Power and Light letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted for use by Westinghouse for Turkey Point Nuclear Power Plants Units 3 and 4 is expected to be applicable for other licensee submittals in response to certain NRC requirements for justification of protection systems setpoints.

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

(a) Provide information in support of plant power uprate licensing submittals.

(b) Provide customer specific calculations.

(c) Provide licensing support for customer submittals.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purpose of meeting NRC requirements for licensing documentation associated with power uprate licensing submittals.

(b) Westinghouse can sell support and defense of the technology to its customer in the licensing process.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

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 information 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 2.390 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 2.390(b)(1).

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