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FOREWORD

The Westinghouse Protection System Setpoint Study provides a basis for the Reactor Protection System, and Engineered Safety Features Actuation System values contained in the Technical Specifications. This report contains the results associated with implementation of the Technical Specifications as well as recommended Trip Setpoints.

The following changes have been made to this document revision:

Pages 2-5 – Updated Reference 4
Pages 3-1 & 3-8 – Updated Reference 6
Page 3-7 – Replaced Reference 6 with Reference 7
Page 3-8 – Added Reference 7
Tables 3-11, 3-18, 3-25, and 2.2-1 (pgs. A-3, A-12)

ACKNOWLEDGMENTS

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1 INTRODUCTION

In Generic Letter 91-04,[1] the NRC has noted that uncertainty calculations should be performed in a manner which results in values at a high probability and a high confidence level. The implication of this is that a more statistically rigorous calculation is required. In addition, Generic Letter 91-18[2] clarifies the NRC's definition of operability. In particular, Generic Letter 91-04 provides guidance on the use of statistically derived drift values based on plant specific operational data. In response to these documents and because of the use of uncertainty values derived from actual plant data, Westinghouse has modified the basic uncertainty algorithm. To address the requirements for a definitive basis for drift, explicit calculations were made to determine appropriate values for the transmitters/sensors.

The basic Westinghouse approach to an uncertainty calculation is to achieve an understanding of the plant instrumentation calibration and operability verification processes. The uncertainty algorithm resulting from this understanding can be function specific, i.e., is very likely different for two functions if their calibration or operability determination processes are different. Effort is expended in determination of what parameters are dependent statistically or functionally. Those parameters that are determined to be independent are treated accordingly. This allows the use of a Square-Root-Sum-Of-The-Squares (SRSS) summation of the various components. A direct benefit of the use of this technique is increased margin in the total allowance. For those parameters determined to be dependent, appropriate (conservative) summation techniques are utilized. An explanation of the overall approach is provided in Section 2.

Section 3 provides a description, or definition, of each of the various components, to allow a clear understanding of the methodology. Also provided is a detailed example of each setpoint margin calculation demonstrating the methodology and noting how each parameter value is utilized. In all cases, margin exists between the summation and the total allowance.

Section 4 provides a description of the methodology utilized in the determination of the Diablo Canyon Units 1 and 2 Technical Specifications and an explanation of the relationship between a trip setpoint and an operability verification. An Appendix is provided noting a recommended set of Technical Specifications using the plant specific data and the revised Westinghouse approach that reflects the plant specific operability verification process.

1.1 REFERENCES/STANDARDS

1. Generic Letter 91-04, 1991, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24 Month Fuel Cycle."

2. Generic Letter 91-18, 1991, "Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability."

2 COMBINATION OF UNCERTAINTY COMPONENTS

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 which has been utilized in other Westinghouse reports. 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, and Instrument Society of America 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 noted in an ISA paper presented in 1992[5].

The relationship between the uncertainty components and the calculated uncertainty for a channel is given in Eq. 2.1,

$$CSA = \{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SMTE + SCA)^2 + (SPE)^2 + (STE)^2 + (SRA)^2 + (RMTE + RD)^2 + (RMTE + RCA)^2 + (RMTE + RCSA)^2 + (RTE)^2\}^{1/2} + EA + BIAS \quad \text{(Eq. 2.1)}$$

where:

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

This equation was originally designed to address analog process racks with bistables. Digital process racks generally operate in a different manner by simulating a bistable. The protection function setpoint is a value held in memory. The digital process racks compare the functions value with the value stored in memory. A trip is initiated when the function input corresponds to or exceeds the value in memory. Thus, with the absence of a physical bistable, the RCSA term can be eliminated. Equation 2.1 represents a slight variation from the equations noted in Reference 5. In particular, it has been determined that the calibration accuracies (SCA and RCA) can be treated as random terms rather than biases. This determination for SCA is based on evaluations which showed that the sensor As Left data can be generally characterized as having a near zero mean and a small standard deviation. Although the Eagle 21 rack As Left data was not evaluated, it is considered to be a random term based on the self-checking feature of the Eagle 21 System.

As can be seen in Equation 2.1, drift and calibration accuracy allowances are treated as dependent parameters with the measuring and test equipment uncertainties. The environmental allowance is not necessarily considered dependent with all other parameters, but as an additional degree of conservatism is added to the statistical sum. Bias terms are one directional with a known magnitude and are added to the statistical sum. The calibration terms are treated in the same radical based on the Generic Letter 91-04[6] requirement for general trending. Pacific Gas & Electric (PG&E) has indicated that trending will be performed to support the requirements of Generic Letter 91-04. This results in a net reduction of the CSA magnitude over that which would be determined if trending was not performed.

It should be noted here that uncertainties for several Reactor Protection System channels were not recalculated by Westinghouse as part of the 24-month fuel cycle evaluation. These channels are the Power Range Neutron Flux High and Low Setpoints, the Power Range Neutron Flux High Positive and High Negative Rates, the Intermediate Range Neutron Flux, and the Source Range Neutron Flux. The CSA equation used for combining the uncertainty components for these channels is the same one used in Revision 2 of WCAP-11082, "Westinghouse Setpoint Methodology for Protection Systems, Diablo Canyon Units 1 and 2, Eagle 21 Version," supporting the current Diablo Canyon Technical Specifications setpoints for those channels. That CSA equation assumed that calibration accuracy and drift are dependent terms, and results in a more conservative CSA than would be obtained if these channels were reevaluated with Equation 2.1. Although these channels were not part of the 24-month fuel cycle evaluation, they have been included in this WCAP for completeness. The uncertainties associated with the Intermediate Range Neutron Flux and the Source Range Neutron Flux channels have been updated by PG&E.

The results in this document are based on the premise that the instrument surveillance program at Diablo Canyon Units 1 and 2 consists of a combination of quarterly rack tests and sensor/relay calibrations performed each refueling outage. Digital Rack Drift is based on system design. Process Measurement Accuracy [7] terms are considered to be conservative values. The cable insulation resistance degradation terms, the reference leg heatup uncertainty for steam generator level, and the transmitter Environmental Allowance terms for transmitters not supplied through Westinghouse were developed by PG&E.

2.2 SENSOR ALLOWANCES

Six parameters are considered to be sensor allowances: SCA, SRA, SMTE, SD, STE, and SPE (see Table 3-25). Of these parameters, three are considered to be independent (SRA, STE and SPE), and three are considered dependent with at least one other term (SCA, SMTE and SD). SRA is the manufacturer's reference accuracy that is achievable by the device. This term is introduced to address repeatability and hysteresis concerns when only performing a single pass calibration, i.e., one up and one down[5]. 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. An example of this would be as follows. Assume a sensor is placed in some position in the containment during a refueling outage. After placement, an instrument technician calibrates the sensor. This calibration is performed at ambient pressure and temperature conditions. At some later plant shutdown, an instrument technician checks the sensor's performance using the same technique as for the initial calibration and from the two sets of readings a drift value can be determined. The ambient temperature and pressure conditions should be essentially the same as those for the initial calibration. Therefore, these conditions have no significant impact on the drift determination and are independent of the drift allowance. The discussion about calibration at plant shutdown is for illustrative purposes only and shutdown is not a necessary condition for the data to be valid. Any variations in the data due to changes in calibration temperature will be inherent in the drift result.

SCA, SMTE and SD are considered to be dependent for the same reason that STE and SPE are considered independent; i.e., due to the manner in which the instrumentation is checked. When calibrating a sensor, the sensor output is checked to determine if it is accurately representing the input. The sensor response, measured by applying known inputs and recording the sensor output, involves the calibrated accuracy of both the sensor and the Measuring & Test Equipment (M&TE). The plant specific drift equals the difference between the "as-found" and the previous "as-left" data and therefore involves the actual sensor drift and calibration M&TE. The "as-found" calibration data indicates whether the sensor input/output relationship was within reasonable allowances over the interval since the last calibration. The combination of "as-left" calibration data and plant specific sensor drift indicate whether it is reasonable to expect the sensor to continue to perform this function for future cycles.

Statistically based drift values were determined for all sensors except where there was insufficient data due to recent sensor replacement. In these cases, a thirty (30) month drift value was determined through engineering judgment which considered manufacturer specifications, drift exhibited by devices of the same manufacturer in similar applications, and Westinghouse experience. Drift for the following devices was not statistically based: all Pressurizer Pressure transmitters, Containment Pressure transmitters, RCP Undervoltage relays and Steam Pressure Rosemount transmitters.

The calibration accuracy and 30 month drift values were combined with the Measuring & Test Equipment accuracy term to form the dependent relationships. A hypothetical example of the impact of this treatment for a level transmitter is (sensor parameters only):

SCA =
SRA =
SMTE =
SPE =
STE =
SD =

[ ] +a,c

excerpting the sensor portion of Equation 2.1 results in:

$$\{(SMTE + SCA)^2 + (SMTE + SD)^2 + (SPE)^2 + (STE)^2 + (SRA)^2\}^{1/2}$$

-or-

$$[\qquad]^{+a,c} = 2.0\ \%$$

Assuming no dependencies for any of the parameters results in the following:

$$\{(SCA)^2 + (SMTE)^2 + (SD)^2 + (SPE)^2 + (STE)^2 + (SRA)^2\}^{1/2} \qquad \text{(Eq. 2.2)}$$

-or-

$$[\qquad]^{+a,c} = 1.5\ \%$$

Thus it can be seen that the approach represented by Equation 2.1, which accounts for dependent parameters, results in a more conservative summation of the allowances.

