March 23, 2011

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10 CFR 50.90

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

Point Beach Nuclear Plant, Units 1 and 2
Dockets 50-266 and 50-301
Renewed License Nos. DPR-24 and DPR-27

License Amendment Request 262
Revision to Technical Specification Operating
Limits to Include Measurement Uncertainty

Pursuant to 10 CFR 50.90, NextEra Energy Point Beach, LLC (NextEra) hereby requests to amend renewed Facility Operating Licenses DPR-24 and DPR-27 for Point Beach Nuclear Plant (PBNP) Units 1 and 2, respectively. NextEra proposes to replace non-conservative values for five operating limits in the PBNP Technical Specifications (TS) with conservative values that incorporate measurement uncertainty. NextEra is currently controlling these nonconservative values in accordance with the guidance in NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety."

Enclosure 1 provides a detailed description of the proposed changes, technical evaluation, regulatory evaluation including No Significant Hazards Consideration, and environmental consideration. Attachment 1 to Enclosure 1 provides the annotated TS pages showing the proposed changes. Attachment 2 to Enclosure 1 provides clean TS pages showing the proposed changes. Attachment 3 to Enclosure 1 provides a markup of proposed TS Bases changes. The TS Bases changes are provided for information only. NRC approval is not being requested for the TS Bases changes.

Enclosures 2 and 3 provide applicable pages from a representative sample of calculations which determine select TS values incorporating measurement uncertainty.

NextEra requests approval of the proposed license amendment by April 1, 2012. Once approved, the amendment shall be implemented within 60 days.

This letter contains no new regulatory commitments and no revisions to existing commitments.

The proposed TS changes have been reviewed by the Plant Operations Review Committee.

In accordance with 10 CFR 50.91, a copy of this letter is being provided to the designated Wisconsin Official.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on March 23, 2011.

Very truly yours,

NextEra Energy Point Beach, LLC

Larry Meyer
Site Vice President

Enclosures

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 262
REVISION TO TECHNICAL SPECIFICATION OPERATING LIMITS TO INCLUDE MEASUREMENT UNCERTAINTY

EVALUATION OF PROPOSED CHANGES TO TECHNICAL SPECIFICATIONS

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1. Proposed Technical Specification Changes (Mark-up)
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1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend renewed Facility Operating Licenses DPR-24 and DPR-27 for Point Beach Nuclear Plant (PBNP) Units 1 and 2, respectively. The proposed changes would revise five nonconservative values in the PBNP Technical Specifications (TS) with conservative values that incorporate measurement uncertainty. NextEra Energy Point Beach, LLC (NextEra) is currently controlling these nonconservative values in accordance with the guidance in NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety" (Reference 1).

2.0 DETAILED DESCRIPTION

NextEra proposes to revise five nonconservative values in the PBNP TS with conservative values that incorporate measurement uncertainty. Additionally, for one of these operating limits, NextEra proposes to replace a volume expressed in cubic feet with a volume expressed in tank percent level. These changes would allow plant operators to verify directly that TS limits are met based on instrument readings. By incorporating measurement uncertainty in these operating limits, the proposed changes also correct nonconservative values that have been documented previously in the PBNP corrective action program. These proposed changes do not affect any installed hardware. A detailed description of each proposed TS change is provided below. Proposed markups for the TS are provided in Attachment 1. Clean TS pages are provided in Attachment 2. Additionally, proposed markups for the Bases are provided in Attachment 3 for NRC staff information.

2.1 <u>Proposed Changes</u>:

1. Steam Generator Level - Narrow Range

   In Surveillance Requirement (SR) 3.4.5.2, replace:
   "Verify steam generator secondary side water levels are ≥ 30% narrow range for required RCS loops."

   With:
   "Verify steam generator secondary side water levels are ≥ 35% narrow range for required RCS loops."

   In SR 3.4.6.2, replace:
   "Verify SG secondary side water levels are ≥ 30% narrow range for required RCS loops."

   With:
   "Verify SG secondary side water levels are ≥ 35% narrow range for required RCS loops."

   In Limiting Condition for Operation (LCO) 3.4.7.b, replace:
   "The secondary side water level of at least one steam generator (SG) shall be ≥ 30% narrow range."

   With:
   "The secondary side water level of at least one steam generator (SG) shall be ≥ 35% narrow range."

In SR 3.4.7.2, replace
"Verify SG secondary side water level is ≥ 30% narrow range in required SG."

With:
"Verify SG secondary side water level is ≥ 35% narrow range in the required SG."

Basis for the changes:

The current TS steam generator limit of ≥ 30% narrow range maintains water level above the top of the SG tubes. This value does not include measurement uncertainties. The proposed TS value of ≥ 35% narrow range was determined by adjusting the current TS limit to incorporate the level indicator uncertainties. Therefore, the SR is met when the indicated SG narrow range level is ≥ 35%. This is stated in the current Bases for LCO 3.4.7, SR 3.4.5.2, SR 3.4.6.2, and SR 3.4.7.2. However, it is appropriate to have limits in the TS with allowance for measurement tolerances already incorporated. The word "the" is inserted in SR 3.4.7.2 for clarity.

2. Refueling Water Storage Tank (RWST) Temperature

In SR 3.5.4.1, replace:
"Verify RWST borated water temperature is ≥ 40°F and ≤ 100°F."

With:
"Verify RWST borated water temperature is ≥ 42.5°F and ≤ 97.5°F."

Basis for the change:

The current values in TS SR 3.5.4.1 for minimum and maximum RWST temperature support the plant accident analyses. The current RWST minimum temperature of 40°F is based on the value assumed in the steam line break analysis core response. Maintaining RWST temperature greater than the minimum value ensures that event consequences remain acceptable and bounded by the analysis. The maximum temperature ensures that the amount of containment cooling provided from the RWST during the heatup phase of a loss-of-coolant accident (LOCA) is consistent with accident analysis assumptions. The current upper temperature limit of 100°F is used in the containment integrity analysis. Exceeding this temperature will result in higher containment pressures due to reduced containment spray cooling capacity. The proposed TS values were determined by adjusting the current TS limits to incorporate the temperature indicator uncertainty. Since the minor scale divisions on the dial thermometers are 1°F, and readability is one half of a minor division, or 0.5°F, the new TS values are directly readable on the indicators without adjustment. Therefore, the SR is met when the indicated RWST temperature is ≥ 42.5°F and ≤ 97.5°F. This is stated in the current Bases for SR 3.5.4.1. However, it is appropriate to have limits in the TS with allowance for measurement tolerances already incorporated. The corresponding calculation is provided as Enclosure 2.

3. Containment Pressure – Low Range

In LCO 3.6.4, replace:
"Containment pressure shall be ≥ -2.0 psig and ≤ +2.0 psig."

With:
"Containment pressure shall be ≥ -1.0 psig and ≤ +1.0 psig."

<u>Basis for the change:</u>

Containment internal pressure is an initial condition used in the accident analyses to establish the maximum peak containment internal pressure. The initial pressure used in the containment LOCA analysis and steam line break containment analysis was 16.7 psia (2.0 psig). With an initial pressure of +2.0 psig, the maximum peak calculated containment pressure does not exceed the containment design pressure. The containment was also designed for an external pressure load equivalent to -2.0 psig. The limits in the current TS do not include measurement uncertainties. The proposed TS values were determined by adjusting the current TS limits to incorporate the pressure indicator uncertainties. This allows for direct surveillance using control room indications. Therefore, the LCO is met when the indicated containment pressure is ≥ -1.0 psig and ≤ +1.0 psig. This is stated in the current Bases for LCO 3.6.4. However, it is appropriate to have limits in the TS with allowance for measurement tolerances already incorporated. The corresponding calculation is provided as Enclosure 3.

4. Containment Average Air Temperature

In LCO 3.6.5, replace:
"Containment average air temperature shall be ≤ 120°F."

With:
"Containment average air temperature shall be:

a. ≤ 116.3°F based on three averaged temperature channels,

b. ≤ 115.7°F based on two averaged temperature channels, or

c. ≤ 112.5°F based on a single temperature channel."

<u>Basis for the change:</u>

The initial containment average air temperature assumed in the accident analyses is the current TS limit of 120°F. The results of the analyses demonstrate that the calculated transient containment air temperature is acceptable for the design basis accident LOCA. The current TS limit does not include measurement uncertainties. The proposed TS values were determined by adjusting the current TS limit to incorporate the indicator uncertainties. The number of channels used to determine average containment air temperature impacts the magnitude of measurement uncertainty that must be applied to ensure the input assumption is preserved. The LCO is revised accordingly to provide different limits based on the number of instrument channels used to determine containment average air temperature. Therefore, the LCO is met when indicated containment temperature is $\leq$116.3°F if three channels are averaged, $\leq$115.7°F if two channels are averaged, or $\leq$112.5°F if a single channel is used. These values are stated in the current Bases for LCO 3.6.5. However, it is appropriate to have limits in the TS with allowance for measurement tolerances already incorporated. The proposed change ensures that the initial conditions assumed in the accident analyses are met and provides operational margin based on the number of instrument channels that are available to indicate containment temperature.

NUREG-1431, Standard Technical Specifications, Westinghouse Plants, presents only a single value for containment average air temperature in corresponding LCO 3.6.5A. NextEra's proposed change to include separate values based on the number of temperature channels allows operational flexibility when one or two temperature channels are unavailable and ensures that the initial condition assumed in the accident analyses remains valid. The corresponding calculation is provided as Enclosure 2.

5. Spray Additive Tank (SAT) Level

In SR 3.6.7.2, replace:
"Verify spray additive tank solution volume is ≥ 2675 gal."

With:
"Verify spray additive tank solution volume is ≥ 43%."

Basis for the change:

The current TS value for minimum SAT volume is based on providing sufficient sodium hydroxide solution to adjust the pH of containment sump water and containment spray solution to neutralize boric acid and convert post-accident iodine to the nonvolatile iodate form. The TS operational limit does not include measurement uncertainties. The proposed minimum volume was calculated by converting the current TS limit to percent level in the SAT, applying uncertainties associated with the level indicator and rounding in the conservative direction. Therefore, the surveillance is met when the indicated SAT level is greater than or equal to 43%. Plant operators determine SAT volume based on the SAT level indicators, which show percent of span. The proposed change to replace the volume in cubic feet to indicated SAT water level would allow operators to use available instrumentation to readily verify SAT level is within the TS limit. The current Bases state that the SR is met when the indicated tank level is ≥ 43%. This ensures the TS limit is maintained. However, it is appropriate to have limits in the TS with allowance for measurement tolerances already incorporated. The corresponding calculation is provided as Enclosure 2.

3.0 TECHNICAL EVALUATION

The proposed change revises five PBNP TS operating limits to include measurement uncertainty. When the previous PBNP TS were converted to the Improved Technical Specifications in 2001, some of the TS operating limits did not account for measurement uncertainty. For the five operating limits addressed in this license amendment request (LAR), the current TS values are analysis values that represent a process condition assumed at the start of the event, or a value that would maintain a system, structure or component in an operable condition to mitigate an event, rather than an indicated value that can be read on plant instrumentation. Because instrument uncertainty is inherent in monitoring process parameters, these TS values should be revised to account for instrument uncertainty. NextEra determined that, for one of the parameters, the limit should be expressed in indicator units of tank level percent, rather than as gallons. These changes would avoid a need to provide operators with additional limits that have been adjusted for uncertainty or unit conversion.

For each of the five operating limits in this LAR, a calculation was performed to determine the proposed value and to demonstrate the technical adequacy of that value. The proposed values were determined by applying calculated instrument uncertainty, in the appropriate direction, to the current TS value (i.e., the analysis value), and then rounding in the conservative direction for readability of the indicator. Instrument uncertainty was calculated based on the square root sum of squares (SRSS) method to combine the random effects that influence instruments, such as accuracy, drift, calibration tolerance, and environmental effects such as ambient temperature. A summary of the calculations is provided below. The proposed TS values are currently implemented in the plant operator logs and other various operating procedures as the surveillance limits for TS compliance. The proposed changes do not affect values assumed in the accident analyses. Applying measurement uncertainty and, for one operating limit, also expressing the limit in terms of percent level, allows operators to compare their installed indications directly to the TS operating limit values without additional conversion.

The calculations to determine the proposed TS operating limit values were performed in accordance with PBNP Design and Installation Guidelines Manual DG-I01, "Instrument Setpoint Methodology." This guidance establishes a consistent approach for the analysis of instrument loop uncertainties and their effect on safety-related setpoints and process indications. A systematic method of identifying and combining instrument uncertainties for safety-related setpoints ensures the proper automatic actuation of plant protection systems that protect the physical barriers to the uncontrolled release of radioactivity. Although the proposed changes do not represent automatic actuations or limiting safety system settings, the systematic approach provides assurance that plant parameters are maintained within the initial conditions assumed in the accident analyses and that automatic actuations occur as assumed in the accident analyses. The design guide requires determination of loop indication errors to ensure that the plant operators are provided with the necessary information to make timely and correct manual actions in response to plant transients and abnormal operating conditions. For the proposed TS values, indication errors were established and accounted for to ensure the parameter values remain within the initial conditions assumed in the accident analyses.

The methodology described in the design guide is based on the requirements in ANSI/ISA S67.04, "Setpoints for Nuclear Safety-Related Instrumentation," Part I, and ISA RP67.04, "Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation," Part II. The design guide also reflects regulatory guidance presented to the Nuclear Energy Institute setpoint methods task force on September 7, 2005 (Reference 2). This methodology provides the basis for identifying, quantifying, and characterizing the error effects that must be considered in the development of an instrument uncertainty/setpoint calculation. Characterization of error effects forms the basis for the manner in which the errors are combined, i.e., square root sum of the squares method and/or a straight sum algebraic approach. This methodology defines each type of error and indicates how the error is determined.

There are some differences between the methodology used to calculate the proposed TS values and ISA-S67.04 and ISA-RP67.04. The PBNP methodology bases the equation for combining error terms on the characterization and applicability of each error term for the specific loop and environmental conditions at which the trip/indication is required. As such, the equations for calculating uncertainty may not be the same as the example equations shown in ISA-RP67.04. For example, some error terms (e.g., uncertainties under harsh accident environments and seismic events) are not assumed to occur during normal plant operation when a TS surveillance is performed. Therefore, these adverse terms are not included in the Total Loop Error (TLE) equation for each of the five proposed TS operational limits.

The methodology requires identifying the applicable sources of instrument error that may exist and must be considered in determining a total uncertainty. It also defines the method for combining these error effects. The setpoint methodology uses a realistic approach by combining the random uncertainties using a straight sum and statistical SRSS approach. This method assumes that all uncertainties do not simultaneously exhibit their maximum behavior and are independent, normally distributed, linear, random variables. Error effects were evaluated based on known behavior and characterized as independent, dependent, random, or non-random. This approach is considered more realistic in terms of the actual behavior of instruments and yields an assessment that more closely approximates the best estimate of total channel uncertainty. When error effects are known to exhibit non-random characteristics, they are treated outside of the SRSS method. Any non-random uncertainties (commonly referred to as a bias) were added algebraically according to sign (straight sum) to the SRSS random error result. With this approach, the final form of the uncertainty equation is determined for each value based on the characteristics (random or non-random) of each applicable element of uncertainty.

In developing the generalized equation for channel uncertainty, independent random elements are combined by SRSS as follows:

$$TLE = \pm (A^2 + B^2)^{1/2}$$

where A and B are independent random elements of uncertainty and TLE is the total uncertainty allowance or total loop error.

Dependent random elements are combined algebraically according to their dependency and combined with other independent random terms by SRSS:

$$TLE = \pm [A^2 + B^2 + (C + D)^2]^{1/2}$$

where C and D are dependent random elements and A and B are independent random elements.

Non-random elements are combined algebraically (straight sum) according to their sign with the results of the SRSS computation:

$$TLE = \pm [A^2 + B^2 + (C + D)^2]^{1/2} \pm \Sigma |X| + \Sigma Y - \Sigma Z$$

where X is a non-random variable with unknown sign; Y is a non-random positive bias; Z is a non-random negative bias; C and D are dependent random elements; and A and B are independent random elements.