2.3 RACK ALLOWANCES

Five parameters, as noted by Table 3-25, are considered to be rack allowances: RCA, RMTE, RCSA, RTE, and RD. Three of these parameters (RCA, RMTE, and RD) are considered to be dependent for much the same reason outlined for sensors in Section 2.2. As noted in Section 2.1, the rack comparator setting accuracy (RCSA) may be eliminated for digital channels. When calibrating or determining drift in the racks for a specific channel, the processes are performed at essentially constant temperature; i.e., ambient temperature (which is reasonably controlled). Because of this, the RTE parameter is considered to be independent of any factors for calibration or drift. However, the same cannot be said for the other rack parameters. As noted in Section 2.2, when calibrating or determining drift for a channel, the same end result is desired; that is, the point at which the bistable changes state. Based on this logic, these factors have been conservatively summed to form several independent groupings (see Equation 2.1). The impact of this approach (formation of independent groups based on dependent components) is significant. For the hypothetical example of an analog channel, using the same approach outlined in Equations 2.1 and 2.2 results in the following:

$$\begin{array}{ll} RCA = & \\ RMTE = & \\ RCSA = & \\ RTE = & \\ RD = & \end{array} \left[\qquad \right]^{+a,c}$$

excerpting the rack portion of Equation 2.1 results in:

$$\{(RMTE + RCA)^2 + (RMTE + RCSA)^2 + (RMTE + RD)^2 + (RTE)^2\}^{1/2}$$

-or-

$$[\qquad]^{+a,c} = 1.5\ \%$$

Assuming no dependencies for any of the parameters yields the following less conservative results:

$$\{(RCA)^2 + (RMTE)^2 + (RCSA)^2 + (RD)^2 + (RTE)^2\}^{1/2} \quad \text{(Eq. 2.3)}$$

-or-

$$[\qquad]^{+a,c} = 1.3\ \%$$

Thus, the use of Equation 2.1 is conservative for rack effects and for sensor effects. Therefore, accounting for dependencies in the treatment of these allowances provides a conservative result. Similar results, with different magnitudes, would be arrived at using digital process rack uncertainties.

2.4 PROCESS ALLOWANCES

Finally, the PMA and PEA parameters are considered to be independent of both sensor and rack parameters. PMA provides allowances for the non-instrument related effects; e.g., neutron flux, calorimetric power uncertainty assumptions, fluid density changes, and temperature stratification assumptions. PMA may consist of more than one independent uncertainty allowance. PEA accounts for uncertainties due to metering devices, such as elbows, venturis, and orifice plates. Thus, these parameters have been factored into Equation 2.1 as independent quantities. 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 to be appropriate, Equation 2.1 would be modified such that the affected term would be treated by arithmetic summation as deemed necessary.

2.5 MEASURING AND TEST EQUIPMENT ACCURACY

Based on information from PG&E, it was concluded that the test equipment used for calibration of the transmitters does not meet ISA S51.1-1979[8] with regards to allowed exclusion from the calculation. This implies that test equipment without an accuracy of 10 % or less of the calibration accuracy is required to be included in the uncertainty calculations of Equations 2.1 and 3.1. Information from PG&E indicated that the Rack Measuring and Test Equipment (Eagle 21 only) does meet the ISA standard, and therefore the RMTE terms are taken to be zero. The Sensor Measuring & Test Equipment (SMTE) accuracies used in this study represent the maximum allowed inaccuracy of the test equipment.

2.6 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-67.04.01-2000, "Setpoints for Nuclear Safety-Related Instrumentation."

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. Generic Letter 91-04, 1991, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24 Month Fuel Cycle."

7. Westinghouse Letter to PG&E, PGE-96-569, J. Hoebel to S. D. Kamdar, 6/14/96.

8. Instrument Society of America Standard S51.1-1979 (Reaffirmed 1993), "Process Instrumentation Terminology."

3 PROTECTION SYSTEM SETPOINT METHODOLOGY

3.1 MARGIN CALCULATION

As noted in Section 2.0, Westinghouse utilizes the square root of the sum of the squares for summation of the various components of the channel uncertainty. This approach is valid where no dependency is present. Arithmetic summation is a conservative treatment when a dependency between two or more parameters exists. The equation used to determine the margin, and thus the acceptability of the parameter values used, is:

$$\text{Margin} = TA - \{(PMA)^2 + (PEA)^2 + (SMTE + SCA)^2 + (SMTE + SD)^2 + (SPE)^2 + (STE)^2 + (SRA)^2 + (RMTE + RCA)^2 + (RMTE + RCSA)^2 + (RMTE + RD)^2 + (RTE)^2\}^{1/2} - EA - BIAS \quad \text{(Eq. 3.1)}$$

where:

TA = Total Allowance, which is defined as (Safety Analysis Limit - Nominal Trip Setpoint)

and all other parameters are as defined for Equation 2.1.

This equation is appropriate when trending of transmitter calibration and drift is taking place. Using Equation 2.1, Equation 3.1 may be simplified to:

$$\text{Margin} = TA - CSA \quad \text{(Eq. 3.2)}$$

For those channels which were not evaluated for the 24-month fuel cycle program, Equation 3.2 may still be used for determining margin. The value for CSA to be used in Equation 3.2 would be based on the CSA equation which was used for that particular channel.

Determination of margin and Total Allowance is appropriate only for those channels which have an explicit Safety Analysis Limit (or other licensing basis limit).

Tables 3-1 through 3-24 provide individual component uncertainties and CSA calculations for the protection functions noted in Tables 2.2-1 and 3.3-4 of the Diablo Canyon Units 1 and 2 Technical Specifications. Table 3-25 provides a summary of the Reactor Protection System/Engineered Safety Features Actuation System Channel Uncertainty Allowances for Diablo Canyon Units 1 and 2 and includes Safety Analysis and Technical Specification values, Total Allowance and Margin. The values in these tables are reported to two decimal places using the conventional technique of rounding down numbers less than 5 and rounding up numbers greater than or equal to 5. Parameters reported in the tables as "N/A", "0", or "---" are not applicable or have no value for that channel.

3.2 DEFINITIONS FOR PROTECTION SYSTEM SETPOINT TOLERANCES

To insure a clear understanding of the channel uncertainty values used in this report, the following definitions are provided. For terms which are not defined in this section, refer to ANSI/ISA-67.04.01-2000[6].

- Analog-to-Digital (A/D)

  An electronic circuit module used to convert a continuously variable analog signal to a discrete digital signal via a prescriptive algorithm.

- Allowable Value

  A bistable trip setpoint (analog function) or CPU trip output (digital function) in plant Technical Specifications, which allows for deviation, e.g., Rack Drift plus Rack Measuring & Test Equipment Accuracy, from the Nominal Trip Setpoint. A trip setpoint found non-conservative with respect to the Allowable Value requires some action for restoration by plant operating personnel.

- 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 a period of operation, a transmitter was found to deviate from the ideal condition by -0.5 % span. This would be the "as found" condition.

- 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 permitted calibration accuracy for a transmitter is ±0.5 % of span, while the worst measured deviation from the ideal condition after calibration is +0.1 % span. 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 +0.1 % span.

- Channel

  The sensing and process equipment, i.e., transmitter to bistable (analog function) or transmitter to CPU trip output (digital function), 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., 2/3 Steam Generator Level - Low-Low channels per 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 arithmetic summation, as appropriate. It includes both instrument (sensor and process rack) uncertainties and non-instrument related effects (Process Measurement Accuracy). This parameter is compared with the Total Allowance for determination of instrument channel margin.

- Environmental Allowance (EA)

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

  a) temperature effects on a transmitter,
  b) radiation effects on a transmitter,
  c) seismic effects on a transmitter,
  d) temperature effects on a level transmitter reference leg,
  e) temperature effects on signal cable insulation, and
  f) seismic effects on process racks.

- Margin

  The calculated difference between the Total Allowance and the Channel Statistical Allowance.

- Nominal Trip Setpoint (NTS)

  A bistable trip setpoint (analog function) or CPU trip output (digital function) in plant Technical Specifications or plant administrative procedures. This value is the nominal value to which the bistable is set, as accurately as reasonably achievable (analog function) or the defined input value for the CPU trip output setpoint (digital function).

- 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 is not known for the restrictor, effectively an orifice, therefore a mass balance between Feedwater Flow and Steam Flow must be made. With the Feedwater Flow known through measurement via the venturi, the Steam Flow is normalized.

- Primary Element Accuracy (PEA)

  Uncertainty due to the use of a metering device, e.g., venturi, orifice, or elbow. 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 or digital 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 Westinghouse process systems, this includes all the equipment contained in the process equipment cabinets, e.g., conversion resistor, transmitter power supply, R/E, lead/lag, rate, lag functions, function generator, summator, control/protection isolator, and bistable for analog functions; conversion resistor, transmitter power supply, signal conditioning-A/D converter and CPU for digital functions. 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. For a digital system, the CPU trip output signal is the input to the voting logic.

- R/E

  Resistance (R) to voltage (E) conversion module. The RTD output (change in resistance as a function of temperature) is converted to a process loop working parameter (voltage) by this analog module. Westinghouse Eagle-21 Process Instrumentation System utilizes R/E converters for treatment of RTD output signals.

- Rack Calibration Accuracy (RCA)

  The reference (calibration) accuracy, or accuracy rating as defined by ISA Standard S51.1-1979[1], for a process loop string. Inherent in this definition is the verification of the following under a reference set of conditions; 1) conformity[2], 2) hysteresis[3] and 3) repeatability[4]. The Westinghouse definition of a process loop includes all modules in a specific channel. Also it is assumed that the individual modules 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 for the string is typically less than the arithmetic sum or SRSS of the individual module tolerances. This forces calibration of the process loop without a systematic bias in the individual module calibrations, i.e., as left values for individual modules must be compensating in sign and magnitude.

  For a Westinghouse supplied digital channel, RCA represents calibration of the signal conditioning – A/D converter providing input to the CPU. Typically there is only one module present in the digital process loop, thus compensation between multiple modules for errors is not possible. However, for protection functions with multiple inputs, compensation between multiple modules for errors is possible. Each signal conditioning – A/D converter module is calibrated to within an accuracy of [ ]$^{+a,c}$ for functions with process rack inputs of 4 - 20 mA or 10 - 50 mA, or [ ]$^{+a,c}$ for RTD inputs.

- Rack Comparator Setting Accuracy (RCSA)

  The reference (calibration) accuracy, or accuracy rating as defined by ISA Standard S51.1-1979[1], of the instrument loop comparator (bistable). Inherent in this definition is the verification of repeatability[4] under a reference set of conditions.For a single input bistable (fixed setpoint) the typical calibration tolerance is [ ]+a,c. This assumes that comparator nonlinearities are compensated by the setpoint. For a dual input bistable (floating setpoint) the typical calibration tolerance is [ ]+a,c. This allows for nonlinearities between the two inputs. In many plants calibration of the bistable is included as an integral part of the rack calibration, i.e., string calibration. Westinghouse supplied digital channels do not have an electronic comparator, therefore no uncertainty is included for this term for these channels.

- Rack Drift (RD)

  The change in input-output relationship over a period of time at reference conditions. Typical values assumed for this parameter are ±1.0 % span for analog channels and [ ]+a,c for digital channels. An example of RD is: for an "as found" value of -0.5 % span and an "as left" value of +0.1 % span, the magnitude of the drift would be {(-0.5) - (+0.1) = -0.6 % span} in the negative direction.

- Rack Measuring & 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 by ISA Standard S51.1-1979[5] it is considered an integral part of RCA. Magnitudes in excess of the 10:1 limit are explicitly included in Westinghouse calculations.

- 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, 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 Westinghouse supplied process instrumentation, a value of [ ]+a,c is used for analog channel temperature effects and [ ]+a,c is used for digital channels. It is assumed that calibration is performed at a nominal ambient temperature of +70 °F.

- Safety Analysis Limit (SAL)

  The parameter value assumed in a transient analysis or other plant operating limit at which a reactor trip or actuation function is initiated.

- Sensor Calibration Accuracy (SCA)

  The calibration accuracy for a Sensor or transmitter as defined by the Diablo Canyon Units 1 and 2 calibration procedures. For transmitters, this accuracy is typically ±0.5 % span as defined by

PG&E Procedures. Utilizing Westinghouse recommendations for 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. An example of SD is: for an "as found" value of +0.5 % span and an "as left" value of +0.1 % span, the magnitude of the drift would be {(+0.5) - (+0.1) = +0.4 % span} in the positive direction. For this evaluation, a maximum surveillance interval of 30 months was assumed when projecting drift allowance.

- Sensor Measuring & 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 by ISA Standard S51.1-1979[5] it is considered an integral part of SCA. Magnitudes in excess of the 10:1 limit are explicitly included in Westinghouse 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 Temperature Effects (STE)

The change in input-output relationship due to a change in the ambient environmental conditions (temperature, humidity, 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. It is assumed that calibration is performed at a nominal ambient temperature of +70 °F.

- Sensor Reference Accuracy

The reference accuracy that is achievable by the device as specified in the manufacturers specification sheets. Reference (calibration) accuracy or accuracy rating for a sensor or transmitter as defined by ISA Standard S51.1-1979[1]. Inherent in this definition is the verification of the following under a reference set of conditions; 1) conformity[2], 2) hysteresis[3] and 3) repeatability[4]. This term is introduced into the uncertainty calculation to address repeatability concerns when only performing 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.

- Span

The region for which a device is calibrated and verified to be operable, e.g., for a Pressurizer Pressure transmitter with a calibrated range of 1250 - 2500 psig would yield a span of 1250 psig. For Pressurizer Pressure, considerable suppression of the zero and turndown of the operating range is exhibited.

- SRSS

Square root of the sum of the squares, i.e.,

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

as approved for use in setpoint calculations by ANSI/ISA-67.04.01-2000[7].

- Total Allowance (TA)

The absolute value of the calculated difference between the Safety Analysis Limit and the Nominal Trip Setpoint |(SAL - NTS)| in % instrument span. Two examples of the calculation of TA are:

– NIS Power Range Neutron Flux - High

SAL	118 % RTP
NTS	- 109 % RTP
TA	9 % RTP

If the instrument span = 120 % RTP, then

TA = (9 % RTP)(100 % span)/(120 % RTP) = 7.5 % span

– Pressurizer Pressure - Low Trip

SAL	1845 psig
NTS	- 1950 psig
TA	|- 105 psi| = 105 psi

If the instrument span = 1250 psi, then

TA = (105 psi)(100 % span)/(1250 psi) = 8.4 % span

3.3 REFERENCES/STANDARDS

1. Instrument Society of America Standard S51.1-1979 (Reaffirmed 1993), "Process Instrumentation Terminology," p 6.

2. Ibid, p 8.

3. Ibid, p 20.

4. Ibid, p 27.

5. Ibid, p 32.

6. ANSI/ISA-67.04.01-2000, "Setpoints for Nuclear Safety-Related Instrumentation," p 15, 2000.

7. Ibid, p 21.

Table 3-1
Power Range, Neutron Flux – High and Low Setpoints**

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration	
[ ]+a,c	
Sensor Pressure Effects	
Sensor Temperature Effects	
[ ]+a,c	
Sensor Drift	
[ ]+a,c	
Environmental Allowance	
Rack Calibration	
Rack Measuring & Test Equipment Accuracy	
Comparator	
One input	
Rack Temperature Effects	
Rack Drift	

* In percent span (120 % Rated Thermal Power)
** Not processed by Eagle-21 racks.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SCA + SD)^2 + (SPE)^2 + (STE)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-2
Power Range, Neutron Flux – High Positive Rate and High Negative Rate**

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration	
[ ]+a,c	
Sensor Pressure Effects	
Sensor Temperature Effects	
[ ]+a,c	
Sensor Drift	
[ ]+a,c	
Environmental Allowance	
Rack Calibration	
Rack Measuring & Test Equipment Accuracy	
Comparator	
One input	
Rack Temperature Effects	
Rack Drift	

* In percent span (120 % Rated Thermal Power)
** Not processed by Eagle-21 racks.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SCA + SD)^2 + (SPE)^2 + (STE)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-3
Intermediate Range, Neutron Flux**

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration	
[ ]+a,c	
Sensor Pressure Effects	
Sensor Temperature Effects	
[ ]+a,c	
Sensor Drift	
[ ]+a,c	
Environmental Allowance	
Rack Calibration	
Rack Measuring & Test Equipment Accuracy	
Comparator	
One input	
Rack Temperature Effects	
Rack Drift	
[ ]+a,c	

* In percent span (conservatively assumed to be 120 % Rated Thermal Power)
** Not processed by Eagle-21 racks.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SCA + SD)^2 + (SPE)^2 + (STE)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-4
Source Range, Neutron Flux**

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration	
[ ]+a,c	
Sensor Pressure Effects	
Sensor Temperature Effects	
[ ]+a,c	
Sensor Drift	
[ ]+a,c	
Environmental Allowance	
Rack Calibration	
Rack Measuring & Test Equipment Accuracy	
Comparator	
One input	
Rack Temperature Effects	
Rack Drift	
3×10^4 cps	

* In % span (1×10^6 cps)
** Not processed by Eagle-21 racks.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SCA + SD)^2 + (SPE)^2 + (STE)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-5
Negative Steamline Pressure Rate - High

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
Primary Element Accuracy	
Sensor Calibration	
[ ]+a,c	
Sensor Pressure Effects	
Sensor Temperature Effects	
[ ]+a,c	
Sensor Drift	
[ ]+a,c	
Environmental Allowance	
Rack Calibration	
Rack Measuring & Test Equipment	
Rack Temperature Effects	
Rack Drift	

*In % span (1200 psi)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SCA + SMTE)^2 + (SMTE + SD)^2 + (SPE)^2 + (STE)^2 + (RCA + RMTE)^2 + (RMTE + RD)^2 + (RTE)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-6
Overtemperature ΔT

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration Accuracy	
[ ]+a,c	
[ ]+a,c	
Sensor Reference Accuracy	
[ ]+a,c	
[ ]+a,c	
Sensor Measuring & Test Equipment Accuracy	
[ ]+a,c	
[ ]+a,c	
Sensor Pressure Effects	
Sensor Temperature Effects	
[ ]+a,c	
Sensor Drift	
[ ]+a,c	
[ ]+a,c	
Environmental Allowance	
Rack Calibration Accuracy	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	

Table 3-6 (continued)
Overtemperature ΔT

Parameter	Allowance*
Rack Measuring & Test Equipment Accuracy	[ ]+a,c
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Rack Temperature Effect	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Rack Drift	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	