Non-random terms are combined with the portion of the random terms having the same sign (i.e., positive non-random terms are combined with the positive portion of the random errors). Bias errors may only be offsetting where it can be proven that the conditions causing the bias will always occur at the same time and at the same magnitude. The offsetting combination of bias otherwise could result in a nonconservative error value.

Random uncertainties applied in the above TLE equation are 95/95 values (2σ values). For indication loops used for TS surveillances, the random portion of the TLE was converted to a 75/75 statistical value (75% probability at a 75% confidence level) by applying a reduction factor of 0.587, as permitted by the graded approach in DG-I01.

The resulting total channel uncertainty or TLE was then used to determine the proposed TS operating limit value. The calculation process starts with the current TS operating limit, which is also the initial condition limit taken from an accident analysis. Consideration is given to whether the TS value is a ≥value or a ≤value, to determine whether positive or negative uncertainty is applied to adjust the analysis value to an indicated value. Additional margin was applied in some cases by rounding in a conservative direction to reflect limitations in instrument readability.

The setpoint methodology establishes setpoints in engineering or process values, e.g., psig or lb/hr. To ensure proper implementation and surveillance of the TS limit, the engineering units in the TS need to match the units for the indication used to perform the periodic surveillance. For example, the calculation for SAT level required converting the TS limit, currently expressed in volume of cubic feet, to the indication units of percent of span. With the proposed change to the SAT level, the TS would be expressed in the same units as the plant indication.

Using the above methodology, the proposed limits provide assurance that the actual process parameter will not exceed the initial condition value assumed in the accident analyses.

1. Steam Generator Level - Narrow Range

   The revised value for steam generator level – narrow range (SGNR) included determining the TLEs for the SGNR water level instrumentation and evaluated the low-low, low, and high-high SGNR water level trip setpoints. This calculation also determined the plant process computer system and control room indicator uncertainties associated with the proposed value. The TLE was calculated to be 4.46% span. The current TS limit of 30% span represents a decreasing process (i.e., lowering steam generator level), so a positive TLE was applied to the current TS value. The results were rounded up for conservatism and adjusted for control room indicator readability of 1%. Therefore, the proposed TS value is 35% span.

Maintaining a minimum steam generator level in MODES 3, 4, and 5 ensures that there is an adequate heat sink for removing decay heat by maintaining water level at or above the top of the tubes. The proposed TS value of 35% reflects the current TS value with adjustment for measurement uncertainty and conservative rounding. Therefore, the proposed value will continue to ensure that the steam generator level will be maintained as assumed in the accident analyses.

2. RWST Temperature

The calculation for the proposed TS RWST temperature limits determined overall instrument uncertainty of the local RWST temperature indicators based on other similar bimetallic thermometers. The instrument uncertainty was determined to be ± 2.5°F. The proposed TS values were determined by adjusting the current TS limits by the assumed indicator uncertainty. Therefore, the proposed minimum temperature would increase from 40°F to 42.5°F, and the proposed maximum temperature would decrease from 100°F to 97.5°F. The scale divisions allow the new values to be read directly from the indicators without adjustment.

The TS limits for RWST temperature ensure that borated water is delivered within the temperature range assumed in the accident analyses. The maximum temperature ensures that the amount of cooling provided from the RWST during the heatup phase of a LOCA is consistent with accident analysis assumptions. The proposed TS values of ≥42.5°F and ≤97.5°F reflect the current TS values with adjustment for instrument uncertainty. Therefore, the proposed value will continue to ensure that the RWST will be maintained consistent with the assumptions in the accident analysis.

3. Containment Pressure – Low Range

The calculation for the proposed TS containment pressure limits adjusts the current TS values of +2.0 psig and -2.0 psig for TLE for the indicator loop. TLE is determined at the 75/75 statistical level using the SRSS method to combine the applicable random and independent errors, and algebraic addition of non-random or bias errors (of like sign). For containment pressure indication, total normal indicator loop error was calculated to be ±1.596% of span. The calibrated span in engineering units is 60 psi. This results in a calculated TLE of ±0.958 psig. However, the readability of these indicators is one-half of the smallest division (or 0.5 psig). Therefore, the TLE is conservatively rounded up to the nearest 0.5 psig interval of ±1.00 psi. Combining the current TS value and the TLE results in proposed TS limits of ≥ -1.0 psig and ≤ +1.0 psig.

Maintaining low range containment pressure within the TS range ensures the initial containment pressure assumed in the accident analysis will be maintained. The proposed TS values reflect the current TS values with adjustment for instrument uncertainty and conservative rounding. Therefore, the proposed value will continue to ensure that the initial containment pressure will be within the values assumed in the accident analyses.

4. Containment Average Air Temperature

The containment air temperature monitoring system consists of three independent instrument channels for each unit. The containment average air temperature indication allows operators to monitor containment temperature. The individual containment temperature indication channel uncertainty for the temperature loops was calculated at a 75/75 statistical level. The random total loop error was ±1.724% of span and the bias was +0.2086% of span. The range of the control room indicators is 50-350°F, for a span of 300°F. The individual loop uncertainty (random plus bias) is 5.8°F. The uncertainty for individual indicators was found by correcting for the readability of the individual control board indicators that are used for the TS surveillance. Indicator readability is one-half of a minor scale division of 5°F (or 2.5°F). Therefore, the uncertainty was rounded up to the nearest readable value, which is 7.5°F. However, when identical indication loops are averaged, the average uncertainty is less than the individual loop uncertainty. The reduction was obtained by dividing the random portion of the individual uncertainty by the square root of the number of indicators used to obtain the average. This averaging method is described in NUREG/CR-3659, Mathematical Model for Assessing the Uncertainties of Instrumentation Measurements for Power and Flow of PWR Reactors. If all three containment temperature channels are averaged, the random portion is reduced to 0.995%. When combined with the bias term, the average uncertainty for three channels (rounded up conservatively) is 3.7°F. For two channels, the random portion is 1.219%, which results in an average uncertainty of 4.3°F.

The proposed TS values were calculated by adjusting the current TS value of 120°F to account for the appropriate channel uncertainties. If three channels are used, the limit becomes ≤116.3°F. If two channels are used, the limit becomes ≤115.7°F. If a single channel is used, the limit would be ≤112.5°F. The proposed TS is presented with three limits. The operator would select the limit that corresponds to the number of indication loops that are available.

The proposed TS limits ensure containment average temperature is maintained below the value assumed in the accident analyses and provide operator flexibility when one or two containment temperature channels are unavailable. The proposed limits adjust the current TS limit for instrument uncertainty based on the number of temperature channels available.

5. Spray Additive Tank Level

The current TS require that the SAT contain a minimum of 2675 gallons of solution. The SAT level indication reads in percent level. In the calculation, the minimum required volume was converted to an equivalent percent SAT level to calculate the appropriate TS value that includes instrument uncertainty. To accomplish this, a relationship was established between tank level in inches, percent level, and tank volume. A physical volume of 2675 gallons corresponds to 38.37% level. Adding the positive indication uncertainty to this value provides a revised value in level percentage. The control room SAT level indicator 75/75 loop uncertainty was calculated to be ±3.425% of span. The range of control room SAT level indicators is 0-100%. The span is 100%, with minor divisions of 2% and readability of one-half of a division, or 1%. Adding the calculated uncertrainty to 38.37% results in a minimum indicated level of 41.795%. Adjusting for readability and including 1% additional margin, the minimum tank level was rounded conservatively to $\geq$43%.

The proposed TS limit ensures there is sufficient volume of sodium hydroxide solution in the SAT for post-accident iodine removal requirements and containment sump water pH during recirculation, as assumed in the accident analysis. The proposed TS value reflects the current TS limit with adjustments for instrument uncertainty.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

NextEra has determined that the proposed TS changes do not require any exemptions or relief from regulatory requirements and do not affect conformance with any general design criteria (GDC) differently than described in the PBNP Final Safety Analysis Report (FSAR).

PBNP was licensed prior to the 1971 publication of 10 CFR 50 Appendix A, GDC (ML003674718). As such, PBNP is not licensed to Appendix A GDCs. PBNP FSAR Section 1.3 lists the plant-specific GDCs to which the plant was licensed. The PBNP GDCs are similar in content to the draft GDCs proposed for public comment in 1967. The following discussion addresses the proposed changes with respect to meeting the requirements of the applicable draft design criteria to which PBNP is licensed.

PBNP GDC 12 - Instrumentation and Control Systems. Instrumentation and controls shall be provided as required to monitor and maintain within prescribed operating ranges essential reactor facility operating variables.

Additionally, the NRC's regulatory requirements related to the content of TS are set forth in 10 CFR 50.36, "Technical Specifications." Specifically, 10 CFR 50.36(c)(2)(ii) sets forth four criteria to be used in determining whether a LCO is required to be included in the TS. The criteria are:

> Criterion 1 - Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
>
> Criterion 2 - A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
>
> Criterion 3 - A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
>
> Criterion 4 - A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

The proposed changes to the TS values incorporate measurement uncertainty to ensure that the five operating parameters are maintained within the limits assumed as initial conditions in the accident analysis, consistent with PBNP GDC 12, above. PBNP GDC 12 continues to be met, since existing instrumentation remains available to monitor and maintain parameters within the prescribed operating ranges. The TS operating limits described in this LAR also meet Criterion 2 of 10 CFR 50.36(c)(2)(ii). The operating limits continue to be included in the TS, consistent with the requirement.

4.2 Precedent

None

4.3 No Significant Hazards Consideration Determination

NextEra Energy Point Beach, LLC has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1) Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated. The proposed changes clarify the requirements for five plant operating limits by incorporating measurement uncertainties in the Technical Specification values to ensure the parameters remain within the ranges assumed in the accident analysis. The parameters are not accident initiators. Therefore, the proposed change will not increase the probability of an accident previously evaluated. Maintaining the parameters within the ranges specified in the Technical Specifications ensures that systems will respond as assumed to mitigate the accidents previously evaluated. Therefore, the proposed change will not increase the consequences of an accident previously evaluated.

   Therefore, operation of the facility in accordance with the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2) Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change does not involve a physical alteration of the plant (i.e., no new or different type of equipment will be installed) or a change in the methods governing normal plant operation. The change does not alter assumptions made in the safety analysis, but ensures that plant operating parameters will be maintained as assumed in the accident analysis. The proposed change is consistent with the accident analysis assumptions.

   Therefore, the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3) Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

The amendment does not involve a significant reduction in a margin of safety. The proposed amendment clarifies the requirements for plant operating limits by incorporating instrument uncertainties to ensure the parameters remain within the initial operating limits or ranges assumed in the accident analysis. No change is made to the accident analysis assumptions.

Therefore, the proposed amendment would not involve a significant reduction in a margin of safety.

Based on the above, NextEra Energy Point Beach concludes that the proposed changes present no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusions

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

The Plant Operations Review Committee has reviewed the proposed changes and concurs with this conclusion.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

(1) U.S. Nuclear Regulatory Commission, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," Administrative Letter 98-10, December 29, 1998 (ML031110108)

(2) NRC letter to Nuclear Energy Institute, dated September 7, 2005, Technical Specification for Addressing Issues Related to Setpoint Allowable Values (ML052500004)

ENCLOSURE 1
ATTACHMENT 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 262
REVISION TO TECHNICAL SPECIFICATION OPERATING LIMITS TO
INCLUDE MEASUREMENT UNCERTAINTY

PROPOSED TECHNICAL SPECIFICATION CHANGES
(MARK-UP)

8 pages follow

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two RCS loops inoperable. <u>OR</u> No RCS loop in operation.	C.1	Place the Rod Control System in a condition incapable of rod withdrawal.	Immediately
	<u>AND</u>		
	C.2	Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	<u>AND</u>		
	C.3	Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.5.1	Verify one RCS loop is in operation.	12 hours
SR 3.4.5.2	Verify steam generator secondary side water levels are ≥ ~~30~~<u>35</u>% narrow range for required RCS loops.	12 hours
SR 3.4.5.3	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	7 days

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One required RHR loop inoperable. AND Two required RCS loops inoperable.	B.1	Be in MODE 5.	24 hours
C. Required RCS or RHR loops inoperable. OR No RCS or RHR loop in operation.	C.1	Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	AND		
	C.2	Initiate action to restore one loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify one RHR or RCS loop is in operation.	12 hours
SR 3.4.6.2	Verify SG secondary side water levels are ≥ ~~30~~35% narrow range for required RCS loops.	12 hours
SR 3.4.6.3	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops—MODE 5, Loops Filled

LCO 3.4.7 One residual heat removal (RHR) loop shall be OPERABLE and in operation, and either:

a. One additional RHR loop shall be OPERABLE; or

b. The secondary side water level of at least one steam generator (SG) shall be ≥ ~~30~~35% narrow range.

-----------------------------------NOTES-----------------------------------

1. The RHR pump of the loop in operation may be not in operation for ≤ 1 hour per 8 hour period provided:

    a. No operations are permitted that would cause reduction of the RCS boron concentration; and

    b. Core outlet temperature is maintained at least 10°F below saturation temperature.

2. One required RHR loop may be inoperable for up to 2 hours for surveillance testing provided that the other RHR loop is OPERABLE and in operation.

3. No reactor coolant pump shall be started with one or more RCS cold leg temperatures ≤ Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR unless the secondary side water temperature of each SG is ≤ 50°F above each of the RCS cold leg temperatures.

4. All RHR loops may be removed from operation during planned heatup to MODE 4 or during the performance of required leakage or flow testing when at least one RCS loop is in operation.

APPLICABILITY: MODE 5 with RCS loops filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RHR loop inoperable. AND Required SG secondary side water level not within limits.	A.1 Initiate action to restore a second RHR loop to OPERABLE status. OR A.2 Initiate action to restore required SG secondary side water level to within limit.	Immediately Immediately
B. Required RHR loops inoperable. OR No RHR loop in operation.	B.1 Suspend all operations involving a reduction of RCS boron concentration. AND B.2 Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.7.1	Verify one RHR loop is in operation.	12 hours
SR 3.4.7.2	Verify SG secondary side water level is ≥ ~~30~~35% narrow range in the required SG.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify RWST borated water temperature is ≥ ~~40~~42.5°F and ≤ ~~100~~97.5°F.	24 hours
SR 3.5.4.2	Verify RWST borated water volume is ≥ 275,000 gallons.	7 days
SR 3.5.4.3	Verify RWST boron concentration is ≥ 2700 ppm and ≤ 3200 ppm.	7 days

3.6 CONTAINMENT SYSTEMS

3.6.4 Containment Pressure

LCO 3.6.4 Containment pressure shall be ≥ -~~2.0~~1.0 psig and ≤ +~~2.0~~1.0 psig.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Containment pressure not within limits.	A.1	Restore containment pressure to within limits.	1 hour
B. Required Action and associated Completion Time not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.4.1	Verify containment pressure is within limits.	12 hours

3.6 CONTAINMENT SYSTEMS

3.6.5 Containment Air Temperature

LCO 3.6.5 Containment average air temperature shall be ~~≤ 120°F.~~:

a. ≤ 116.3°F based on three averaged temperature channels,

b. ≤ 115.7°F based on two averaged temperature channels, or

c. ≤ 112.5°F based on a single temperature channel.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment average air temperature not within limit.	A.1 Restore containment average air temperature to within limit.	8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.5.1	Verify containment average air temperature is within limit.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Verify each spray additive manual, power operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position is in the correct position.	31 days
SR 3.6.7.2	Verify spray additive tank solution volume is ≥ ~~2675gal~~43%.	184 days
SR 3.6.7.3	Verify spray additive tank NaOH solution concentration is ≥ 30% and ≤ 33% by weight.	184 days
SR 3.6.7.4	Verify each spray additive automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months

ENCLOSURE 1
ATTACHMENT 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 262
REVISION TO TECHNICAL SPECIFICATION OPERATING LIMITS TO INCLUDE MEASUREMENT UNCERTAINTY

PROPOSED TECHNICAL SPECIFICATION CHANGES
(CLEAN)

8 pages follow

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two RCS loops inoperable. <u>OR</u> No RCS loop in operation.	C.1	Place the Rod Control System in a condition incapable of rod withdrawal.	Immediately
	<u>AND</u>		
	C.2	Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	<u>AND</u>		
	C.3	Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.5.1	Verify one RCS loop is in operation.	12 hours
SR 3.4.5.2	Verify steam generator secondary side water levels are ≥ 35% narrow range for required RCS loops.	12 hours
SR 3.4.5.3	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	7 days

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One required RHR loop inoperable. AND Two required RCS loops inoperable.	B.1 Be in MODE 5.	24 hours
C. Required RCS or RHR loops inoperable. OR No RCS or RHR loop in operation.	C.1 Suspend all operations involving a reduction of RCS boron concentration. AND C.2 Initiate action to restore one loop to OPERABLE status and operation.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.6.1	Verify one RHR or RCS loop is in operation.	12 hours
SR 3.4.6.2	Verify SG secondary side water levels are ≥ 35% narrow range for required RCS loops.	12 hours
SR 3.4.6.3	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops—MODE 5, Loops Filled

LCO 3.4.7 One residual heat removal (RHR) loop shall be OPERABLE and in operation, and either:

a. One additional RHR loop shall be OPERABLE; or

b. The secondary side water level of at least one steam generator (SG) shall be ≥ 35% narrow range.