* In percent ΔT span (ΔT - 96.6 °F - Unit 1 (this is bounding for the Unit 1 uprated value of 98.6 °F); 97.5 °F - Unit 2)
N_H = # of hot leg RTDs = 2
N_C = # of cold leg RTDs = 1

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 +$$

$$\left[\frac{\{(SMTE_{\Delta T} + SD_{\Delta T})^2 + (SMTE_{\Delta T} + SCA_{\Delta T})^2 +}{N_H}\right.$$

$$\left.\frac{(SMTE_{\Delta T} + SD_{\Delta T})^2 + (SMTE_{\Delta T} + SCA_{\Delta T})^2\}^{1/2}]^2 +}{N_C}\right.$$

$$\frac{[\{(RMTE_{\Delta T} + RD_{\Delta T})^2 + (RTE_{\Delta T})^2 + (RMTE_{\Delta T} + RCA_{\Delta T})^2 +}{N_H}$$

$$\frac{(RMTE_{\Delta T} + RD_{\Delta T})^2 + (RTE_{\Delta T})^2 + (RMTE_{\Delta T} + RCA_{\Delta T})^2\}^{1/2}]^2 +}{N_C}$$

$$(SMTE_P + SD_P)^2 + (SRA_P)^2 + (SPE_P)^2 + (STE_P)^2 + (SMTE_P + SCA_P)^2 +$$
$$(RMTE_P + RD_P)^2 + (RTE_P)^2 + (RMTE_P + RCA_P)^2$$
$$2(RMTE_{\Delta I} + RD_{\Delta I})^2 + 2(RTE_{\Delta I})^2 + 2(RMTE_{\Delta I} + RCA_{\Delta I})^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-7
Overpower ΔT

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration Accuracy	
[ ]+a,c	
Sensor Reference Accuracy	
[ ]+a,c	
Sensor Measuring & Test Equipment Accuracy	
[ ]+a,c	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift	
[ ]+a,c	
Environmental Allowance	
ΔT - Cable IR Effects (+1 °F)	
Tavg - Cable IR Effects (+8 °F)	
Rack Calibration Accuracy	
[ ]+a,c	
Rack Measuring & Test Equipment Accuracy	
[ ]+a,c	

Table 3-7 (continued)
Overpower ΔT

Parameter	Allowance*
Rack Temperature Effect	[ ]+a,c
[ ]+a,c	
Rack Drift	
[ ]+a,c	

* In percent ΔT span (ΔT - 96.6 °F - Unit 1 (this is bounding for the Unit 1 uprated value of 98.6 °F); 97.5 °F - Unit 2)
N_H = # of hot leg RTDs = 2
N_C = # of cold leg RTDS = 1

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + \left[\frac{\{(SMTE_{\Delta T} + SD_{\Delta T})^2 + (SMTE_{\Delta T} + SCA_{\Delta T})^2 +}{N_H}\right.$$

$$\frac{(SMTE_{\Delta T} + SD_{\Delta T})^2 + (SMTE_{\Delta T} + SCA_{\Delta T})^2\}^{1/2}]^2 +}{N_C}$$

$$\frac{[\{(RMTE_{\Delta T} + RD_{\Delta T})^2 + (RTE_{\Delta T})^2 + (RMTE_{\Delta T} + RCA_{\Delta T})^2 +}{N_H}$$

$$\frac{(RMTE_{\Delta T} + RD_{\Delta T})^2 + (RTE_{\Delta T})^2 + (RMTE_{\Delta T} + RCA_{\Delta T})^2\}^{1/2}]^2\}^{1/2} +}{N_C}$$

EA + BIAS

[ ]+a,c

Table 3-8
Pressurizer Pressure – Low And High Reactor Trip

Parameter	Allowance* [ ]$^{+a,c}$
Process Measurement Accuracy	
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In percent span (1250 psi)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]$^{+a,c}$

Table 3-9
Pressurizer Water Level – High

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift/Process Effects (30 months)**	
Environmental Allowance	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In percent span (100 %)

** A drift allowance of ±5.0 % has been calculated based on the Pressurizer Level as-found and as-left data. Since Rosemount transmitter drift is typically in the range of ±0.6 % to ±1.2 %, it is the joint PG&E and Westinghouse engineering judgment that the ±5 % drift is caused by installation/configuration effects associated with the DP level measurement system, as well as the transmitter. As long as the as-found and as-left data reflects both the process effects and transmitter drift, the 5 % process/transmitter drift allowance may be used to verify continued performance consistent with historical data.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RTE)^2 + (RMTE + RD)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-10
Loss of Flow

Parameter	Allowance*
Process Measurement Accuracy	[ ]$^{+a,c}$
[ ]$^{+a,c}$	
Primary Element Accuracy	
[ ]$^{+a,c}$	
Sensor Calibration	
[ ]$^{+a,c}$	
Sensor Reference Accuracy	
[ ]$^{+a,c}$	
Sensor Measuring & Test Equipment Accuracy	
[ ]$^{+a,c}$	
Sensor Pressure Effects	
[ ]$^{+a,c}$	
Sensor Temperature Effects	
[ ]$^{+a,c}$	
Sensor Drift	
[ ]$^{+a,c}$	
Bias	
[ ]$^{+a,c}$	
Rack Calibration	
[ ]$^{+a,c}$	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effects	
[ ]$^{+a,c}$	
Rack Drift	
[ ]$^{+a,c}$	

* In % flow span (120.0 % Thermal Design Flow). Percent ΔP span converted to flow span via Equation 3-28.8, with F_{max} = 120.0 % and F_N = 90 %

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SCA)^2 + (RTE)^2 + (RMTE + RD)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]$^{+a,c}$

Table 3-11
Steam Generator Narrow Range Water Level – Low-Low
(assumed scaling pressure = 1010.5 psia)

Parameter	**Allowance***
Process Measurement Accuracy**	[ ]+a,c
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Transmitter Elevated Temperature Effects	
Reference Leg Heatup	
Cable IR Effects	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

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

Table 3-11 (continued)
Steam Generator Narrow Range Water Level – Low-Low
(assumed scaling pressure = 1010.5 psia)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ] +a,c

Table 3-12
Reactor Coolant Pump Undervoltage**
BASLER BE1-27 Relay

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In Volts
** Not processed by Eagle-21 racks.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-13
Reactor Coolant Pump Underfrequency**
BASLER BE1-81 O/U Relay

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects***	
Sensor Drift (30 months)	
Environmental Allowance	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In Hertz
** Not processed by Eagle-21 racks.
*** Based on engineering judgment, not specified by Vendor.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-14
Containment Pressure – High, High-High

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In percent span (60 psi)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-15
Pressurizer Pressure – Low, Safety Injection

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Transmitter Effects	
Cable IR Effects	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In percent span (1250 psi)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-16
Steam Line Pressure – Low
Rosemount 1154 Transmitter

Parameter	Allowance
Process Measurement Accuracy	[ ]+a,c
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Transmitter Effects (R1154SH9 Temp and Pressure effect)	
Cable IR Effects	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

Tag Nos. - P515 (Unit 1), P524 (Unit 1), P545 (Unit 2)

* In percent span (1200 psi)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-17
Steam Line Pressure – Low
Barton 763 Transmitter

Parameter	Allowance
Process Measurement Accuracy	+a,c
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Transmitter Elevated Temperature Effects	
Cable IR Effects	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

Tag Nos. - P514, P515 (Unit 2), P516, P524 (Unit 2), P525, P526, P534, P535, P536, P544, P545 (Unit 1), P546

* In percent span (1200 psi)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

+a,c

Table 3-18
Steam Generator Narrow Range Water Level – High-High
(assumed scaling pressure = 1010.5 psia)

Parameter	Allowance*
Process Measurement Accuracy**	+a,c
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In percent span (100 %)

** [ ]+a,c

Table 3-18 (continued)
Steam Generator Narrow Range Water Level – High-High
(assumed scaling pressure = 1010.5 psia)

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ] +a,c

Table 3-19
RCS Loop ΔT Equivalent to Power

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
[ ]+a,c	
Primary Element Accuracy	
Sensor Calibration Accuracy	
[ ]+a,c	
Sensor Reference Accuracy	
[ ]+a,c	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift	
[ ]+a,c	
Environmental Allowance	
[ ]+a,c	
Rack Calibration Accuracy	
[ ]+a,c	
Rack Measuring & Test Equipment Accuracy	
[ ]+a,c	
Rack Temperature Effect	
[ ]+a,c	
Rack Drift	
[ ]+a,c	

* In percent ΔT span (ΔT - 96.6 °F - Unit 1 (this is bounding for the Unit 1 uprated value of 98.6 °F); 97.5 °F - Unit 2)
N_H = # of hot leg RTDs = 2
N_C = # of cold leg RTDs = 1

Table 3-19 (continued)
RCS Loop ΔT Equivalent to Power

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 +$$

$$\frac{[\{(SMTE_{\Delta T} + SD_{\Delta T})^2 + (SMTE_{\Delta T} + SCA_{\Delta T})^2 +}{N_H}$$

$$\frac{(SMTE_{\Delta T} + SD_{\Delta T})^2 + (SMTE_{\Delta T} + SCA_{\Delta T})^2\}^{1/2}]^2 +}{N_C}$$

$$\frac{[\{(RMTE_{\Delta T} + RD_{\Delta T})^2 + (RTE_{\Delta T})^2 + (RMTE_{\Delta T} + RCA_{\Delta T})^2 +}{N_H}$$

$$\frac{(RMTE_{\Delta T} + RD_{\Delta T})^2 + (RTE_{\Delta T})^2 + (RMTE_{\Delta T} + RCA_{\Delta T})^2\}^{1/2}]^2\}^{1/2} +}{N_C}$$

$$EA + BIAS$$

+a,c

Table 3-20
Seismic Trip**
Kinematics Electromagnetic Seismic Triggers
Model TS-33A

Parameter	Allowance*
Process Measurement Accuracy	[ ]+a,c
Primary Element Accuracy	
Sensor Calibration Accuracy	
Sensor Reference Accuracy	
Sensor Measuring & Test Equipment Accuracy	
Sensor Pressure Effects	
Sensor Temperature Effects	
Sensor Drift (30 months)	
Environmental Allowance	
Rack Calibration Accuracy	
Rack Measuring & Test Equipment Accuracy	
Rack Temperature Effect	
Rack Drift	

* In units of acceleration, fraction of the gravitation constant, g. (where g = 32.2 ft/sec^2)
** Not processed by Eagle-21 racks.

Channel Statistical Allowance =

$$\{(PMA)^2 + (PEA)^2 + (SMTE + SD)^2 + (SRA)^2 + (SPE)^2 + (STE)^2 + (SMTE + SCA)^2 + (RMTE + RD)^2 + (RTE)^2 + (RMTE + RCA)^2\}^{1/2} + EA + BIAS$$

[ ]+a,c

Table 3-21
4.16 KV Bus Undervoltage*
Westinghouse Relays/Nominal Setpoint 85 Volts

This CSA is the responsibility of PG&E and will be developed as part of other activities.

Channel Statistical Allowance =

This CSA is the responsibility of PG&E and will be developed as part of other activities.

* Not processed by Eagle-21 racks.

Table 3-22
4.16 KV Bus Undervoltage*
Westinghouse Relays/Nominal Setpoint 107.8 Volts

This CSA is the responsibility of PG&E and will be developed as part of other activities.

Channel Statistical Allowance =

This CSA is the responsibility of PG&E and will be developed as part of other activities.

* Not processed by Eagle-21 racks.

Table 3-23
4.16 KV Bus Undervoltage*
General Electric Relays/Nominal Setpoint 82.45 Volts

This CSA is the responsibility of PG&E and will be developed as part of other activities.

Channel Statistical Allowance =

This CSA is the responsibility of PG&E and will be developed as part of other activities.

* Not processed by Eagle-21 racks.

Table 3-24
4.16 KV Bus Undervoltage*
General Electric Relays/Nominal Setpoint 76.5 Volts

This CSA is the responsibility of PG&E and will be developed as part of other activities.

Channel Statistical Allowance =

This CSA is the responsibility of PG&E and will be developed as part of other activities.

* Not processed by Eagle-21 racks.

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Table 3-25
Reactor Protection System/Engineered Safety Features Actuation System Channel Error Allowances
Diablo Canyon

							SENSOR						INSTRUMENT RACK										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
Item No.	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)	Comparator Setting Accuracy (1)	Temperature Effects (1)	Drift (1)	Safety Analysis Limit (2)	Allowable Value (3)	Trip Setpoint (4)	Total Allowance (1)	Channel Statistical Allowance (1)	Margin (1)	]a,c	Item No.
1	Power Range, Neutron Flux - High Setpoint															118 % RTP	110.2 % RTP	109 % RTP					1
2	Power Range, Neutron Flux - Low Setpoint															35 % RTP	26.2 % RTP	25 % RTP					2
3	Power Range, Neutron Flux - High Positive Rate															(9)	5.6 % RTP/2 SEC	5.0 % RTP/2 SEC					3
4	Power Range, Neutron Flux - High Negative Rate															(9)	5.6 % RTP/2 SEC	5.0 % RTP/2 SEC					4
5	Intermediate Range, Neutron Flux															(9)	30.6 % RTP	25 % RTP					5
6	Source Range, Neutron Flux															(9)	1.4E+5 CPS	1.0E+5 CPS					6
7	Negative Steamline Pressure Rate - High															(9)	103.4 PSI	100 PSI					7
8	Overtemperature ΔT — ΔT Channel Tavg Channel Pressurizer Pressure Channel ΔI Channel															FUNCTION (18)	FUNCTION (19) + 0.46 % ΔT span for the FRI card 0.14 % ΔT span 0.19 % ΔT span	FUNCTION (19)					8
9	Overpower ΔT — ΔT Channel Tavg Channel															FUNCTION (18)	FUNCTION (19) + 0.46 % ΔT span	FUNCTION (19)					9
10	Pressurizer Pressure - Low, Reactor Trip															1845 PSIG	1947.5 PSIG	1950 PSIG					10
11	Pressurizer Pressure - High															2445 PSIG	2397.5 PSIG	2385 PSIG					11
12	Pressurizer Water Level - High															(9)	90.2 % SPAN	90 % SPAN (22)					12
13	Loss Of Flow															85 % FLOW	89.8 % FLOW	90 % FLOW					13
14	Steam Generator Water Level - Low-Low(32)															0 % SPAN	14.8 % SPAN	15 % SPAN					14
15	Undervoltage - RCP															(9)	78.77 V (29)	80.50 V (29)					15
16	Underfrequency - RCP															53.9 HZ	53.9 HZ	54.0 HZ					16
17	Containment Pressure - High															5.0 PSIG	3.12 PSIG	3.0 PSIG					17
18	Containment Pressure - High-High															24.7 PSIG	22.12 PSIG	22.0 PSIG					18
19	Pressurizer Pressure - Low, SI															1680 PSIG	1847.5 PSIG	1850 PSIG					19
20	Steamline Pressure - Low (Rosemount)															444.0 PSIG	597.6 PSIG	600 PSIG					20
21	Steamline Pressure - Low (Barton)															444.0 PSIG	597.6 PSIG	600 PSIG					21
22	Steam Generator Water Level - High-High(32)															85 % SPAN (33)	75.2 % SPAN	75 % SPAN					22
23	RCS Loop ΔT Equivalent To Power — ΔT Channel Tavg Channel															59 % RTP	50.7 % RTP	50 % RTP					23
24	Seismic															(31)	0.53 g	0.35 g					24

NOTES:
1. All values are shown as magnitude only and in percent of span unless otherwise noted. Signs shown in Tables 3-1 through 3-24.
2. As noted in Section 15.1 of the updated FSAR.
3. As calculated using the approved methodology of Section 4.3.
4. As noted in Diablo Canyon technical specifications
5. [ ]a,c
6. [ ]a,c
7. [ ]a,c
8. [ ]a,c
9. Not used in the safety analysis
10. Included in [ ]a,c
11. [ ]a,c
12. [ ]a,c
13. [ ]a,c
14. Included in [ ]a,c
15. [ ]a,c
16. Incore-excore f(ΔI) comparison as noted in Technical Specifications
17. [ ]a,c
18. As noted in Figure 15.1-1 of updated FSAR
19. As noted in Table 2.2-1 of Diablo Canyon Technical Specifications
20. Cable insulation resistance degradation provided by PG&E - treated as a bias
21. [ ]a,c
22. Recommended trip setpoint value
23. [ ]a,c
24. [ ]a,c
25. [ ]a,c
26. [ ]a,c
27. Rosemount transmitter EA term provided by PG&E - treated as a bias
28. Reference leg heatup effect provided by PG&E - treated as a bias
29. These Technical Specification values have been converted to the equivalent value seen by the relays.
30. Barton elevated temperature effects provided by PG&E - treated as a bias
31. Not used in accident analysis but part of the licensing basis for DCPP. Licensing basis accelerations are 0.75g horizontal and 0.5g vertical.
32. Assumed sealing pressure ~ 1010.5 psia
33. Conservative value with respect to MRH.

Table 3-26
Overtemperature ΔT Calculations

- The equation for Overtemperature ΔT:

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

K_1 (nominal)	=	1.20 Technical Specification value
K_1 (max)	=	[ ]+a,c
K_2	=	0.0182/°F
K_3	=	0.000831/psi
Vessel T_H	=	608.8 °F*
Vessel T_C	=	544.4 °F*
ΔI gain	=	2.38 % RTP/% ΔI

- Full power ΔT calculation:

ΔT span = [ ]+a,c
ΔT span_pwr = 150 % RTP

- Process Measurement Accuracy Calculations:

[ ]+a,c

[ ]+a,c

[ ]+a,c

ΔI - Incore/Excore Mismatch

[ ]+a,c

ΔI - Incore Map Delta-I

[ ]+a,c

* These values are based on Unit 1 operating conditions prior to power uprating which provides the most conservative result.

Table 3-26 (continued)
Overtemperature ΔT Calculations

- Pressure Channel Uncertainties

Gain = [ ] +a,c

SCA = [ ] +a,c
SRA =
SMTE =
STE =
SD =

RCA = [ ] +a,c
RMTE =
RTE =
RD =

- ΔI Channel Uncertainties

Gain = [ ] +a,c

RCA = [ ] +a,c
RMTE =
RTE =
RD =

- Total Allowance

[ ] +a,c

* These values are based on Unit 1 operating conditions prior to power uprating which provides the most conservative result.