--------------------------------------NOTES-----------------------------------

1. The RHR pump of the loop in operation may be not in operation for ≤ 1 hour per 8 hour period provided:

    a. No operations are permitted that would cause reduction of the RCS boron concentration; and

    b. Core outlet temperature is maintained at least 10°F below saturation temperature.

2. One required RHR loop may be inoperable for up to 2 hours for surveillance testing provided that the other RHR loop is OPERABLE and in operation.

3. No reactor coolant pump shall be started with one or more RCS cold leg temperatures ≤ Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR unless the secondary side water temperature of each SG is ≤ 50°F above each of the RCS cold leg temperatures.

4. All RHR loops may be removed from operation during planned heatup to MODE 4 or during the performance of required leakage or flow testing when at least one RCS loop is in operation.

APPLICABILITY: MODE 5 with RCS loops filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RHR loop inoperable. AND Required SG secondary side water level not within limits.	A.1 Initiate action to restore a second RHR loop to OPERABLE status. OR A.2 Initiate action to restore required SG secondary side water level to within limit.	Immediately Immediately
B. Required RHR loops inoperable. OR No RHR loop in operation.	B.1 Suspend all operations involving a reduction of RCS boron concentration. AND B.2 Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.7.1	Verify one RHR loop is in operation.	12 hours
SR 3.4.7.2	Verify SG secondary side water level is ≥ 35% narrow range in the required SG.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify RWST borated water temperature is ≥ 42.5°F and ≤ 97.5°F.	24 hours
SR 3.5.4.2	Verify RWST borated water volume is ≥ 275,000 gallons.	7 days
SR 3.5.4.3	Verify RWST boron concentration is ≥ 2700 ppm and ≤ 3200 ppm.	7 days

3.6 CONTAINMENT SYSTEMS

3.6.4 Containment Pressure

LCO 3.6.4 Containment pressure shall be ≥ -1.0 psig and ≤ +1.0 psig.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment pressure not within limits.	A.1 Restore containment pressure to within limits.	1 hour
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.4.1 Verify containment pressure is within limits.	12 hours

3.6 CONTAINMENT SYSTEMS

3.6.5 Containment Air Temperature

LCO 3.6.5 Containment average air temperature shall be:

a. ≤ 116.3°F based on three averaged temperature channels,

b. ≤ 115.7°F based on two averaged temperature channels, or

c. ≤ 112.5°F based on a single temperature channel.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment average air temperature not within limit.	A.1 Restore containment average air temperature to within limit.	8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.5.1	Verify containment average air temperature is within limit.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Verify each spray additive manual, power operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position is in the correct position.	31 days
SR 3.6.7.2	Verify spray additive tank solution volume is ≥ 43%.	184 days
SR 3.6.7.3	Verify spray additive tank NaOH solution concentration is ≥ 30% and ≤ 33% by weight.	184 days
SR 3.6.7.4	Verify each spray additive automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months

ENCLOSURE 1
ATTACHMENT 3

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 262
REVISION TO TECHNICAL SPECIFICATION OPERATING LIMITS TO
INCLUDE MEASUREMENT UNCERTAINTY

PROPOSED TECHNICAL SPECIFICATION BASES CHANGES
(FOR INFORMATION ONLY)

16 pages follow

BASES

APPLICABLE SAFETY ANALYSES (continued)

path that functions or actuates to prevent or mitigate a Design Basis Accident or transient that either assumes the failure of, or presents a challenge to, the integrity of a fission product barrier.

RCS Loops - MODE 3 satisfy Criterion 3 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least two RCS loops be OPERABLE. In MODE 3 with the Rod Control System capable of rod withdrawal, one RCS loop must be in operation. One RCS loop is required to be in operation in MODE 3 with the Rod Control System capable of rod withdrawal due to the postulation of a power excursion because of an inadvertent control rod withdrawal. The required number of RCS loops in operation ensures that the Safety Limit criteria will be met for all of the postulated accidents.

When the Rod Control System is not capable of rod withdrawal only one RCS loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. An additional RCS loop is required to be OPERABLE to ensure that safety analyses limits are met.

The Note permits all RCPs to be not in operation for ≤ 1 hour per 8 hour period. The purpose of the Note is to perform tests that are designed to validate various accident analyses values. An example of one of these tests is validation of the pump coastdown curve used as input to a number of accident analyses including a loss of flow accident. This test is generally performed in MODE 3 during the initial startup testing program, and as such should only be performed once. If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values of the coastdown curve must be revalidated by conducting the test again.

The 1 hour time period specified is adequate to perform the desired tests, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of the Note is permitted provided the following conditions are met, along with any other conditions imposed by initial startup test procedures:

a. No operations are permitted that would dilute the RCS boron concentration, thereby maintaining the margin to criticality. Boron reduction is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation;

BASES

ACTIONS (continued) B.1

If restoration is not possible within 72 hours, the unit must be brought to MODE 4. In MODE 4, the unit may be placed on the Residual Heat Removal System. The additional Completion Time of 12 hours is compatible with required operations to achieve cooldown and depressurization from the existing plant conditions in an orderly manner and without challenging plant systems.

C.1, C.2, and C.3

If two RCS loops are inoperable or no RCS loop is in operation, except as during conditions permitted by the Note in the LCO section, place the Rod Control System in a condition incapable of rod motion (e.g., CRDMs must be de-energized by opening the RTBs or de-energizing the MG sets). All operations involving a reduction of RCS boron concentration must be suspended, and action to restore one of the RCS loops to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and opening the RTBs or de-energizing the MG sets removes the possibility of an inadvertent rod withdrawal. The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.5.1

This SR requires verification every 12 hours that one RCS loop is in operation. Verification includes flow rate, temperature, and pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS loop performance.

SR 3.4.5.2

SR 3.4.5.2 requires verification of SG OPERABILITY.
SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ ~~30~~35% for required RCS loops. If the SG secondary side narrow range water level is < ~~30~~35%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink for removal of the decay heat. The minimum steam generator narrow range level limit (~~30~~35%) ~~does not~~ includes instrument uncertainty. ~~The Surveillance Requirement is met when indicated steam generator narrow range level is ≥35%.~~ The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to a loss of SG level.

BASES

ACTIONS (continued)

C.1 and C.2

If no loop is OPERABLE or in operation, except during conditions permitted by Note 1 in the LCO section, all operations involving a reduction of RCS boron concentration must be suspended and action to restore one RCS or RHR loop to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that one RCS or RHR loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

SR 3.4.6.2

SR 3.4.6.2 requires verification of SG OPERABILITY.
SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ ~~30~~35%. If the SG secondary side narrow range water level is < ~~30~~35%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The minimum steam generator narrow range level limit (~~30~~35%) ~~does not~~ includes instrument uncertainty. ~~The Surveillance Requirement is met when indicated steam generator narrow range level is ≥35%.~~ The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.6.3

Verification that the required pump is OPERABLE ensures that an additional RCS or RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

None.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.7 RCS Loops - MODE 5, Loops Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops filled, the primary function of the reactor coolant is the removal of decay heat and transfer this heat either to the steam generator (SG) secondary side coolant via natural circulation (Ref. 1) or the component cooling water via the residual heat removal (RHR) heat exchangers. While the principal means for decay heat removal is via the RHR System, the SGs via natural circulation (Ref. 1) are specified as a backup means for redundancy. Even though the SGs cannot produce steam in this MODE, they are capable of being a heat sink due to their large contained volume of secondary water. As long as the SG secondary side water is at a lower temperature than the reactor coolant, heat transfer will occur. The rate of heat transfer is directly proportional to the temperature difference. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 5 with RCS loops filled, the reactor coolant is circulated by means of two RHR loops connected to the RCS, each loop containing an RHR heat exchanger, an RHR pump, and appropriate flow and temperature instrumentation for control, protection, and indication. One RHR pump circulates the water through the RCS at a sufficient rate to prevent boric acid stratification.

The number of loops in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one RHR loop for decay heat removal and transport. The flow provided by one RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that a second path be available to provide redundancy for heat removal.

The LCO provides for redundant paths of decay heat removal capability. The first path can be an RHR loop that must be OPERABLE and in operation. The second path can be another OPERABLE RHR loop or maintaining one SG with secondary side water levels above ~~30~~35% narrow range to provide an alternate method for decay heat removal.

BASES

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The RHR loops provide this circulation.

RCS Loops - MODE 5 (Loops Filled) have been identified in the NRC Policy Statement as important contributors to risk reduction.

LCO

The purpose of this LCO is to require that at least one of the RHR loops be OPERABLE and in operation with an additional RHR loop OPERABLE or one SG with secondary side water level ≥ ~~30~~35% narrow range. One RHR loop provides sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. An additional RHR loop is required to be OPERABLE to meet single failure considerations. However, if the standby RHR loop is not OPERABLE, an acceptable alternate method is one SG with its secondary side water level ≥ ~~30~~35% narrow range. Should the operating RHR loop fail, the SG could be used to remove the decay heat via natural circulation (Ref. 1). The minimum steam generator narrow range level limit (~~30~~35%) ~~does not~~ includes instrument uncertainty.~~ The LCO is met when indicated steam generator narrow range level is ≥35%.~~

Note 1 permits all RHR pumps to be not in operation ≤ 1 hour per 8 hour period. The Note permits the performance of tests which require that the pumps be stopped for a short period of time. One example of a test which may be performed is the validation of rod drop times during cold conditions without flow. This no flow test may be performed in MODE 3, 4, or 5 and requires that the pumps be stopped for a short period of time. The Note permits stopping of the pumps in order to perform the test. The 1 hour time period is adequate to perform the test, and operating experience has shown that boron stratification is not likely during this short period with no forced flow.

Utilization of Note 1 is permitted provided the following conditions are met, along with any other conditions imposed by initial startup test procedures:

a. No operations are permitted that would dilute the RCS boron concentration, therefore maintaining the margin to criticality. Boron reduction is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and

b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

BASES

LCO (continued)

Note 2 allows one RHR loop to be inoperable for a period of up to 2 hours, provided that the other RHR loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when such testing is safe and possible.

Note 3 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of a reactor coolant pump (RCP) with an RCS cold leg temperature ≤ Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR. This restriction is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 4 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting removal of RHR loops from operation when at least one RCS loop is in operation. This Note provides for the transition to MODE 4 where an RCS loop is permitted to be in operation and replaces the RCS circulation function provided by the RHR loops. Note 4 also allows both RHR loops to be removed from operation when at least one RCS loop is in operation to allow for the performance of leakage or flow testing, as required by Technical Specifications or by regulation. This allowance is necessary based on the design of the Point Beach RHR System configuration, which requires the system to be removed from service to perform the required PIV testing.

RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. An SG can perform as a heat sink via natural circulation (Ref. 1) when it has an adequate water level and is OPERABLE.

APPLICABILITY

In MODE 5 with RCS loops filled, this LCO requires forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of RHR provides sufficient circulation for these purposes.

However, one additional RHR loop is required to be OPERABLE, or the secondary side water level of at least one SGs is required to be ≥ ~~30~~35% narrow range.

BASES

APPLICABILITY (continued)

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2";
LCO 3.4.5, "RCS Loops - MODE 3";
LCO 3.4.6, "RCS Loops - MODE 4";
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
LCO 3.9.4, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1 and A.2

If one RHR loop is inoperable and the required SG has secondary side water level < ~~30~~35% narrow range, redundancy for heat removal is lost. Action must be initiated immediately to restore a second RHR loop to OPERABLE status or to restore the required SG secondary side water level. Either Required Action A.1 or Required Action A.2 will restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1 and B.2

If no RHR loop is in operation, except during conditions permitted by Note 1, or if no loop is OPERABLE, all operations involving a reduction of RCS boron concentration must be suspended and action to restore one RHR loop to OPERABLE status and operation must be initiated. To prevent boron dilution, forced circulation is required to provide proper mixing and preserve the margin to criticality in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification every 12 hours that the required loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RHR loop performance.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.7.2

Verifying that at least one SG is OPERABLE by ensuring its secondary side narrow range water level is ≥ ~~30~~35% narrow range ensures an alternate decay heat removal method via natural circulation (Ref. 1) in the event that the second RHR loop is not OPERABLE. The minimum steam generator narrow range level limit (~~30~~35%) ~~does not~~ includes instrument uncertainty. ~~The Surveillance Requirement is met when indicated steam generator narrow range level is ≥35%.~~ If both RHR loops are OPERABLE, this Surveillance is not needed. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.7.3

Verification that a second RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the RHR pump. If secondary side water level is ≥ ~~30~~35% narrow range in at least one SG, this Surveillance is not needed. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

1. NRC Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation."

BASES

APPLICABLE SAFETY ANALYSES (continued)

thereby minimizing containment pressure. Minimizing containment pressure increases RCS blowdown rate, increasing core reflood time, which results in higher peak clad temperatures. The RWST minimum temperature of ~~40~~42.5°F is based on the value assumed in the SLB analysis, core response, adjusted for instrument uncertainty. Maintaining RWST temperature greater than the minimum values ensures that event consequences remain acceptable and bounded by the analysis. The upper temperature limit of ~~100~~97.5°F is based on the value used in the containment integrity analysis, adjusted for instrument uncertainty. Exceeding this temperature will result in higher containment pressures due to reduced containment spray cooling capacity.

The RWST satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The RWST ensures that an adequate supply of borated water is available to cool and depressurize the containment in the event of a Design Basis Accident (DBA), to cool and cover the core in the event of a LOCA, to maintain the reactor subcritical following a DBA, and to ensure adequate level in the containment sump to support ECCS and Containment Spray System pump operation in the recirculation mode.

To be considered OPERABLE, the RWST must meet the water volume, boron concentration, and temperature limits established in the SRs.

APPLICABILITY

In MODES 1, 2, 3, and 4, RWST OPERABILITY requirements are dictated by ECCS and Containment Spray System OPERABILITY requirements. Since both the ECCS and the Containment Spray System must be OPERABLE in MODES 1, 2, 3, and 4, the RWST must also be OPERABLE to support their operation. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops-MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops-MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation-High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation-Low Water Level."

ACTIONS

A.1

With RWST boron concentration or borated water temperature not within limits, they must be returned to within limits within 8 hours. Under these conditions neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE condition. The 8 hour limit to restore the RWST temperature or boron concentration to within limits was developed considering the time required to change either the boron concentration or temperature and the fact that the contents of the tank are still available for injection.

BASES

ACTIONS (continued)

B.1

With the RWST inoperable for reasons other than Condition A (e.g., water volume), it must be restored to OPERABLE status within 1 hour. In this Condition, neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE status or to place the plant in a MODE in which the RWST is not required. The short time limit of 1 hour to restore the RWST to OPERABLE status is based on this condition simultaneously affecting redundant trains.

C.1 and C.2

If the RWST cannot be returned to OPERABLE status within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

The RWST borated water temperature should be verified every 24 hours to be within the limits assumed in the accident analyses band. This Frequency is sufficient to identify a temperature change that would approach either limit and has been shown to be acceptable through operating experience. The minimum and maximum RWST water temperature limits (~~40~~42.5°F and ~~100~~97.5°F, respectively) ~~do not~~ include instrument uncertainty. ~~The Surveillance Requirement is met when indicated RWST temperature is ≥ 42.5°F and ≤ 97.5°F.~~

SR 3.5.4.2

The RWST water volume should be verified every 7 days to be above the required minimum level in order to ensure that a sufficient initial supply is available for injection and to support continued ECCS and Containment Spray System pump operation on recirculation. Since the RWST volume is normally stable and is protected by an alarm, a 7 day Frequency is appropriate and has been shown to be acceptable through operating experience. The minimum RWST water volume limit (275,000 gallons) includes instrument uncertainty. The Surveillance Requirement is met when indicated RWST level is ≥ 95%.

BASES

APPLICABLE SAFETY ANALYSES (continued)

For certain aspects of transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the cooling effectiveness of the Emergency Core Cooling System during the core reflood phase of a LOCA analysis increases with increasing containment backpressure. Therefore, for the reflood phase, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the containment pressure response in accordance with 10 CFR 50, Appendix K (Ref. 3).

Containment pressure satisfies Criterion 2 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).

LCO

Maintaining containment pressure at less than or equal to the LCO upper pressure limit ensures that, in the event of a DBA, the resultant peak containment accident pressure will remain below the containment design pressure. The ~~2.0~~1.0 psig positive containment pressure limit was chosen based upon analysis. A ~~2.0~~1.0 psig positive pressure limit is sufficiently low to prevent exceeding the containment design pressure (60 psig) in the event of a DBA, while allowing the operational flexibility to accommodate containment pressure increases resulting from evolutions such as plant heat ups and atmospheric pressure changes, in addition to instrument air leakage and operation of air operated valves. Maintaining containment pressure at greater than or equal to the LCO lower pressure limit ensures that the containment will not exceed the design negative differential pressure. The minimum and maximum containment pressure limits ~~(- 2.0 psig and + 2.0 psig, respectively) do not~~ include instrument uncertainty.~~The LCO is met when indicated containment pressure is ≥ -1.0 psig and ≤ + 1.0 psig.~~

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment. Since maintaining containment pressure within limits is essential to ensure that containment integrity is maintained, the LCO is applicable in MODES 1, 2, 3 and 4.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, maintaining containment pressure within the limits of the LCO is not required in MODE 5 or 6.

BASES

ACTIONS

A.1

When containment pressure is not within the limits of the LCO, it must be restored to within these limits within 1 hour. The Required Action is necessary to return operation to within the limits established to ensure that containment design pressures are not exceeded. The 1 hour Completion Time is consistent with the ACTIONS of LCO 3.6.1, "Containment," which requires that containment be restored to OPERABLE status within 1 hour.

B.1 and B.2

If containment pressure cannot be restored to within limits within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.4.1

Verifying that containment pressure is within limits ensures that unit operation remains within the limits established to ensure that containment design pressures are not exceeded. The minimum and maximum containment pressure limits ~~(-2.0 psig and + 2.0 psig, respectively) do not~~ include instrument uncertainty. The Surveillance Requirement is met when indicated containment pressure is $\geq$ - 1.0 psig and $\leq$ + 1.0 psig. The 12 hour Frequency of this SR was developed based on operating experience related to trending of containment pressure variations during the applicable MODES. Furthermore, the 12 hour Frequency is considered adequate in view of other indications available in the control room.

REFERENCES

1. FSAR, Section 14.
2. FSAR, Section 5.5.2.
3. 10 CFR 50, Appendix K

BASES

APPLICABLE SAFETY ANALYSES (continued)

and Containment Cooling System being rendered inoperable. The postulated DBA SLB was similarly analyzed, except that both trains of the Containment Spray System and the Containment Cooling System are assumed operable. This is acceptable since the DBA SLB analysis assumed a single failure of the feedwater regulating valve as the worst case single failure for the containment integrity analysis.

The limiting DBA for the maximum peak containment air temperature is a LOCA. The initial containment average air temperature assumed in the design basis analyses (Ref. 1) is 120°F. This resulted in a maximum containment air temperature of 297.9°F and a surface temperature of the containment wall and dome of 261°F. The containment structure design temperature is 286°F.

The temperature limit is used to establish the environmental qualification operating envelope for containment. The maximum peak containment air temperature was calculated to exceed the containment design temperature for only a few seconds during the transient. The basis of the containment design temperature, however, is to ensure the performance of safety related equipment inside containment (Ref. 2). Thermal analyses showed that the time interval during which the containment air temperature exceeded the containment design temperature was short enough that the equipment surface temperatures remained below the design temperature. Therefore, it is concluded that the calculated transient containment air temperature is acceptable for the DBA LOCA.

The containment pressure transient is sensitive to the initial air mass in containment and, therefore, to the initial containment air temperature. The limiting DBA for establishing the maximum peak containment internal pressure is a SLB. The temperature limit is used in this analysis to ensure that in the event of an accident the maximum containment internal pressure will not be exceeded.

Containment average air temperature satisfies Criterion 2 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).

LCO

During a DBA, with an initial containment average air temperature less than or equal to the LCO temperature limit, the resultant peak accident temperature is maintained below the containment design temperature. As a result, the ability of containment to perform its design function is ensured.

The containment air temperature limits ~~(120°F) does not~~ include instrument uncertainty. The LCO is met when indicated containment temperature is ≤112.5°F (for a single ~~indicator~~channel), ~~<~~≤ 115.7°F (two ~~indicators~~channels averaged), or ~~<~~≤ 116.3°F (three ~~indicators~~channels averaged).

BASES

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, maintaining containment average air temperature within the limit is not required in MODE 5 or 6.

ACTIONS

A.1

When containment average air temperature is not within the limit of the LCO, it must be restored to within limit within 8 hours. This Required Action is necessary to return operation to within the bounds of the containment analysis. The 8 hour Completion Time is acceptable considering the sensitivity of the analysis to variations in this parameter and provides sufficient time to correct minor problems.

B.1 and B.2

If the containment average air temperature cannot be restored to within its limit within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.5.1

Verifying that containment average air temperature is within the LCO limits ensures that containment operation remains within the limit assumed for the containment analyses. In order to determine the containment average air temperature, an arithmetic average is calculated using measurements taken at locations within the containment selected to provide a representative sample of the overall containment atmosphere. The containment average air temperature limits ~~(120°F) does not~~ include instrument uncertainty. The Surveillance Requirement is met when indicated containment temperature is ≤112.5°F (for a single ~~indicator~~channel), ~~<~~≤ 115.7°F (two ~~indicators~~channels averaged), or ~~<~~≤ 116.3°F (three ~~indicator~~channels averaged). The 24 hour Frequency of this SR is considered acceptable based on observed slow rates of temperature increase within containment as a result of environmental heat sources (due to the large volume of containment).

BASES

APPLICABLE SAFETY ANALYSES	Following a design basis LOCA, the containment is assumed to leak at its analysis leakage limit (1.0 L_a) for the first 24 hours of the event and 50% of L_a for the remainder of the calculated 30 day dose period. The containment spray system is assumed to remove elemental iodine from the containment atmosphere until a decontamination factor of 200 is achieved. Once removed from the atmosphere, iodine is assumed to stay in solution with the sump recirculation fluids. In order to assure long term iodine retention with no significant re-evolution, an equilibrium sump fluid pH of between 7.0 and 10.5 is desired. The Spray Additive System satisfies Criterion 3 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).
LCO	The Spray Additive System is necessary to reduce the release of radioactive material to the environment in the event of a DBA. Sodium hydroxide addition to the containment also ensures a containment sump fluid pH of between 7.0 and 10.5 to assist in minimizing the evolution of iodine from the containment recirculation fluids. This pH band also minimizes the effects of chloride and caustic stress corrosion on containment systems, components, and structures. To be considered OPERABLE, the volume and concentration of the spray additive solution must be sufficient to provide NaOH injection into the containment. In addition, it is essential that the Containment Spray System is OPERABLE, valves in the Spray Additive System flow paths are properly positioned, and that automatic valves are capable of activating to their correct positions.
APPLICABILITY	In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment requiring the operation of the Spray Additive System. The Spray Additive System assists in reducing the iodine fission product inventory prior to release to the environment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations in these MODES. Thus, the Spray Additive System is not required to be OPERABLE in MODE 5 or 6.
ACTIONS	A.1 With one Spray Additive System flowpath inoperable, the inoperable flowpath must be restored to OPERABLE status within 72 hours. In this condition, the remaining OPERABLE portion of the Spray Additive System is adequate to ensure a containment sump fluid pH between

BASES

SURVEILLANCE REQUIREMENTS (continued)

spray additive to adjust pH for all water injected. This SR is performed to verify the availability of sufficient NaOH solution in the Spray Additive System. The limit for minimum spray additive volume ~~(2675 gallons)~~ ~~does not~~ includes instrument uncertainty. The limit for minimum SAT volume is 2900 gallon. The Surveillance Requirement is met when indicated SAT level is $\geq$ 43%. The 184 day Frequency was developed based on the low probability of an undetected change in tank volume occurring during the SR interval (the tank is isolated during normal unit operations). Tank level is also indicated and alarmed in the control room, so that there is high confidence that a substantial change in level would be detected.

SR 3.6.7.3

This SR provides verification of the NaOH concentration in the spray additive tank and is sufficient to ensure that the spray solution being injected into containment is at the correct pH level. The 184 day Frequency is sufficient to ensure that the concentration level of NaOH in the spray additive tank remains within the established limits. This is based on the low likelihood of an uncontrolled change in concentration (the tank is normally isolated) and the probability that any substantial variance in tank volume will be detected.

SR 3.6.7.4

This SR provides verification that each automatic valve in the Spray Additive System flow path actuates to its correct position. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. FSAR, Chapter 14.3.

ENCLOSURE 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 262
REVISION TO TECHNICAL SPECIFICATION OPERATING LIMITS TO INCLUDE MEASUREMENT UNCERTAINTY

CALCULATION 2006-0035, REVISION 1
RWST TEMPERATURE, CONTAINMENT AVERAGE AIR TEMPERATURE AND SPRAY ADDITIVE TANK LEVEL UNCERTAINTY/SETPOINT CALCULATION

25 pages follow

1.0 BACKGROUND, PURPOSE, AND SCOPE OF CALCULATION

1.1 Background

Parametric Values have been in use at Point Beach Nuclear Plant to provide operators with a means of conducting Technical Specification (TS) surveillance on plant parameters using the control board indicators. Parametric Values were used to account for indication uncertainty and/or convert the TS value into the same units indicated on plant indicators (TS gallons to indicated percentage, for example). The NRC Inspection Manual contains the following regarding TS values and instrument uncertainty:

> The TS limits are established with allowance for measurement tolerances already incorporated. The limits take into consideration measurement uncertainties as necessary to assure safe plant operation. The stated limit presupposes that the licensees have tolerances consistent with normal industry standards (e.g., ASTM, IEEE, ACI, etc.). (*NRC Inspection Manual part 9900, section 3.0 dated 10/01/1978*)

To comply with this requirement, the use of Parametric Values must be discontinued and instrument uncertainty must be incorporated into the TS values.

1.2 Purpose of this Calculation

This calculation determines revised TS and Technical Requirements Manual (TRM) values used for performing routine surveillance of parameter limits found in the TS and TRM that do not account for instrument uncertainty. This calculation determines the instrument uncertainty of the indication loop that is used to monitor the variable, and adjusts the corresponding TS or TRM value for the indication uncertainty.

The revised TS/TRM values determined by this calculation are applicable to both PBNP units. The uncertainties applied to the TS values are 75/75 (75% probability at a 75% confidence level) values. 75/75 values are used for verifying TS operating limits (rather than 95/95 values) because the conservatism and rigor involved in determining the 95/95 uncertainty values is not necessary for TS-related plant parameter monitoring (Reference 4-1).

This calculation supersedes calculation 2006-0035 Rev. 0.

1.3 Purpose of this Revision

The purpose of this revision is to eliminate the discussions of parametric values in the calculation. This calculation will then provide the technical basis for new TS values that will include instrument uncertainty and thereby eliminate the need for a parametric value to meet TS/TRM surveillance requirements.

1.4 Scope

This calculation determines the indication loop uncertainties and new TS/TRM values for the TS/TRM parameters listed in Table 1.4-1.

Table 1.4-1 - Plant Parameter Indicator Loop Uncertainties Calculated

Parameter	TS/TRM Section(s)	TS/TRM Value(s)	Related Calculations
Containment Average Air Temperature	LCO 3.6.5 SR 3.6.5.1	<120°F	2005-0028 Rev 0, Section 8.3.1
Refueling Water Storage Tank (RWST) Temperature	SR 3.5.4.1	≥ 40°F ≤ 100°F	2004-0026 Rev 0
Spray Additive Tank (SAT) Level	SR 3.6.7.2	≥ 2675 gallons	N-87-026 Rev 2 Section 8.4.2
Fuel Oil Storage Tank (FOST) Level	SR 3.8.3.1	≥ 11,000 gallons	N-94-142 Rev 5
Boric Acid Storage Tank (BAST) Temperature	TRM Table 3.5.1-1	Varies with boric acid concentration	None

The scope is limited only to the indication loop for the above parameters, and does not extend to other branches of the instrument loop that may perform other functions.

1.5 Applicability

The changes made by this revision are valid upon approval of License Amendment Request 262 by the NRC.

2.0 10 CFR 50.59/72.48 REVIEW

The activity of revising this calculation is in support of License Amendment Request (LAR) 262. This LAR will incorporate instrument uncertainty into Technical Specification values that have been identified to not currently account for uncertainty.

The conclusions of this revision have determined a value that is more conservative than the current Technical Specification, however under the provisions of 10 CFR 50.59, any activity that requires a change to the Technical Specifications requires prior NRC approval to implement. And as such, the new recommended Technical Specification determined by this calculation cannot be implemented until approval of LAR 262 is received from the NRC.

Upon LAR 262 approval, per FP-E-SE-03, a 10 CFR 50.59 screening/evaluation will not need to be performed for the implementing documents as long as the change is covered in full by the approved license amendment. These changes would be covered by pre-screening criterion 5; "the NRC reviewed and approved the activity in its entirety as proposed at PBNP."

3.0 ACCEPTANCE CRITERIA

This calculation will determine new TS/TRM values to be used as operator log limits to comply with TS and TRM surveillances of normal operating limits, by accounting for indication loop instrument uncertainty. Plant Operations may elect to specify a more restrictive (conservative) operating limit than the TS/TRM values in plant procedures and operator logsheets.

A new value is acceptable when the new value is offset from its previous corresponding TS/TRM limit by at least the amount of indication loop instrument uncertainty (and corrected for indication readability) in the appropriate direction, such that when the operator log limit is reached, the TS/TRM limit will be protected (not exceeded). When adjusting for indicator readability, the calculated value must be rounded in the conservative direction of the corresponding TS/TRM limit.

The new TS must be expressed in the same units as the old TS value. In situations where the TS value is in a different unit than is read by plant indication, the TS bases will express the TS in both the TS units and indicator units. Operator's logs will provide the operator with the TS limit in the indicator unit.