Table 3-27
Overpower ΔT Calculations

- The equation for Overpower ΔT:

$$\Delta T \frac{(1+\tau_4 S)}{(1+\tau_5 S)} \leq \Delta T_0 \{K_4 - K_5 \left(\frac{\tau_3 S}{1+\tau_3 S}\right) T - K_6 [T - T''] - f_2 (\Delta I)\}$$

K_4 (nominal)	=	1.072 Technical Specification value
K_4 (max)	=	[ ]+a,c
K_5	=	0.0 for decreasing average temperature
K_5	=	0.0174 for increasing average temperature (sec/°F)
K_6	=	0.00145/°F
Vessel T_H	=	608.8 °F*
Vessel T_C	=	544.4 °F*

- Full power AT calculation:

ΔT span = [ ]+a,c
ΔT span_pwr = 150 % RTP

- Process Measurement Accuracy Calculations:

[ ]+a,c

[ ]+a,c

[ ]+a,c

- Total Allowance

[ ]+a,c

---

* These values are based on Unit 1 operating conditions prior to power uprating which provides the most conservative result.

Table 3-28
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

$$\partial F_N = \frac{\partial \Delta P_N}{2F_N} \qquad \text{(Eq. 3-28.1)}$$

Error at a point (not in percent) is:

$$\frac{\partial F_N}{F_N} = \frac{\partial \Delta P_N}{2(F_N)^2} = \frac{\partial \Delta P_N}{2\Delta P_N} \qquad \text{(Eq. 3-28.2)}$$

and

$$\frac{\Delta P_N}{\Delta P_{max}} = \frac{(F_N)^2}{(F_{max})^2} \qquad \text{(Eq. 3-28.3)}$$

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

$$\frac{\partial \Delta P_N}{\Delta P_{max}}(100) = \text{percent error in Full Scale } \Delta P\ (\%\ \varepsilon\ FS\ \Delta P) \qquad \text{(Eq. 3-28.4)}$$

therefore:

$$\frac{\partial F_N}{F_N} = \frac{\Delta P_{max}\left[\frac{\%\,\varepsilon\,FS\,\Delta P}{100}\right]}{2\Delta P_{max}\left[\frac{F_N}{F_{max}}\right]^2} = \left[\frac{\%\,\varepsilon\,FS\,\Delta P}{(2)(100)}\right]\left[\frac{F_{max}}{F_N}\right]^2 \qquad \text{(Eq. 3-28.5)}$$

Table 3-28 (continued)
ΔP Measurements Expressed in Flow Units

Error in flow units is:

$$\partial F_N = F_N \left[\frac{\%\,\varepsilon\,FS\,\Delta P}{(2)(100)}\right]\left[\frac{F_{max}}{F_N}\right]^2 \qquad \text{(Eq. 3-28.6)}$$

Error in percent nominal flow is:

$$\frac{\partial F_N}{F_N}(100) = \left[\frac{\%\,\varepsilon\,FS\,\Delta P}{2}\right]\left[\frac{F_{max}}{F_N}\right]^2 \qquad \text{(Eq. 3-28.7)}$$

Error in percent full span is:

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

$$= \left[\frac{\%\,\varepsilon\,FS\,\Delta P}{2}\right]\left[\frac{F_{max}}{F_N}\right] \qquad \text{(Eq. 3-28.8)}$$

Equation 3-28.8 is used to express errors in percent full span in this document.

4 APPLICATION OF THE SETPOINT METHODOLOGY

4.1 UNCERTAINTY CALCULATION BASIC ASSUMPTIONS/PREMISES

The equations noted in Sections 2 and 3 have several basic premises which were determined by a systematic review of the calibration procedures utilized at Diablo Canyon Units 1 and 2 and statistical evaluations of "as left" and "as found" data for the RPS/ESFAS functions noted in Tables 3-6 through 3-24:

1. The instrument technicians optimize, within the calibration tolerance, the Nominal Setpoint's "as left" condition at the start of each process rack's surveillance interval,

2. The instrument technicians optimize, within the calibration tolerance, the sensor/transmitter's "as left" condition at the start of each surveillance interval,

3. The process rack drift is limited by the Eagle 21 self-checking feature,

4. The sensor/transmitter drift is trended over the fuel cycle and evaluated (probability distribution function characteristics and drift magnitude) over multiple fuel cycles,

5. The sensor/transmitter calibration accuracy is evaluated (probability distribution function characteristics and magnitude) over multiple surveillance intervals,

6. The sensor/transmitters are calibrated using a one up and one down pass utilizing multiple calibration points (minimum 5 points, as recommended by ISA51.1[1]).

It should be noted for (1) and (2) that it is not necessary for the instrument technician to recalibrate a device or channel if the "as left" condition is not exactly at the nominal condition but is within the plus or minus "as left" procedural tolerance. As noted above, the uncertainty calculations assume that the "as left" tolerance (conservative and non-conservative direction) is satisfied on a statistical basis, not that the nominal condition is satisfied exactly. Westinghouse evaluated, using actual Diablo Canyon "as left" data, the achieved sensor calibration accuracy (as-left data) for the RPS/ESFAS sensor/transmitters for Diablo Canyon Units 1 and 2 over multiple calibration cycles and verified them to be consistent with procedural tolerances and the assumptions of the statistical uncertainty combination methodology.

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

As part of this effort, drift data ("as found" - "as left") for the sensor/transmitters was evaluated. Where data was available, multiple surveillance intervals were evaluated to determine the appropriate values for drift for a surveillance interval of 30 months. This evaluation determined that the SD parameter values noted in Tables 3-1 through 3-24 were satisfied on a 95 % probability/95 % confidence level basis for a 30 month surveillance interval. Generic Letter 91-04[2] requires that drift be monitored or trended on a periodic basis. The equations used in Sections 2 and 3, assume that drift data is evaluated for continuation of the validity of the basic characteristics determined by the Westinghouse evaluation. This assumption has a significant beneficial effect on the basic uncertainty equations utilized, i.e., it results in a reduction in the CSA magnitude.

4.2 SENSOR/TRANSMITTER PROCEDURAL EVALUATION

Generic Letter 91-04, Enclosure 2, requires that the assumptions of the setpoint evaluations be appropriately reflected in plant surveillance procedures and that a program be in place to monitor and assess the effects of increased calibration surveillance intervals on instrument drift and its effect on safety. The program should ensure that existing procedures provide data for evaluating the effects of increased calibration intervals. The data should confirm that the estimated errors for instrument drift with increased calibration intervals are within projected limits. This requirement to monitor instrument drift is consistent with the format of the uncertainty equations noted in Sections 2 and 3 of this WCAP, whereby calibration accuracy and drift are treated as two statistically independent parameters. An implication of this format is that equipment performance should be evaluated based, not only on the capability of the equipment to be calibrated, but also on continued equipment performance which is consistent with the drift allowances based on historical performance and incorporated in the uncertainty calculations.

As input to the verification that sensor/transmitter performance is consistent with the assumptions of the setpoint evaluations, an initial surveillance test procedure evaluation criterion is used, based on an "as found" tolerance about the nominal value. A reasonable value for this tolerance is SMTE + SD. SD is the 95/95 drift value identified in the Diablo Canyon statistical setpoint study based on historical performance, and SMTE is the uncertainty for the MTE used to calibrate the sensors as identified in the Diablo Canyon Units 1 and 2 procedures. Values for the "as found" tolerance evaluation are provided in Table 4.2-1. The tolerance represents the value for the evaluation criterion based on the SMTE program presently used at Diablo Canyon.

These criteria for sensors can be incorporated into plant procedures as the defined "as found" tolerance about the desired calibration value. If the device is found to be outside these criterion, the device characteristics will be evaluated in conjunction with the previous experience for that specific device to determine whether the device performance is within the assumptions of the Diablo Canyon statistical setpoint study. Additional criteria for field performance evaluation are the ability to calibrate the sensor/transmitter within the two-sided "as left" tolerance and the qualitative response characteristics of the device.

The approach described here provides a reasonable set of initial criteria for input to the sensor/transmitter performance evaluation when used in conjunction with the Diablo Canyon drift monitoring and assessment program. The Diablo Canyon drift monitoring and assessment program should confirm that the observed instrument drift with increased calibration intervals is within the projected limits. More elaborate evaluation and more frequent on-line monitoring may be included, as necessary, if the drift appears to be excessive or the device is difficult to calibrate.

Table 4.2-1
Sensor/Transmitter As-Found Criteria

Function	Criteria (SD + SMTE) +a,c
Pressurizer Pressure - Low, Reactor Trip	
Pressurizer Pressure - High	
Pressurizer Water Level - High	
Loss of Flow	
Steam Generator Water Level - Low-Low	
Undervoltage - RCP	
Underfrequency - RCP	
Containment Pressure - High	
Containment Pressure - High-High	
Pressurizer Pressure - Low, SI	
Steamline Pressure - Low (Rosemount)	
Steamline Pressure - Low (Barton)	
Steam Generator Water Level - High-High	
Seismic	

4.3 PROCESS RACK OPERABILITY DETERMINATION PROGRAM AND CRITERIA

A program has been determined to define operability criteria for the Eagle 21 digital process racks. Since the process racks are self-checking, the critical parameter is the ability of the process racks to be calibrated within the Rack Calibration Accuracy. These values are currently found in the plant calibration procedures as the "as left" calibration accuracy, and are consistent with the Eagle 21 card/channel Analog Input Verification Test Criteria with the following values:

EAI
ERI-NR (TEMP)
ERI-WR (TEMP)
ERI-WR (Voltage)

[ ]+a,c

A channel found in excess of the Rack Calibration Accuracy and less than or equal to the Allowable Value, designated as (RD + RMTE), should be considered operable if the "as left" condition can be returned to within the Rack Calibration Accuracy. If the measured setpoint is found in excess of the Allowable Value, the channel bistable/output device must be evaluated for operability. The channel will be considered inoperable if it cannot be returned to within the Rack Calibration Accuracy regardless of the "as found" value. The Allowable Values are defined as:

EAI	0.20 % Span
ERI-NR (TEMP)	0.30 % Span
ERI-WR (TEMP)	0.20 % Span
ERI-WR (Voltage)	0.20 % Span

For the Nuclear Instrument channels, PG&E will use the same definition for Allowable Value as is being applied to the other channels in this setpoint study, i.e., the difference between the Allowable Value and the Nominal Trip Setpoint equals Rack Drift plus Rack Measuring & Test Equipment accuracy.