4.0 REFERENCES

4-1. Design Guideline DG-I01, Instrument Setpoint Methodology, Rev 4

4-2. NUREG/CR-3659, "Mathematical Model for Assessing the Uncertainties of Instrumentation Measurements for Power and Flow of PWR Reactors", February 1985, page 14 on uncertainty averaging methodology

4-3. Tank Level Book TLB 19, Rev 7, Spray Additive Tank 1(2) T-38

4-4. ICP 06.069, Rev 4, Emergency Diesel Generator G-01/2 and G-03 Non-Outage Calibration Procedure, Data Sheet 3

4-5. ICP 06.070, Rev 3, Emergency Diesel Generator G-04 Non-Outage Calibration Procedure, Data Sheet 3

4-6. 1(2) ICP 04.019B, Rev 8/10, Instrumentation for Operations Inservice Test Support Train B

4-7. ICP 6.21C, Rev 24, Chemical and Volume Control System (Non-Outage, Common Equipment)

4-8. 1(2) ICP 06.050-2, Rev 5/6, Spec 200 Cabinet 1(2) C-171 Rack Instrument Calibrations, Data Sheet 4

4-9. 1(2) ICP 06.050-3, Rev 6/7, Spec 200 Cabinet 1(2) C-173 Rack Instrument Calibrations, Data Sheets 2 and 3

4-10. Operations Procedure OM 1.1, Rev 29, Conduct of Plant Operations – PBNP Specific

4-11. Form PBF-2031, Rev 90, Daily Logsheet Aux Building Log

4-12. Form PBF-2033, Rev 75, Daily Logsheet Turbine Building Log Unit 2

4-13. Form PBF-2034, Rev 75, Daily Logsheet Control Room Log Unit 1

4-14. Form PBF-2035, Rev 75, Daily Logsheet Control Room Log Unit 2

4-15. 2005-0028, Rev 0, "Containment Air Temperature Indication Loop Uncertainty", Section 8.3.1

4-16. 2004-0026, Rev 0, "Instrument Uncertainty of Condensate Storage Tank Local Temperature Indicators TI-4045 and TI-4046"

4-17. N-87-026, Rev 2, "Spray Additive Tank Level Scaling and Uncertainty Calculation", Section 8.4.2

4-18. N-94-142, Rev 5 and 5A, "Emergency Diesel Generator, Gas Turbine, and Fire Pump Diesel Engine Fuel Oil Systems"

4-19. Engineering Evaluation 2001-0032 Rev 6, "Parametric Values" [superseded by Rev. 0 of this calculation; listed for historical information only]

4-20. Technical Specification Section 3.5.4, RWST, and associated Bases B3.5.4

4-21. Technical Specification Section 3.6.5, Containment Air Temperature, and associated Bases B3.6.5

4-22. Technical Specification Section 3.6.7, Spray Additive System, and associated Bases B3.6.7

4-23. Technical Specification Section 3.8.3, Diesel Fuel Oil and Starting Air, and associated Bases B3.8.3

4-24. Technical Requirements Manual Section 3.5.1, Chemical and Volume Control System TS Section

4-25. EMD Vendor Tech Manual 367N

4-26. Foxboro Vendor Tech Manual 623

4-27. Ashcroft Product Selection Information – Bimetal Thermometers (www.ashcroft-usa.com/ash_pdf/bimetal_therm_select_info.pdf) (Attachment D)

4-28. Marsh and Perma-Cal Pressure Gage accuaracy information (http://marshallinstruments.com/products/liquidfilled.cfm and http://www.perma-cal.com/partnumbers.htm) (Attachment E)

4-29. Spray Additive Tank Drawing, Westinghouse 685J119

4-30. CRC Standard Mathematical Tables and Formulae, 30th Edition. CRC Press, 1996 (Attachment G to calculation)

4-31. Design Guideline DG-I02, Instrument Scaling Methodology, Rev 0

4-32. Perry's Chemical Engineer's Handbook, 6th Edition. Mc-Graw-Hill, 1984 (Attachment H to calculation)

4-33. NRC Inspection Manual part 9900, section 3.0 dated 10/01/1978

4-34. Microsoft Excel spreadsheet calculating Spray Addition Tank level and volume (Attachment F to calculation)

4-35. Introduction to Probability and Statistics, Third Edition by Wm. Mendenhall. Duxbury Press, 1971.

5.0 ASSUMPTIONS

5.1 Validated Assumptions

5.1.1 It is assumed that for indication loop uncertainties that are not in an existing calculation, the loop uncertainty is ± 3% of span for local non-electronic indicators, and ± 4% of span for loops that contain multiple electronic instruments (typically a transmitter, power supply, isolator, and remote indicator).

Basis: These values bound typical uncertainties for similar local indicators and electronic indicators for 75/75 uncertainties and for performing surveillances under normal (non-accident) conditions. For example, Section 8.2 of this calculation is a calculated single local instrument 75/75 uncertainty that is below ± 3% of span. Similarly, Section 8.3 of this calculation is an example of a calculated multiple instrument loop 75/75 uncertainty that is less than ± 4% of span. Further, a review of indication loop uncertainties for other Technical Specifications[1] outside the scope of this calculation found that the random 75/75 uncertainties were all less than ± 4% for electronic loops and less than ± 3% for local indicators.

1 See TS Value 75/75 random uncertainty calculations for: Pressurizer Level (CN-CPS-07-2 R1), SG Narrow Range Level (CN-CPS-07-6 R1), Accumulator Level and Pressure (PBNP-IC-27 R4), Containment Temperature (2005-0028 R0) Containment Pressure (PBNP-IC-17 R3), CST Level (PBNP-IC-42 R2), and Steam Line Pressure (PBNP-IC-39 R3)

5.1.2 It is assumed that the RWST local temperature indicators have the same accuracy and drift values (expressed in % span) as the condensate storage tank (CST) local temperature indicators, whose uncertainty was determined by Reference 4-16. Both the RWST and CST local indicators are Ashcroft dial thermometers installed in thermowells on the respective tank wall. They differ by the span of their temperature readings.

Basis: A photograph of the RWST local temperature thermometer is provided in Attachment A to this calculation. The Ashcroft thermometer is the same type that is installed on the CSTs, but the RWST has a smaller scale of 30-130°F instead of 0-250°F. The vendor information on these bimetallic thermometers provided in calculation 2004-0026 (Reference 4-16) and in Attachment D (Reference 4-27) shows that all Ashcroft bimettalic thermometer accuracies are a standard ±1% of span based on their specification as an ASME B40.3 Grade 'A' instrument. Drift in percent span is also expected to be the same for these thermometers over their calibration interval and their installed locations in the Turbine and Auxiliary Building ambient environments.

5.2 Unvalidated Assumptions

None

6.0 DESIGN INPUTS

6.1 Calculations

The following calculations provide instrument uncertainties for this calculation:

- 2005-0028, Rev 0, "Containment Air Temperature Indication Loop Uncertainty", Section 8.3.1, provides a 75/75 random loop error of ± 1.724% of span and a bias of + 0.2086% of span for each separate containment temperature indication loop.
- 2004-0026, Rev 0, "Instrument Uncertainty of Condensate Storage Tank Local Temperature Indicators TI-4045 and TI-4046", provides the accuracy of ± 1% of span and drift of ± 1% of span for local Ashcroft thermometer indicators that are similar to those used for RWST temperature monitoring.
- N-87-026, Rev 2, "Spray Additive Tank Level Scaling and Uncertainty Calculation", Section 8.4.2, provides the 75/75 uncertainty for the control room SAT level indication loops of ± 3.425% of span.
- N-94-142, Rev 5, "Emergency Diesel Generator, Gas Turbine, and Fire Pump Diesel Engine Fuel Oil Systems", pages 47, 52, and Attachment 19 provide the tank volume data to convert the FOST volume from gallons to percent level, and vice versa.
- N-94-142, Rev 5A, "Emergency Diesel Generator, Gas Turbine, and Fire Pump Diesel Engine Fuel Oil Systems", provides the basis for the volume

of fuel oil required to support two diesel generators at rated load for 48 hours.

6.2 Other Documents

- Data Sheet 4 of 1(2) ICP 06.050-2, Spec 200 Cabinet 1C-171 Rack Instrument Calibrations and Data Sheets 2 and 3 of 1(2) ICP 06.050-3, Spec 200 Cabinet 1C-173 Rack Instrument Calibrations, provide the range of the containment temperature indicators in the control room as 50-350°F.
- Data Sheet 11 of 1(2) ICP 04.019B, Instrumentation for Operations Inservice Test Support Train B, provides the range of the RWST local temperature indicators as 30-130°F.
- Data Sheet 3 of ICPs 06.069 and 06.070, EDG Non-Outage Calibration Procedures , provides the range and model of the local Fuel Oil Storage Tank digital indicators as 0-100% and Drexelbrook Model 508, respectively.
- Data Sheet 3 of ICP 6.21C, CVCS Non-Outage Common Equipment, provides the range of the Boric Acid Storage Tank temperature indicators as 50-200°F.
- Operator Logsheets PBF-2031, -2033, -2034, and -2035 provide the specific indicators used to perform surveillance on the parameter limits that are listed in the Technical Specifications. The table in Section 8.0 lists the specific surveillance indicators for each parameter of interest in this calculation, taken from the Operator Logsheets.

6.3 Readability Inputs

Attachment A provides photographs of the indicators that monitor various parameters in this calculation. The photographs show the meter faces with minor divisions that are used to determine indicator readability. As discussed in Section 7.3, readability is defined in Reference 4-1 as one-half of the smallest scale division for analog indicators.

7.0 METHODOLOGY

7.1 Determining Indication Loop Uncertainties

The indication loop uncertainties used for this calculation will either be taken from other referenced calculations or be based on Assumption 5.1.1.

7.2 Determining TS/TRM Values

7.2.1 "Greater than or equal" Limits

For process limits with a " $\geq$ " sign, the corresponding TS/TRM value is calculated as follows:

TS Value = process limit + positive TLE   Equation 7.2-1

where the positive Total Loop Error (TLE) is the 75/75 value of the positive TLE (75/75 random errors plus any positive biases) for the indicator loop(s) used to perform the surveillance in the operator logsheet

7.2.2 "Less than or equal" Limits

For process limits with a " $\leq$ " sign, the corresponding TS/TRM value is calculated as follows:

TS/TRM Value = process limit + negative TLE   Equation 7.2-2

where the negative TLE is the 75/75 value of the negative TLE (75/75 random errors plus any negative biases) for the indicator loop(s) used to perform the surveillance in the operator logsheet

7.3 Adjusting TS/TRM Values for readability

When adjusting calculated values for indicator readability, the rounding convention is to round the calculated value in the conservative direction to protect the process limit. For a " $\geq$ " limit, the calculated value will be rounded up for readability to preserve margin between the calculated limit and the process limit. For a " $\leq$ " value, the calculated value will be rounded down for readability to preserve margin between the calculated limit and the process limit. As discussed in Section 3.3.5.3 of Reference 4-1, readability is one-half of the smallest scale division for analog indicators.

7.4 Averaging of Indication Readings

For the containment temperature TS, the temperature can be read by taking the average of all three indicators (as allowed by the TS). The calculation will determine uncertainties based on averaging of two or all three containment temperature readings per unit, based on the approach on page 14 of Reference 4-2 and Attachment C.

When identical indication loops are averaged, the average random uncertainty is less than the individual loop uncertainty. The reduction factor that is applied to the random portion of individual uncertainty is dividing individual random uncertainty by the square root of the number of indicators used to obtain the average. For example, if two indicator readings are taken with identical loops, the average uncertainty will be the individual loop uncertainty divided by the square root of two. Similarly, the uncertainty for three readings averaged will be the individual loop uncertainty divided by the square root of three. After average random uncertainty is determined, any bias is added to the random uncertainty to determine total average uncertainty in the appropriate direction.

Indicator readability is already factored into the taking of individual readings, and the TS value for average indication does not need to be rounded down for readability. Therefore, the TS can be expressed in terms of tenths of a degree, instead of whole degrees.

7.5 Significant Digits and Rounding

This uncertainty calculation will adhere to the rules given below for the treatment of numerical results.

1. For values less than 100, the rounding of discrete calculated instrument uncertainties (e.g. reference accuracy, temperature effect, etc.) should be performed such that the numerical value is restricted to three (3) or less digits shown to the right of the decimal point. For example, an uncertainty calculated as 0.6847661 should be listed (and carried through the remainder of the calculation) as 0.685. An uncertainty calculated as 53.235487 should be listed (and carried through the remainder of the calculation) as 53.235.
2. For values greater than or equal to 100, but less than 1000, the rounding of discrete calculated instrument uncertainties (e.g., reference accuracy, temperature effect, etc.) should be performed such that the numerical value is restricted to two (2) or less digits shown to the right of the decimal point. For example, an uncertainty calculated as 131.6539 should be listed (and carried through the remainder of the calculation) as 131.65.
3. For values greater than or equal to 1000, the rounding of discrete calculated instrument uncertainties (e.g. reference accuracy, temperature effect, etc.) should be performed such that the numerical value is restricted to one (1) or less digits shown to the right of the decimal point. For example, an uncertainty calculated as 2251.4533 should be listed (and carried through the remainder of the calculation) as 2251.5.
4. For Total Loop Uncertainties and Channel Check Tolerances, the calculated result should be rounded to the numerical precision that is readable on the associated loop indication or recorder. If the loop of interest does not have an indicator or recorder, the Total Loop Error should be rounded to the numerical precision currently used in the associated calibration procedure for the end device in that loop (e.g. trip unit or alarm unit).

   For calibration tolerances, the calculated result should be rounded to the numerical precision currently used in the associated calibration procedure. These rules are intended to preserve a value's accuracy, while minimizing the retention of insignificant or meaningless digits. In all cases, the calculation preparer shall exercise judgment when rounding and carrying numerical values, to ensure that the values are kept practical with respect to the application of interest.

8.0 ANALYSIS

This section determines indication loop uncertainties and TS/TRM values for the following plant variables:

Table 7.5-1 - Plant Parameters and Indicators Analyzed

Parameter	Surveillance Indication	TS/TRM Section(s)	Section
Containment Average Air Temperature	1(2)TI-3292, 1(2)TI-3293 1(2)TI-3295	LCO 3.6.5 SR 3.6.5.1	8.1
RWST Temperature	1(2)TI-960	SR 3.5.4.1	8.2
Spray Additive Tank Level	1(2)LI-931	SR 3.6.7.2	8.3
Fuel Oil Storage Tank Level	LIT-3985A LIT-3985B	SR 3.8.3.1	8.4
Boric Acid Storage Tank Temperature	1(2)TIC-107 TIC-103	TRM Table 3.5.1-1	8.5

8.1 Containment Average Air Temperature

Section 8.3.1 Reference 4-15 determined the individual containment temperature indication channel uncertainty for temperature loops on both units. The 75/75 random total loop error is ±1.724% of span and the bias is +0.2086% of span. The range of the control room indicators is 50-350°F for a span of 300°F, as stated in References 4-8 and 4-9 and shown in Attachment A. Therefore, the individual loop uncertainty (random plus bias) in units of °F is:

$$300°F * (0.01724 + 0.002086) = 5.8°F \qquad \text{(from Reference 4.15)}$$

The uncertainty for individual indicators is found by correcting for the readability of the individual control board indicators 1(2)TI-3292, -3293, and -3295 that perform TS surveillance SR 3.6.5.1. Attachment A shows indicator readability is ½ of a minor scale division of 5°F (or 2.5°F). Therefore, the uncertainty is rounded up to the nearest readable value, which is 7.5°F.

However, when identical indication loops are averaged, the average uncertainty is less than the individual loop uncertainty. The reduction is obtained by dividing the random portion of the individual uncertainty by the square root of the number of indicators used to obtain the average. This averaging technique is based on page 14 of NUREG/CR-3659 (Reference 4-2 and Attachment C).

8.1.1 Average uncertainty for three indicators

If all three containment temperature indicators are averaged by the control room logsheets (Reference 4-13 for Unit 1 and Reference 4-14 for Unit 2), then the random portion of the average uncertainty will be reduced to:

$$\frac{1.724\%}{\sqrt{3}} = 0.995\%$$

When combined with the bias term, the average uncertainty (expressed in °F) for three indicators (rounded up conservatively) is:

300°F * (0.00995 + 0.002086) = **3.7°F**

8.1.2 Average uncertainty for two indicators

A similar calculation for averaging two containment temperature indicators (allowed by the control room logsheets) is:

$$\frac{1.724\%}{\sqrt{2}} = 1.219\%$$

When combined with the bias term, the average uncertainty for two indicators (rounded up conservatively) is:

300°F * (0.01219 + 0.002086) = **4.3°F**

Average uncertainty values do not need to be rounded for indicator readability, because the logsheet number is a computed average, instead of a value read on a single indicator. The input readings themselves incorporate indicator readability.

8.1.3 Technical Specification

Chapter 14 of the FSAR assumes that containment average air temperature is at or below 120°F to support the plant accident analyses. The new recommended TS value is determined using the 120°F accident analysis limit and the three-channel indication uncertainties:

TS for three averaged temperature channels:

120°F - 3.7°F = 116.3°F

Technical Specification: Containment average air temperature ≤ 116.3°F

The average of three indicators will be the new TS value, but in the event that one or two channels are out of service, the containment air temperature limit must be reduced to ensure that the containment air temperature initial condition for accident analysis is satisfied.

Single-channel operation:

120°F - 7.5°F = 112.5°F

Single-channel limit: Single Indicator ≤ 112.5°F

Two-channel operation:

120°F - 4.3°F = 115.7°F

Two-Channel limit: Two-channel average ≤ 115.7°F

8.2 Refueling Water Storage Tank (RWST) Temperature

A calculation does not exist for the indicator uncertainty of local RWST temperature instruments 1(2)TI-960 used to satisfy TS surveillance SR 3.5.4.1. The local indicators are Ashcroft bimetallic dial thermometers with a range of 30-130°F and a 100°F span (Reference 4-6 and Attachment A).

8.2.1 Indicator Uncertainty

Reference 4-16 determined the instrument uncertainty of the Condensate Storage Tank (CST) temperature indicators, which are also local Ashcroft thermometers installed in thermowells. The difference between the RWST and CST local indicators is the temperature range. The CST indicators have a range of 0 - 250°F with a 250°F span. Based on Assumption 5.1.2, thermometer uncertainty values taken from 2004-0026 (expressed in percent span) will be applied in this calculation to estimate the uncertainty of the RWST temperature indicators.

Reference 4-16 determined the accuracy of the Ashcroft dial thermometers as ±1% of span, the drift as ±1% of span, and the setting tolerance of ±1.2% of span. These random terms were then combined using the square-root-sum-of-the-squares (SRSS) to estimate the total indicator uncertainty in % span.

Of the uncertainty terms for accuracy, drift, and setting tolerance, the RWST indicators are assumed to have the same accuracy and drift values as the CST Ashcroft bimetallic thermometers (Assumption 5.1.2). The calibration setting tolerance for the RWST temperature indicator is different, and is found in 1(2) ICP 04.019B Data Sheet 11 (Reference 4-6) as ±2°F or ± 2% of span. Therefore, the overall uncertainty of the RWST temperature indicators (in % span and in °F) is determined by the SRSS of accuracy, drift, and setting tolerance, as follows:

$$\sqrt{1.0^2 + 1.0^2 + 2.0^2} = \pm 2.45\% \text{ span}$$

$$\pm 2.45\% \text{ span} * (100°F) = \pm 2.5°F$$

8.2.2 Technical Specification Value

TS surveillance SR 3.5.4.1 values for minimum and maximum RWST temperature are 40°F and 100°F, respectively, to support plant accident analysis. The new recommended TS values are determined by adjusting the current TS limits by the indicator uncertainty as follows:

Using Equation 7.2-1, the recommended RWST low temperature TS is:

40°F + 2.5°F = 42.5°F

RWST Temperature ≥ 42.5°F

Using Equation 7.2-2, the maximum temperature TS is:

100°F - 2.5°F = 97.5°F

RWST Temperature ≤ 97.5°F

The minor scale divisions on the dial thermometers are 1°F (see Attachment A), and readability is one half of a minor division or 0.5°F. Therefore, the new TS values are directly readable on the indicators without adjustment.

Technical Specification: 42.5°F ≤ RWST Temperature ≤ 97.5°F

8.3 Spray Additive Tank (SAT) Level Technical Specification

8.3.1 Indicator Uncertainty

Section 8.4.2 of Reference 4-17 determined the control room SAT level indicator 75/75 loop uncertainty to be ±3.425% of span. Based on the Attachment A photo of indicator 1LI-931, the range of control room SAT level indicators is 0-100%, the span is 100%, with minor divisions of 2% and readability of one-half of a division or 1%.

Based on Reference 4-17, the normal positive indicator uncertainty is +3.425%.

8.3.2 Technical Specification

Ref. 4-22 requires that the spray additive tank contains a minimum of 2675 gallons of solution. This volume must be converted to an equivalent percent SAT level to calculate the appropriate TS value that includes instrument uncertainty. To accomplish this, a relationship must be established between tank level in inches, percent level, and tank volume.

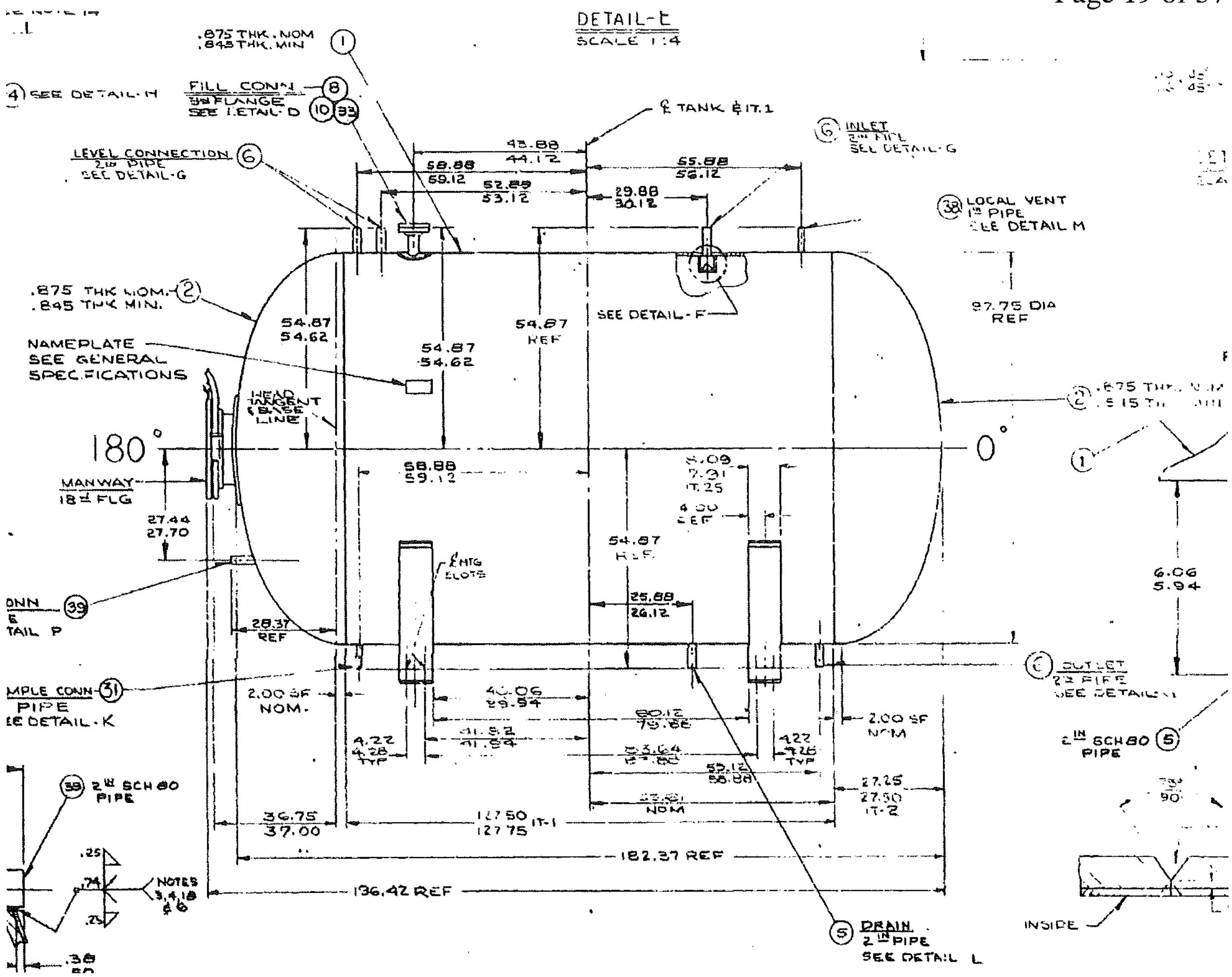

Figure 8.3-1 - Spray Additive Tank per Westinghouse 685J119 (Side View)

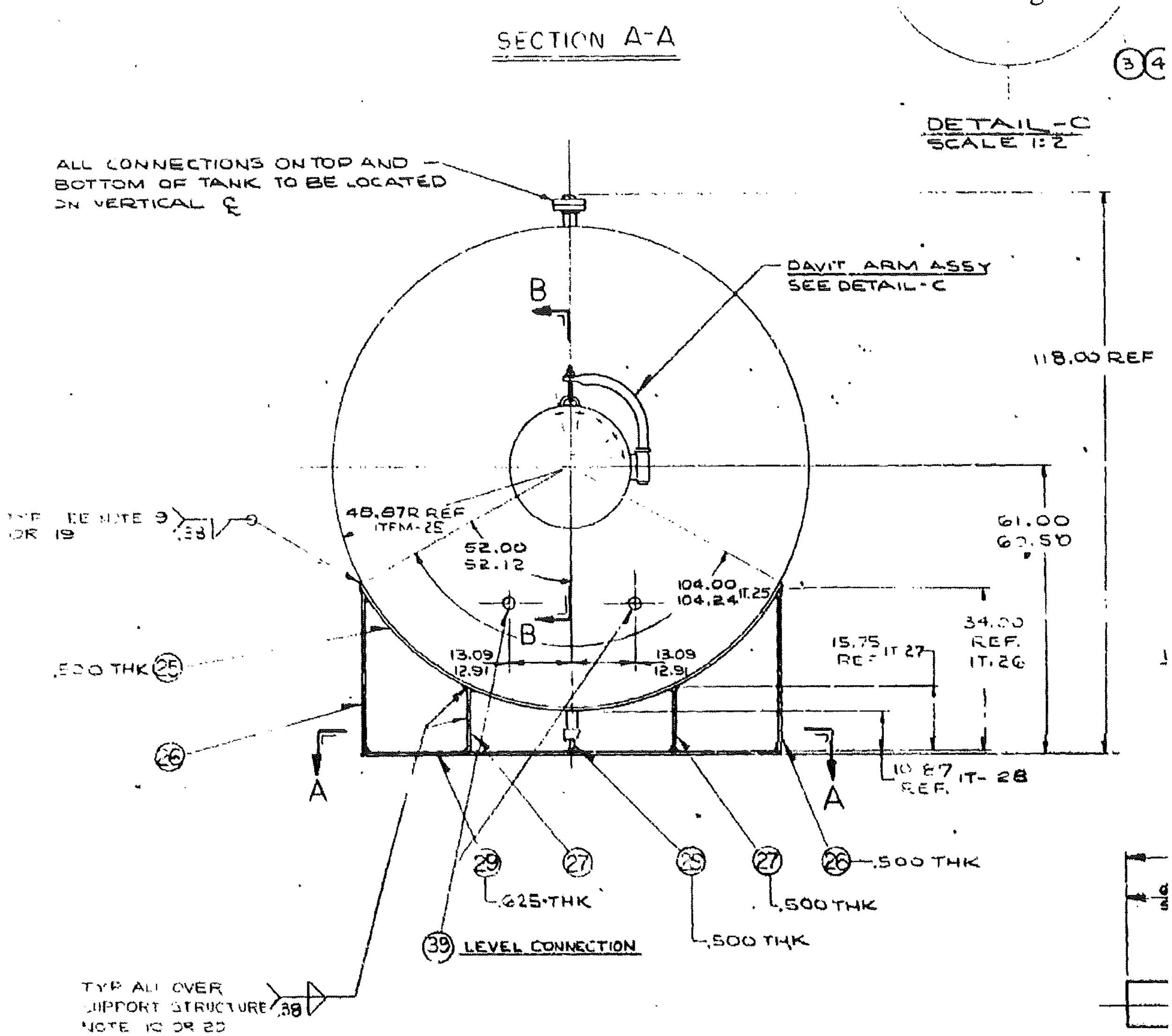

Figure 8.3-2 - Spray Additive Tank per Westinghouse 685J119 (End View)

Calculating the volume of liquid in the SAT as a function of level is broken down into two parts: calculating the volume in the cylindrical portion, and calculating the volume in the tank heads on either end of the tank. Table 8.3-1 lists the tank dimensions used in the calculation.

Table 8.3-1 - Spray Additive Tank Dimensions Used in Calculations

Dimension	Value	Basis
Cylinder and Tank Head Diameter (*D*)	96 inches	97.75 inches head diameter -2×0.875 inches nominal tank wall thickness (See Figure 8.3-1)
Cylinder length (*L*)	131.63 inches	127.63 inches average cylinder length plus 2 × 2 inches of length between cylinder and tank heads (See Figure 8.3-1)

Dimension	Value	Basis
Tank Head length (l)	24.5 inches	25.375 inches average tank head length – 0.875 inches nominal tank head wall thickness (See Figure 8.3-1)
Liquid Height (h)	Varies	Height of liquid in tank
Level Tap Height (h_{tap})	20.43 inches	96 inches diameter – 48 inches radius – 27.57 inches below tank centerline (See Figure 8.3-1)

As the tank dimensions are in inches and the desired final volumes are in gallons, the conversion from cubic inches to gallons is calculated to be

$$\frac{1\,\text{in}^3}{16.38706\,\text{cm}^3} \times \frac{1000\,\text{cm}^3}{1\,\text{liter}} \times \frac{1\,\text{liter}}{0.2641721\,\text{gallons}} = 231\frac{\text{in}^3}{\text{gallon}}.$$

8.3.2.1 Cylindrical Volume

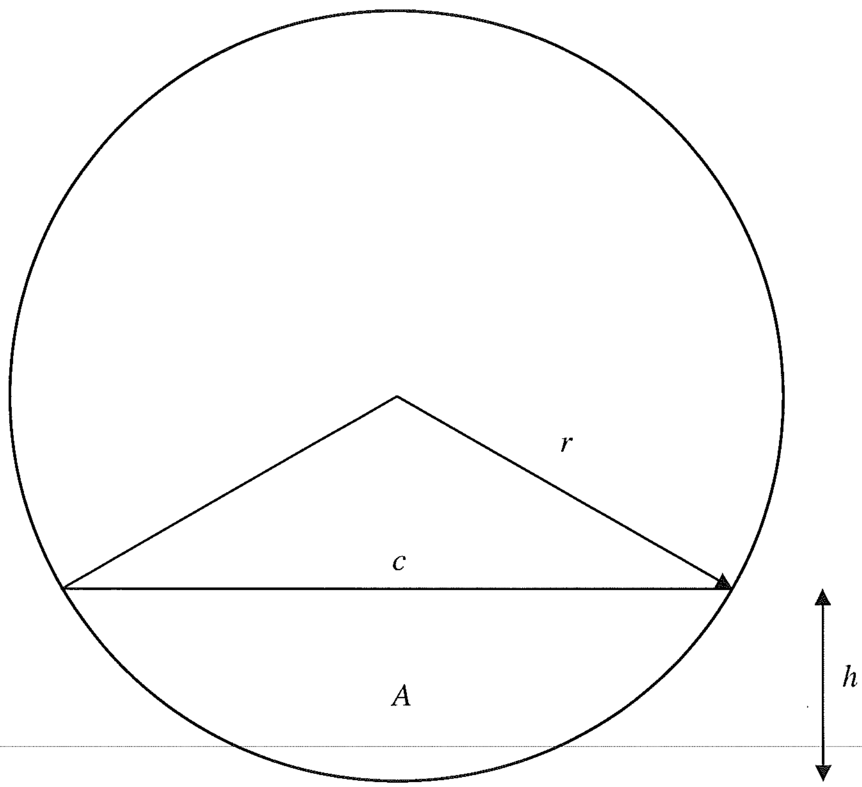

Figure 8.3-3 - Partially-Filled Cylindrical Tank, Cross-Sectional View

The geometry of the liquid in a partially-filled cylindrical tank is shown in Figure 8.3-3. The region A, bounded by the bottom of the tank and chord c, represents the cross-sectional area of fluid in the partially-filled tank. Working with angular units of radians per Ref. 4-30, the area of region A is calculated as

$$A = r^2 \cos^{-1}\left(\frac{r-h}{r}\right) - (r-h)\sqrt{2rh - h^2}\ .$$

For a full tank where $h=2r$,

$$\begin{aligned} A &= r^2 \cos^{-1}\left(\frac{r-2r}{r}\right) - (r-2r)\sqrt{2r(2r) - (2r)^2} \\ &= r^2 \cos^{-1}(-1) - (-r)\sqrt{4r^2 - 4r^2} \\ &= \pi r^2 \end{aligned}\ .$$

The volume of liquid in a partially-filled tank is obtained by multiplying the cross-sectional area of the fluid by the cylinder length L:

$$V_{cylinder}(h) = \left(r^2 \cos^{-1}\left(\frac{r-h}{r}\right) - (r-h)\sqrt{2rh - h^2} \right)(L).$$

The total volume of the cylindrical portion of the tank ($h=2r$) is

$$\begin{aligned} V_{cylinder} &= \pi r^2 L \\ &= \pi(48^2)(131.63) \\ &= 952.77 \times 10^3 \text{ in}^3 \end{aligned}\ .$$

$$952.77 \times 10^3 \text{ in}^3 \times \frac{\text{gallon}}{231 \text{in}^3} = 4124.5 \text{ gallons}$$

8.3.2.2 Tank Head Volume

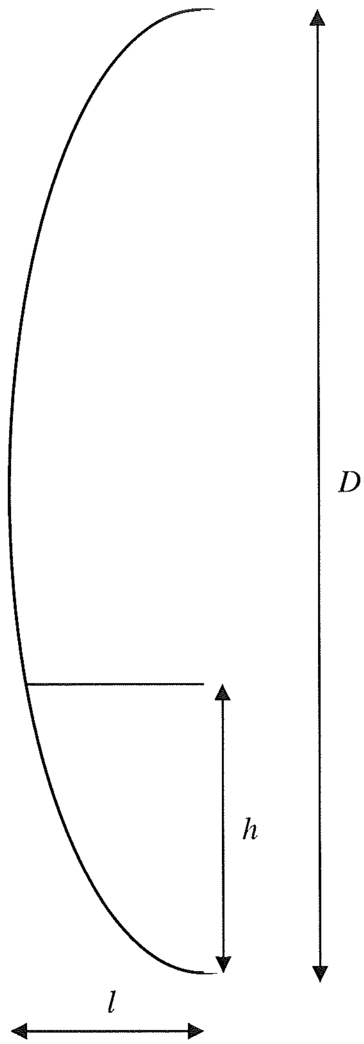

Figure 8.3-4 - Partially-filled Tank Head, Side Cross-sectional View

The tank head volume is calculated using the equation for an elliptical tank head per Table 6-51 of Ref. 4-32. The full tank head volume (per single head) is

$$\begin{aligned} V_{head} &= \frac{\pi}{6} D^2 l \\ &= \frac{\pi}{6} \left(96^2\right)\left(24.5\right) \\ &= 118.22 \times 10^3 \text{ in}^3 \end{aligned}$$

$$118.22 \times 10^3 \text{ in}^3 \times \frac{\text{gallon}}{231 \text{in}^3} = 511.79 \text{ gallons}$$

The total volume for both tank heads is 2(511.79) gallons, or 1023.6 gallons.