4.4 APPLICATION TO THE PLANT TECHNICAL SPECIFICATIONS

Westinghouse recommends revision of Table 2.2-1 "Reactor Trip System Instrumentation Setpoints" and Table 3.3-4, "Engineered Safety Features Actuation System Instrumentation Trip Setpoints" in the Technical Specifications. Appendix A provides the Westinghouse recommendations for revision of these two tables with the recommended Nominal Trip Setpoint and Allowable Value for each RPS/ESFAS protection function, which was utilized in the Westinghouse uncertainty calculations and determined to be acceptable for use.

4.5 REFERENCES/STANDARDS

1. Instrument Society of America Standard S51.1-1979 (Reaffirmed 1993), "Process Instrumentation Terminology," p 33.

2. Generic Letter 91-04, 1991, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24 month Fuel Cycle."

APPENDIX A
SAMPLE DIABLO CANYON UNITS 1 AND 2 SETPOINT TECHNICAL SPECIFICATIONS

Table 2.2-1
Reactor Trip System Instrumentation Trip Setpoints

	Functional Unit	Nominal Trip Setpoint	Allowable Values
1.	Manual Reactor Trip	NA	NA
2.	Power Range, Neutron Flux		
	a. Low Setpoint	≤ 25 % of RATED THERMAL POWER	≤ 26.2 % of RATED THERMAL POWER
	b. High Setpoint	≤ 109 % of RATED THERMAL POWER	≤ 110.2 % of RATED THERMAL POWER
3.	Power Range, Neutron Flux, High Positive Rate	≤ 5 % of RATED THERMAL POWER with a time constant ≥ 2 seconds	≤ 5.6 % of RATED THERMAL POWER with a time constant ≥ 2 seconds
4.	Power Range, Neutron Flux, High Negative Rate	≤ 5 % of RATED THERMAL POWER with a time constant ≥ 2 seconds	≤ 5.6 % of RATED THERMAL POWER with a time constant ≥ 2 seconds
5.	Intermediate Range, Neutron Flux	≤ 25 % of RATED THERMAL POWER	≤ 30.6 % of RATED THERMAL POWER
6.	Source Range, Neutron Flux	≤ 10^{+5} counts per second	≤ 1.4 x 10^{5} counts per second
7.	Overtemperature ΔT	See Note 1	See Note 2
8.	Overpower ΔT	See Note 3	See Note 4
9.	Pressurizer Pressure - Low	≥ 1950 psig	≥ 1947.5 psig
10.	Pressurizer Pressure - High	≤ 2385 psig	≤ 2387.5 psig
11.	Pressurizer Water Level - High	≤ 90 % of instrument span	≤ 90.2 % of instrument span
12.	Reactor Coolant Flow - Low	≥ 90 % of minimum measured flow* per loop	≥ 89.8 % of minimum measured flow* per loop

* Minimum Measured Flow Per Loop = 89,800 gpm per loop for Unit 1 and 90,625 gpm per loop for Unit 2.

Table 2.2-1 (continued)
Reactor Trip System Instrumentation Trip Setpoints

	Functional Unit	Nominal Trip Setpoint	Allowable Values
13.	Steam Generator Water Level - Low-Low	≥ 15.0 % of narrow range instrument span - each steam generator	≥ 14.8 % of narrow range instrument span - each steam generator
	Coincident with:		
	a. RCS Loop ΔT Equivalent to Power ≤ 50 % RATED THERMAL POWER	RCS Loop ΔT variable input ≤ 50 % RTP	RCS Loop ΔT variable input ≤ 50.7 % RTP
	With a time delay (TD)	≤ TD (Note 5)	≤ (1.01) TD (Note 5)
	OR		
	b. RCS Loop ΔT Equivalent to Power > 50 % RATED THERMAL POWER	RCS Loop ΔT variable input > 50 % RTP	RCS Loop ΔT variable input > 50.7 % RTP
	With no time delay	TD = 0	TD = 0
14.	DELETED		
15.	Undervoltage - RCP	≥ 8050 V each bus	≥ 7877 V each bus
16.	Underfrequency - RCP	≥ 54.0 Hz each bus	≥ 53.9 Hz each bus
17.	Turbine Trip		
	a. Low Autostop Oil Pressure	≥ 50 psig	≥ 45 psig
	b. Turbine Stop Valve Closure	≥ 1 % open	≥ 1 % open
18.	Safety Injection Input from ESF	NA	NA
19.	RCP Breaker Position Trip	NA	NA
20.	Reactor Trip Breakers	NA	NA
21.	Automatic Trip and Interlock Logic	NA	NA

Table 2.2-1 (continued)
Reactor Trip System Instrumentation Trip Setpoints

	Functional Unit	Nominal Trip Setpoint	Allowable Values
22.	Reactor Trip System Interlocks		
	a. Intermediate Range Neutron Flux, P-6	≥ 1 x 10^{-10} amps	≥ 8 x 10^{-11} amps
	b. Low Power Reactor Trips Block, P-7		
	1. P-10 input	10 % of RATED THERMAL POWER	≥ 8.8 %, ≤ 11.2 % of RATED THERMAL POWER
	2. P-13 input	≤ 10 % RATED THERMAL POWER Turbine Impulse Pressure Equivalent	≤ 10.2 % RATED THERMAL POWER Turbine Impulse Pressure Equivalent
	c. Power Range Neutron Flux, P-8	≤ 35 % RATED THERMAL POWER	≤ 36.2 % RATED THERMAL POWER
	d. Power Range Neutron Flux, P-9	≤ 50 % RATED THERMAL POWER	≤ 51.2 % RATED THERMAL POWER
	e. Power Range Neutron Flux, P-10	10 % of RATED THERMAL POWER	≥ 8.8 %, ≤ 11.2 % of RATED THERMAL POWER
	f. Turbine Impulse Chamber Pressure, P-13	≤ 10 % RATED THERMAL POWER Turbine Impulse Pressure Equivalent	≤ 10.2 % RATED THERMAL POWER Turbine Impulse Pressure Equivalent
23.	Seismic Trip	≤ 0.35g	≤ 0.43g

Table 2.2-1 (continued)
Reactor Trip System Instrumentation Trip Setpoints

Table Notations

Note 1: OVERTEMPERATURE ΔT

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

where:

ΔT	=	Measured ΔT by Reactor Coolant System Instrumentation
$\frac{1+\tau_4 S}{1+\tau_5 S}$	=	Lead-lag compensator on measured ΔT
τ_4, τ_5	=	Time constants utilized in the lead-lag controller for ΔT, τ_4 = 0 secs., τ_5 = 0 secs.
ΔT_o	=	Loop specific indicated ΔT at RATED THERMAL POWER
K_1 (nominal)	=	1.20
K_2 (nominal)	=	0.0182/ °F
$\frac{1+\tau_1 S}{1+\tau_2 S}$	=	The function generated by the lead-lag compensator for T_{avg} dynamic compensation
τ_1, τ_2	=	Time constants utilized in the lead-lag controller for T_{avg}, τ_1 = 30 secs., τ_2 = 4 secs.
T	=	Average temperature, °F
T'	≤	Nominal loop specific indicated T_{avg} at RATED THERMAL POWER
K_3 (nominal)	=	0.000831/psig
P	=	Pressurizer pressure, psig
P'	=	2235 psig (Nominal RCS operating pressure)
S	=	Laplace transform operator, sec^{-1}

Table 2.2-1 (continued)
Reactor Trip System Instrumentation Trip Setpoints

Table Notations (continued)

and f1 (ΔI) is a function of the indicated difference between top and bottom detectors of the power range nuclear ion chambers; with gains to be selected based on measured instrument response during plant startup tests such that:

(1) For qt - qb between -19 % and +7 %, f1 (ΔI) = 0 (where qt and qb are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and qt + qb is total THERMAL POWER in percent of RATED THERMAL POWER);

(2) For each percent that the magnitude of (qt - qb) exceeds -19 %, the ΔT Trip Setpoint shall be automatically reduced by 2.75 % of its value at RATED THERMAL POWER; and

(3) For each percent that the magnitude of (qt - qb) exceeds +7 %, the ΔT Trip Setpoint shall be automatically reduced by 2.38 % of its value at RATED THERMAL POWER.

Note 2: The Channel's maximum trip setpoint shall not exceed its computed trip setpoint by more than 0.45 % ΔT span for hot leg or cold temperature inputs, 0.14 % ΔT span for pressurizer pressure input, or 0.19 % ΔT span for ΔI inputs.