8.3.2.3 Total Tank Volume

The total tank volume is the summation of the cylindrical portion plus two tank heads when h = 96 inches.

$$
\begin{aligned}
V_{total} &= V_{cylinder} + 2V_{head} \\
&= 4124.5 + (2)(511.79) \\
&= 5148.1 \text{ gallons}
\end{aligned}
$$

8.3.2.4 Tank Head Partial Volume

Table 6-52 of Ref. 4-32 lists the fractional volume of liquid in partially-filled tank heads on horizontal tanks as a function of liquid level versus fractional volume. The points listed in this table can be approximated with high correlation[2] using a third-degree polynomial. Figure 8.3-5 shows the curve generated by the individual points from Table 6-52 of Ref. 4-32. The third-degree polynomial shown in the figure was generated using the polynomial curve-fitting function in Microsoft Excel. By expressing the fractional volume as this polynomial, the fractional volume at any liquid level may be calculated.

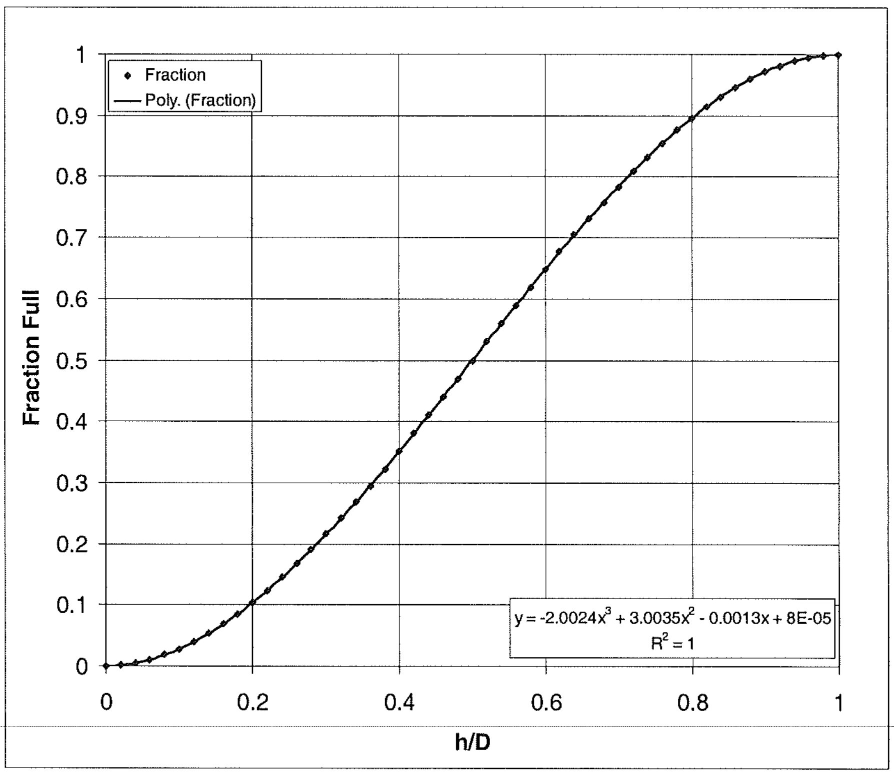

Figure 8.3-5 - Fractional Volume of Tank Heads

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[2] Per Ref. 4-35, R^2 is the square of the correlation coefficient, a measure of the correlation between the points in Table 6-52 of Ref. 4-32 and the value of the third-degree polynomial at each value of h/D over the interval of $0 \leq h/D \leq 1$. In this case, as $R^2=1$, each point from the table lies exactly on the curve, i.e. the curve accurately predicts the fractional full value at each value of h/D. (Ref. 4-35)

The partial volume of an individual tank head with liquid level h is the product of the full volume (511.79 gallons) and the fractional volume. This results in a function that returns the tank head volume in gallons.

$$V_{head}(h) = (511.79)\left(-2.0024\left(\frac{h}{D}\right)^3 + 3.0035\left(\frac{h}{D}\right)^2 - 0.0013\left(\frac{h}{D}\right)^2 + 8\times10^{-5} \right)$$

The volume of liquid in the SAT as a function of h is the summation of the cylinder volume and tank heads.

$$\begin{aligned} V_{total}(h) &= V_{cylinder}(h) + 2V_{head}(h) \\ &= \left(r^2 \cos^{-1}\left(\frac{r-h}{r}\right) - (r-h)\sqrt{2rh-h^2} \right)(L) \\ &\quad + (2)(511.79)\left(-2.0024\left(\frac{h}{D}\right)^3 + 3.0035\left(\frac{h}{D}\right)^2 - 0.0013\left(\frac{h}{D}\right) + 8\times10^{-5} \right) \end{aligned}$$

8.3.2.5 Volume Unseen By Level Switch

The volume of liquid below the level tap is unseen by the level switch and represents the volume of liquid contained in the tank at the 0% indicated level.

When $h = h_{tap}$ and using the terms from Table 8.3-1,

$$\begin{aligned} V_{cylinder}(h_{tap}) &= \left(48^2 \cos^{-1}\left(\frac{48-20.43}{48}\right) - (48-20.43)\sqrt{2(48)(20.43) - 20.43^2} \right)(131.63) \\ &= \left(2304\cos^{-1}(0.57438) - 27.57\sqrt{1961.3 - 417.38}\right)(131.63) \\ &= (2304(0.9590) - 1083.3)(131.63) \\ &= (2209.5 - 1083.3)(131.63) \\ &= 148242\ \text{in}^3 \end{aligned}$$

$$148242\ \text{in}^3\left(\frac{1\ \text{gallon}}{231\ \text{in}^3}\right) = 641.74\ \text{gallons}$$

$$\begin{aligned} V_{head}(h_{tap}) &= (511.79)\left(-2.0024\left(\frac{20.43}{96}\right)^3 + 3.0035\left(\frac{20.43}{96}\right)^2 - 0.0013\left(\frac{20.43}{96}\right)^2 + 8\times10^{-5} \right) \\ &= (511.79)\left(-2.0024(0.21281)^3 + 3.0035(0.21281)^2 - 0.0013(0.21281)^2 + 8\times10^{-5}\right) \\ &= (511.79)\left(-2.0024(0.0096) + 3.0035(0.0452) - 0.0013(0.21281) + 8\times10^{-5}\right) \\ &= 59.541\ \text{gallons} \end{aligned}$$

$$V_{total}(h_{tap}) = V_{cylinder}(h_{tap}) + 2V_{head}(h_{tap})$$
$$= 641.74 \text{ gallons} + (2)(59.541) \text{ gallons}$$
$$= 760.82 \text{ gallons}$$

The total liquid volume at the 0% indicated level, consisting of two heads and the main tank cylinder, is 760.82 gallons. A spreadsheet using these equations and constants calculated a tank volume of 760.98 gallons. In addition, the spreadsheet result at a tank level h of 96 inches returned a total tank volume of 5148 gallons, very close to the stated nominal tank volume of 5100 gallons (Ref. 4.27) and the same as the total tank volume calculated in Section 8.3.2.3. The spreadsheet (Reference 4-34 and Attachment F) will be used to calculate liquid volumes at various heights for the rest of this section.

8.3.2.6 Scaling SAT Liquid Level to Level Percentage

References 4.17 and 4.27 show that the tank level that can be detected by the level switch ranges from 20.43 to 96 inches, representing the 0-100%. The scaling of percent level to inches is done using the linear scaling method of Reference 4-31.

The point-slope equation is of the form

$$y - y_1 = m(x - x_1)$$

where

$$m = \left(\frac{y_2 - y_1}{x_2 - x_1} \right)$$

and the variables are defined in Table 8.3-2.

Table 8.3-2 - Linear Scaling Variable Definitions

Variable	Definition
x	Process value variable (known)
x_1	Process value at 0% span (20.43 inches)
x_2	Process value at 100% span (96 inches)
y	Analog variable (unknown)
y_1	Analog value at 0% span (0%)
y_2	Analog value at 100% span (100%)
m	Slope, gain of function, scale factor

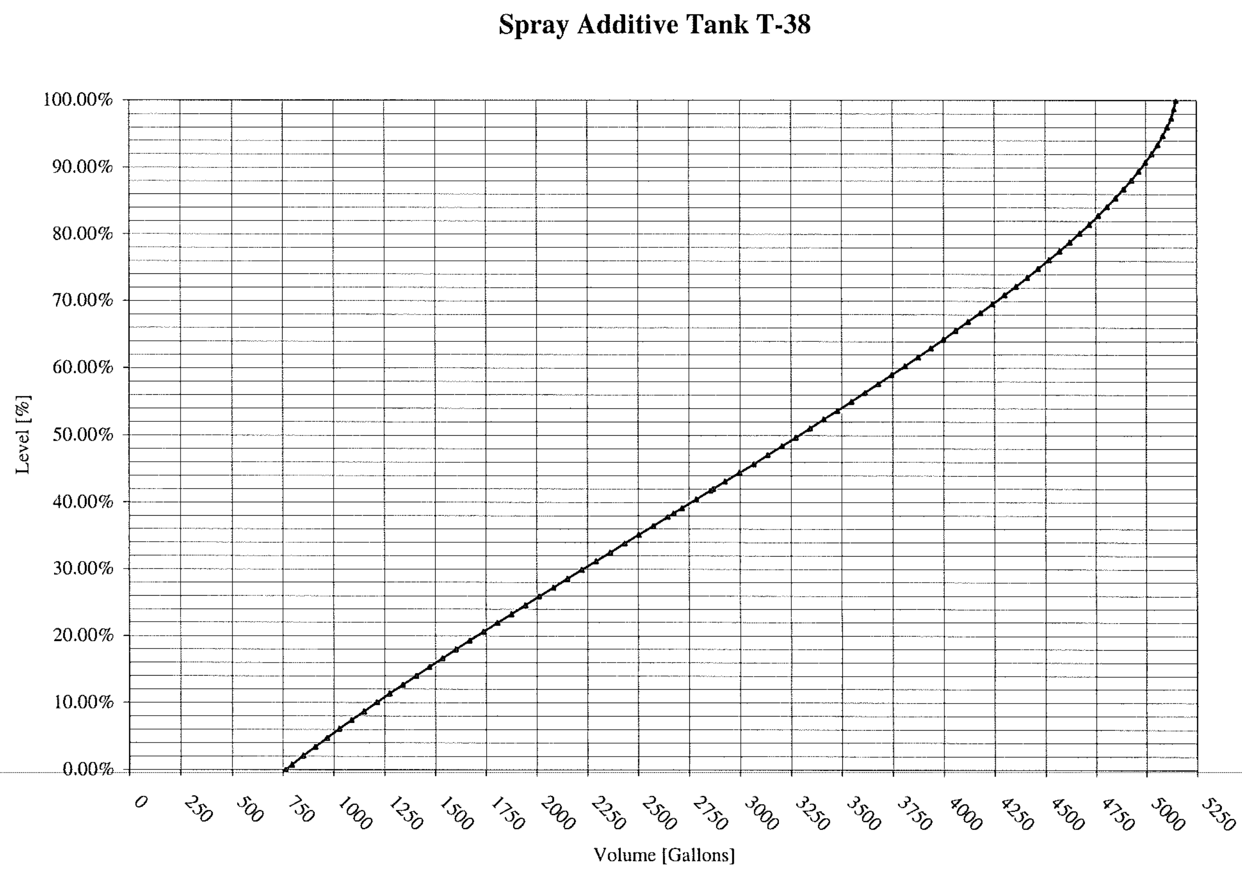
The scaling factor m is calculated by treating the tank level in inches as the process value as this is the parameter being measured by the level switch. Percent level is the analog variable as this is the value being calculated based on tank level.

$$m = \left(\frac{100\% - 0\%}{96\,\text{inches} - 20.43\,\text{inches}} \right)$$
$$= \frac{100\%}{75.57\,\text{inches}}$$
$$= 1.3233 \frac{\%}{\text{inch}}$$

By solving the point-slope equation for y, the tank level in terms of percent can be found for a given level input in inches.

$$y = m(x - x_1) + y_1$$

With the relationship between tank level and volume established mathematically, the relationship may be shown graphically using Microsoft Excel.



8.3.2.7 Converting the Current TS Value to Percent Tank Level

The purpose of Sections 8.3.2.1 through 8.3.2.6 was to establish the relationships between tank volume, level in inches, and percent level. With these relationships established, the current TS value can be expressed in terms of percent level.

The current TS requirement for SAT level is 2675 gallons, not including instrument uncertainty. To add instrument uncertainty, the TS requirement must first be converted to a value in terms of percent tank level. Using Reference 4-34, a volume of 2675 gallons corresponds to 38.37% level. Adding the positive indication uncertainty per Ref. 4-17 to the current TS value provides the new recommended TS in level percentage, as follows:

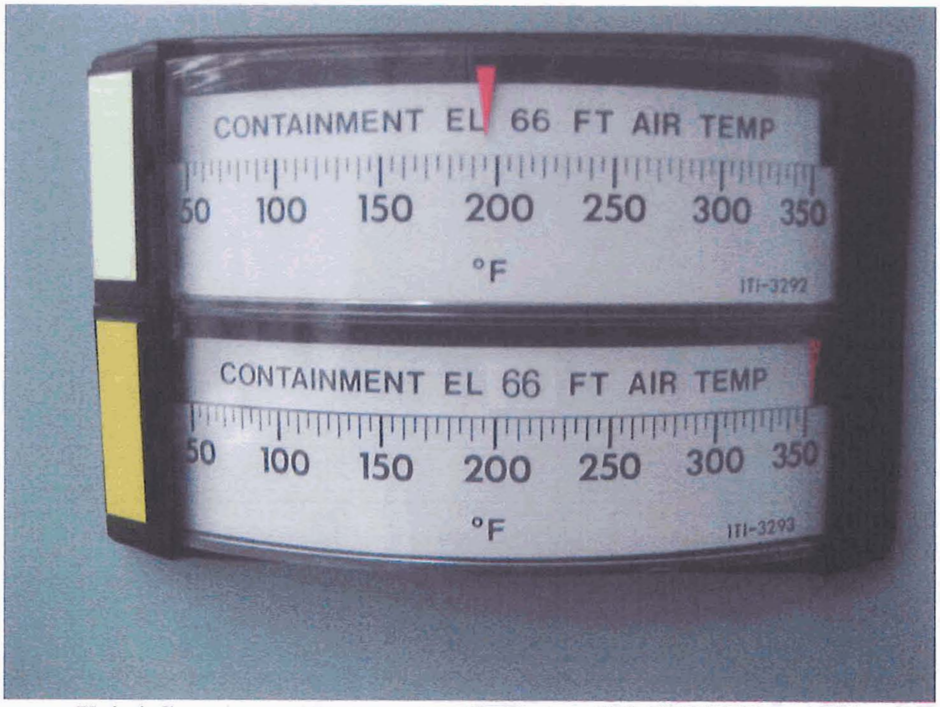
$38.37\% + 3.425\% = 41.795\%$

Using Reference 4-34, a tank level of 41.795% in corresponds to a tank volume of 2857.5 gallons. To provide additional margin, this value is rounded conservatively to 2900 gallons.