Table 2.2-1 (continued)
Reactor Trip System Instrumentation Trip Setpoints

Table Notations (continued)

Note 3: OVERPOWER ΔT

$$\Delta T\left(\frac{1+\tau_4 S}{1+\tau_5 S}\right) \le \Delta T_o \{K_4 - K_5\left(\frac{\tau_3 S}{1+\tau_3 S}\right)T - K_6\,[T - T''] - f_2\,(\Delta I)\}$$

where:

ΔT	=	Measured ΔT by Reactor Coolant System Instrumentation
$\frac{1+\tau_4 S}{1+\tau_5 S}$	=	Lead-lag compensator on measured ΔT
τ_4, τ_5	=	Time constants utilized in the lead-lag controller for ΔT, $\tau_4 = 0$ secs., $\tau_5 = 0$ secs.
ΔT_o	=	Loop specific indicated ΔT at RATED THERMAL POWER
K_4 (nominal)	=	1.072
K_5 (nominal)	=	0.0174/°F for increasing average temperature and 0 for decreasing average temperature
$\frac{\tau_3 S}{1+\tau_3 S}$	=	The function generated by the rate-lag compensator for T_{avg} dynamic compensation
τ_3	=	Time constants utilized in the rate-lag controller for T_{avg}, $\tau_3 = 10$ secs.
K_6 (nominal)	=	0.00145/°F for $T > T''$ and 0 for $T \le T''$
T	=	Average temperature, °F
T''	≤	Nominal loop specific indicated T_{avg} at RATED THERMAL POWER
S	=	Laplace transform operator, sec^{-1}
f_2 (ΔI)	=	0 for all ΔI

Note 4: The Channel's maximum trip setpoint shall not exceed its computed trip setpoint by more than 0.46 % ΔT span.

Table 2.2-1 (continued)
Reactor Trip System Instrumentation Trip Setpoints

Table Notations (continued)

Note 5: Steam Generator Water Level Low-Low Trip Time Delay

$$TD = B1(P)^3 + B2(P)^2 + B3(P) + B4$$

where:

P = RCS Loop ΔT Equivalent to Power (% RTP), P ≤ 50 % RTP
TD = Time delay for Steam Generator Water Level Low-Low Reactor Trip (in seconds)

B1 = -0.007218
B2 = +0.8099
B3 = -31.40
B4 = +464.1

Table 3.3-4
Engineered Safety Features Actuation System Instrumentation Trip Setpoints

	Functional Unit	Nominal Trip Setpoint	Allowable Values
1.	Safety Injection		
	(Reactor Trip, Feedwater Isolation, Start Diesel Generators, Containment Fan Cooler Units, and Component Cooling Water)		
	a. Manual Initiation	NA	NA
	b. Automatic Actuation Logic	NA	NA
	c. Containment Pressure - High	≤ 3 psig	≤ 3.12 psig
	d. Pressurizer Pressure - Low	≥ 1850 psig	≥ 1847.5 psig
	e. DELETED		
	f. Steamline Pressure - Low	≥ 600 psig (Note 1)	≥ 597.6 psig (Note 1)
2.	Containment Spray		
	a. Manual Initiation	NA	NA
	b. Automatic Actuation Logic and Actuation Relays	NA	NA
	c. Containment Pressure - High-High	≤ 22.0 psig	≤ 22.12 psig

Table 3.3-4 (continued)
Engineered Safety Features Actuation System Instrumentation Trip Setpoints

Functional Unit	Nominal Trip Setpoint	Allowable Values
3. Containment Isolation		
a. Phase "A" Isolation		
1) Manual Initiation	NA	NA
2) Automatic Actuation Logic and Actuation Relays	NA	NA
3) Safety Injection	See Item 1 above for all Safety Injection Trip Setpoints and Allowable Values.	
b. Phase "B" Isolation		
1) Manual Initiation	NA	NA
2) Automatic Actuation Logic and Actuation Relays	NA	NA
3) Containment Pressure - High-High	≤ 22.0 psig	≤ 22.12 psig
c. Containment Ventilation Isolation		
1) Automatic Actuation Logic and Actuation Relays	NA	NA
2) DELETED		
3) Safety Injection	See Item 1 above for all Safety Injection Trip Setpoints and Allowable Values.	
4) Containment Ventilation Exhaust Radiation-High (RM-44A and 44B)	Per the ODCP	

Table 3.3-4 (continued)
Engineered Safety Features Actuation System Instrumentation Trip Setpoints

	Functional Unit	Nominal Trip Setpoint	Allowable Values
4.	Steam Line Isolation		
	a. Manual Initiation	NA	NA
	b. Automatic Actuation Logic and Actuation Relays	NA	NA
	c. Containment Pressure - High-High	≤ 22.0 psig	≤ 22.12 psig
	d. Steamline Pressure - Low	≥ 600.0 psig (Note 1)	≥ 597.6 psig (Note 1)
	e. Steam Line Pressure - Negative Rate - High	≤ 100 psi (Note 3)	≤ 102.4 psi (Note 3)
5.	Turbine Trip and Feedwater Isolation		
	a. Automatic Actuation Logic Actuation Relays	NA	NA
	b. Steam Generator Water Level - High-High	≤ 75 % of narrow range instrument span each steam generator	≤ 75.2 % of narrow range instrument span each steam generator

Table 3.3-4 (continued)
Engineered Safety Features Actuation System Instrumentation Trip Setpoints

Functional Unit		Nominal Trip Setpoint	Allowable Values
6.	Auxiliary Feedwater		
	a. Manual Initiation	NA	NA
	b. Automatic Actuation Logic and Actuation Relays	NA	NA
	c. Steam Generator Water Level - Low-Low	≥ 15.0 % of narrow range instrument span each steam generator	≥ 14.8 % of narrow range instrument span each steam generator
	Coincident with:		
	1) RCS Loop ΔT Equivalent to Power ≤ 50 % RTP	RCS Loop ΔT variable input ≤ 50 % RTP	RCS Loop ΔT variable input ≤ 50.7 % RTP
	With a time delay (TD)	≤ TD (Note 2)	≤ (1.01) TD (Note 2)
	OR		
	2) RCS Loop ΔT Equivalent to Power > 50 % RTP	RCS Loop ΔT variable input > 50 % RTP	RCS Loop ΔT variable input > 50.7 % RTP
	With no time delay	TD = 0	TD = 0
	d. Undervoltage - RCP	≥ 8050 volts	≥ 7877 volts
	e. Safety Injection	See Item 1 above for all Safety Injection Trip Setpoints and Allowable Values.	

Table 3.3-4 (continued)
Engineered Safety Features Actuation System Instrumentation Trip Setpoints

	Functional Unit	Nominal Trip Setpoint	Allowable Values
7.	Loss of Power (4.16 kV Emergency Bus Undervoltage)		
	a. First Level		
	1) Diesel Start	TBD by PG&E	TBD by PG&E
	2) Initiation of Load Shed	TBD by PG&E	TBD by PG&E
	b. Second Level		
	1) Diesel Start	TBD by PG&E	TBD by PG&E
	2) Initiation of Load Shed	TBD by PG&E	TBD by PG&E
8.	Engineered Safety Features Actuation System Interlocks		
	a. Pressurizer Pressure, P-11	≤ 1915 psig	≤ 1917.5 psig
	b. DELETED		
	c. Reactor Trip, P-4	NA	NA

Table 3.3-4 (continued)
Engineered Safety Features Actuation System Instrumentation Trip Setpoints

Table Notations

Note 1: The time constants utilized in the lead-lag controller for Steam Pressure - Low are τ_1 = 50 seconds and τ_2 = 5 seconds.

Note 2: Steam Generator Water Level Low-Low Trip Time Delay

$$TD = B1(P)^3 + B2(P)^2 + B3(P) + B4$$

where:

P = RCS Loop ΔT Equivalent to Power (% RTP), $P \leq 50$ % RTP
TD = Time delay for Steam Generator Water Level Low-Low Reactor Trip (in seconds)

B1 = -0.007218
B2 = +0.8099
B3 = -31.40
B4 = +464.1

Note 3: The time constants utilized in the rate-lag controller for Negative Steam Line Pressure Rate - High are τ_3 = 50 seconds and τ_4 = 50 seconds.

Westinghouse Authorization Letter, CAW-03-1609
Affidavit
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Westinghouse

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Our ref: CAW-03-1609

March 13, 2003

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-11082, Revision 6 "Westinghouse Setpoint Methodology for Protection Systems, Diablo Canyon Units 1 & 2, 24 Month Fuel Cycle Evaluation" (Proprietary)
WCAP-13705, Revision 5 "Westinghouse Setpoint Methodology for Protection Systems, Diablo Canyon Units 1 & 2, 24 Month Fuel Cycle Evaluation" (Non-proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-03-1609 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Pacific Gas and Electric Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-03-1609 and should be addressed to the undersigned.

Very truly yours,

H. A. Sepp, Manager
Regulatory and Licensing Engineering

Enclosures

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

CAW-03-1609

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

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

[signature]

H. A. Sepp, Manager

Regulatory and Licensing Engineering

Sworn to and subscribed
before me this 13th day
of March, 2003

Notary Public

SHARON L. FIORI COMMONWEALTH OF PENNSYLVANIA NOTARY PUBLIC

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WCAP-11082, Revision 6, "Westinghouse Setpoint Methodology for Protection Systems, Diablo Canyon Units 1 & 2, 24 Month Fuel Cycle Evaluation" (Proprietary), dated February 2003, being transmitted by the Pacific Gas and Electric Company letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted for use by Westinghouse Electric Company LLC for Diablo Canyon Units 1 & 2 is expected to be applicable for other licensee submittals in response to certain NRC requirements for justification of changing plant Steam Generator level instrumentation setpoints.

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

(a) Information in support of a plant license submittal.

(b) Provide plant specific calculations.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for licensing documentation associated with Steam Generator level setpoints.

(b) Westinghouse can sell support and defense of the technology to its customers 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 calculations and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

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

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

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

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

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

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