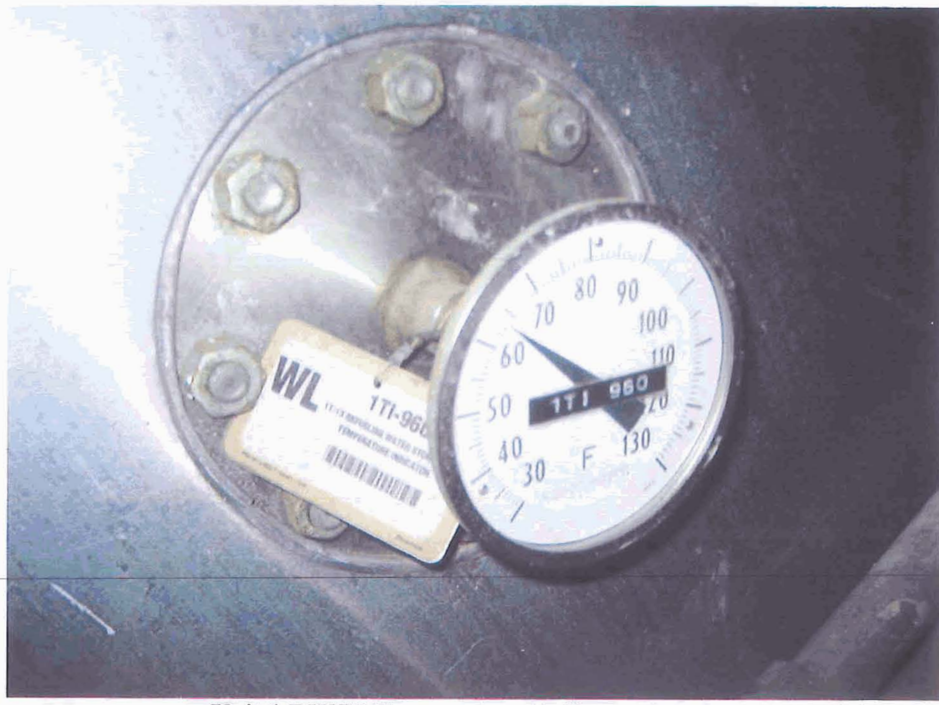
Technical Specification: SAT Volume ≥ 2900 gallons.

Using Reference 4-34, a tank volume of 2900 gallons corresponds to a tank level of 42.59%. For surveillance requirements, the current surveillance requirement of 43% may be retained as it is more conservative than the TS.

ATTACHMENT A

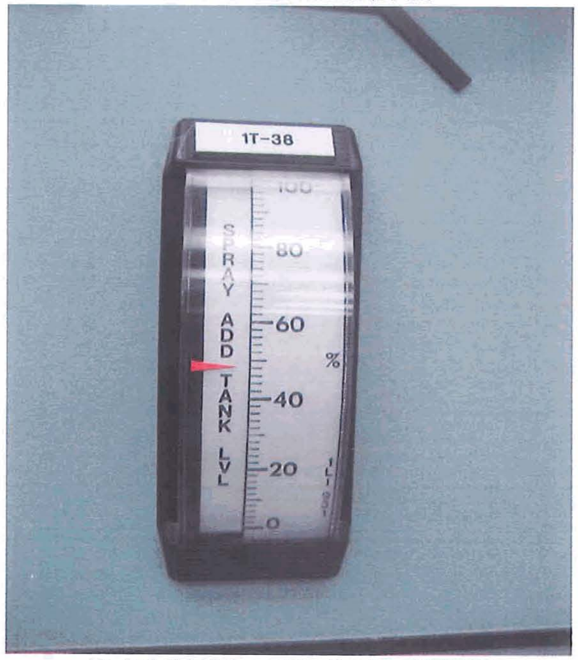


Unit 1 Containment Temperature Indicators 1TI-3292/3293 on 1C20



Unit 1 RWST Temperature Indicator 1TI-960

ATTACHMENT A



Unit 1 SAT Level Indicator 1LI-931

ENCLOSURE 3

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 262
REVISION TO TECHNICAL SPECIFICATION OPERATING LIMITS TO INCLUDE MEASUREMENT UNCERTAINTY

CALCULATION PBNP-IC-17, REVISION 3
LOW RANGE CONTAINMENT PRESSURE INSTRUMENT LOOP UNCERTAINTY/SETPOINT CALCULATION

86 pages follow

1.0 BACKGROUND, PURPOSE, AND SCOPE OF CALCULATION

1.1 Background

The Low Range Containment Pressure Channels, P-945, P-947, and P-949, provide input to the engineered safety features actuation system (ESFAS) and indication to the control room operators.

The Low Range Containment Pressure Channels utilize a two-out-of-three coincidence circuit to provide input for three separate ESFAS functions: (1) actuation of safety injection, (2) actuation of condensate isolation, and (3) actuation of containment spray (Note: the containment spray signal is initiated by a 2-out-of-3 logic of the High-High Low Range Containment Pressure signal and a 2-out-of-3 logic of the High-High Intermediate Range Containment Pressure signal). The values of containment pressure at which these actuations occur are controlled as ESFAS setpoints.

Low Range Containment Pressure indication is used by the operators to verify that containment pressure is within the values allowed by the Technical Specifications LCO 3.6.4 (Reference G.14). It is also used to ensure specific safety functions are accomplished in the emergency operating procedures (EOPs). The particular values of containment pressure that appear in the EOPs are controlled as EOP setpoints.

1.2 Purpose

The purpose of this calculation is to determine the instrument and loop uncertainties, Limiting Trip Setpoints, Operability Limits, As-Found Tolerance and As-Left Tolerance associated with the Low Range Containment Pressure ESFAS functions and control room indication. In WEP-SPT-29, "Containment Parameter EOP Setpoints", the indication uncertainties are used to calculate specific EOP setpoints.

1.3 Purpose of this Revision

The purpose of this revision is to determine Operability Limits (OL) and to re-evaluate the Limiting Trip Setpoint (LTSP) associated with the Low Range Containment Pressure ESFAS functions. This revision will also include elevated radiation effects under accident conditions for the indication uncertainties used to calculate the EOP setpoints. The Operability Limits will be as-found limits for each function during Channel Operational Testing (COT), beyond which the function will be considered inoperable. The OL values may also be incorporated into licensing documents (e.g., the TRM) and the calibration procedures for the purpose of determining operability within the plant Technical Specifications. The LTSP will be re-evaluated based on temperature and radiation effects that are less (i.e. closer to actual plant conditions) than those used in the previous revision. The transmitters used for EOP indication are located in an area of the auxiliary building that will receive a large radiation dose during the recirculation phase of a LOCA. These transmitters are part of the loop required for some EOP actions, and therefore need to include this uncertainty in the total loop error calculation.

1.4 Scope

The scope of this calculation is listed below:

- Determine uncertainties associated with the Indication Loop under normal and accident environmental conditions. These uncertainties are then used in the EOP (WEP-SPT-29, "Containment Parameter EOP Setpoints") setpoint evaluations.
- Determine the Limiting Trip Setpoint (LTSP) and Operability Limits (OL) for High Containment Pressure – Safety Injection actuation setpoint, the High-High Containment Pressure – Containment Spray actuation setpoint, and the High Containment Pressure-Condensate Isolation actuation setpoint.
- Evaluate the existing Field Trip Setpoints (FTSP) for High Containment Pressure – Safety Injection actuation, High-High Containment Pressure – Containment Spray actuation, and High Containment Pressure – Condensate Isolation actuation.
- Determine Acceptable As-Found/As-Left Calibration Tolerances for applicable devices.
- Determine Channel Check Tolerance.
- Develop a scaling calculation for the High Containment Pressure – Safety Injection actuation, High-High Containment Pressure – Containment Spray actuation, and High Containment Pressure – Condensate Isolation actuation setpoints and Operability Limits.
- Determine indication and PPCS loop uncertainties used to determine compliance with the station's parametric value for Low Range Containment Pressure.
- Determine the Containment Pressure Parametric Values to be used for Tech Spec surveillance.

1.5 Instrumentation Evaluated

This calculation evaluates the plant equipment (for Units 1 and 2) listed in the table below. See Sections 6.2 and 6.3 of this calculation for instrument specifications, parameters, and loop configurations.

Table 1.5-1 Instrumentation List

Pressure Transmitters	Power Supplies	Bistables	Current-to-Current Repeaters	Indicators	PPCS
1(2)PT-945	1(2)PQ-945	1(2)PC-945A/B	1(2)PM-945	1(2)PI-945	1(2)P-945
1(2)PT-947	1(2)PQ-947	1(2)PC-947A/B	1(2)PM-947	1(2)PI-947	1(2)P-947
1(2)PT-949	1(2)PQ-949	1(2)PC-949A/B	1(2)PM-949	1(2)PI-949	1(2)P-949

1.6 Superseded Station Calculations

The following existing calculation(s) will be superseded upon issuance of Revision 3 of PBNP-IC-17:

- PBNP-IC-17– Low Range Containment Pressure Instrument Loop Uncertainty/Setpoint Calculation, Revision 2.
- PBNP-IC-17– Low Range Containment ressure Instrument Loop Uncertainty/Setpoint Calculation, Revision 2A.
- PBNP-IC-17– Low Range Containment ressure Instrument Loop Uncertainty/Setpoint Calculation, Revision 2B.
- EE 2001-0032, Rev. 6, "Parametric Values" – only the portions that apply to Low Range Containment Pressure.

2.0 ACCEPTANCE CRITERIA

The Tech Spec OL and FTSP are acceptable if the following criteria are met:

- The LTSP is established to ensure that the instrument channel trip occurs before the AL is reached. The LTSP is compared to the FTSP to ensure that the FTSP is less than or equal to the LTSP (for increasing setpoint) or the FTSP is greater than or equal to the LTSP (for decreasing setpoint).
- The Operability Limits for primary trips are intended to be more conservative than the corresponding Limiting Trip Setpoint, i.e. closer to the FTSP than the LTSP. The OL establishes whether the trip bistable portion of the channel is performing acceptably during the channel operational test. This will allow the Technical Specification tables for RPS and ESFAS trip functions to be revised to insert the LTSPs as new Allowable Values for the primary trip functions. Backup trip functions and permissives do not have a LTSP and therefore are not considered to require an Allowable Value in the TS. However, all trip functions will have operability limits.
- Channel Check Tolerance (CCT) is the maximum expected deviation between channel indications when performing a qualitative assessment of channel behavior during operation. The calculated CCT is compared to the existing CCT to ensure that the existing CCT is less than or equal to the calculated CCT.

3.0 ABBREVIATIONS

3.1	AL	Analytical Limit
3.2	AV	Allowable Value
3.3	BAF	Bistable As-Found Tolerance
3.4	BAL	Bistable As-Left Tolerance
3.5	DBE	Design Basis Event
3.6	EOP	Emergency Operating Procedure
3.7	ESF	Engineered Safety Features
3.8	FSAR	Final Safety Analysis Report
3.9	FTSP	Field Trip Setpoint
3.10	HELB	High Energy Line Break
3.11	IAF	Indicator As-Found Tolerance
3.12	IAL	Indicator As-Left Tolerance
3.13	I/I	Current-to-Current Converter
3.14	I/IAF	Current-to-Current Converter As-Found Tolerance
3.15	I/IAL	Current-to-Current Converter As-Left Tolerance
3.16	IND	Indicator
3.17	LOCA	Loss of Coolant Accident
3.18	LTSP	Limiting Trip Setpoint
3.19	M&TE	Measurement and Test Equipment
3.20	MSLB	Main Steam Line Break
3.21	OL	Operability Limit
3.22	PBNP	Point Beach Nuclear Plant
3.23	PE	Process Error
3.24	PPCS	Plant Process Computer System
3.25	PPCSAF	Plant Process Computer System As-Found Tolerance
3.26	PPCSAL	Plant Process Computer System As-Left Tolerance

3.27	PS	Process Span (engineering unit)
3.28	RAD	Radiation Absorbed Dose
3.29	RE	Rack Error
3.30	SAF	Sensor Acceptable As-Found
3.31	SAL	Sensor Acceptable As-Left
3.32	SLB	Steam Line Break
3.33	SI	Safety Injection
3.34	SR	Surveillance Requirements
3.35	SRSS	Square Root of the Sum of the Squares
3.36	Tech Spec	Technical Specifications
3.37	TLE	Total Loop Error
3.38	XMTR	Transmitter

4.0 REFERENCES

The revisions and/or dates of the References per this section are current as of 10/26/2006.

4.1 General

G.1 Point Beach Nuclear Plant Design Guideline DG-I01, Instrument Setpoint Methodology, Rev. 4

G.2 Deleted per Rev. 2 of this calculation.

G.3 Deleted per Rev. 2 of this calculation.

G.4 Deleted per Rev. 2 of this calculation.

G.5 Deleted per Rev. 2 of this calculation.

G.6 Deleted per Rev. 2 of this calculation.

G.7 Deleted per Rev. 2 of this calculation.

G.8 PBNP Condition Report A/R 141685 (CR 95-109) Evaluation, dated February 22, 1995

G.9 Deleted per Rev. 2 of this calculation.

G.10 Deleted per Rev. 2 of this calculation

G.11 Deleted per Rev. 2 of this calculation

G.12 Deleted per Rev. 2 of this calculation.

G.13 Deleted per Rev. 2 of this calculation.

G.14 Point Beach Nuclear Plant Technical Specifications, Section 3.3.2, Table 3.3.2-1, Items #1 and #2, dated November 2001; and Section 3.6.4, dated December 2002. Technical Specification Bases B 3.6.4, dated January 2006 and B 3.3.2, November 2001

G.15 Deleted per Rev. 2 of this calculation.

G.16 Deleted per Rev. 2 of this calculation.

G.17 Deleted per Rev. 2 of this calculation.

G.18 Deleted per Rev. 2 of this calculation.

G.19 Deleted per Rev. 2 of this calculation.

G.20 Deleted per Rev. 2 of this calculation.

G.21 Deleted per Rev. 2 of this calculation.

G.22 WCAP-8587, Rev. 6-A, "Methodology for Qualifying Westinghouse WRD Supplied NSSS Safety Related Electrical Equipment", dated March 1983

G.23 Bechtel Specification No. 6118-M-40, Rev.1, "Specification for Heating, Ventilating and Air Conditioning Controls"

G.24 Point Beach Nuclear Plant FSAR Section 6.4 dated June 2007, Section 7.6, dated June 2007, Section 9.8.1, dated June 2007, Section 11.6, dated June 2003, Section 9.5, dated June 2000, and Section 14 for applicable accident analysis

G.25 Westinghouse Correspondence WEP-06-23, dated March 28, 2006, "Input for Current Analysis of Record (RPS/ESFAS)"

G.26 Not used.

G.27 Modification Package IC-259, "Seismic Pressure and Differential Pressure (Unit 1)", completed 7/25/1985

G.28 Modification Package IC-260, "Seismic Pressure and Differential Pressure (Unit 2)", completed 7/25/1985

G.29 PB 634, Rev. 3, "Specification for Safety Assessment System and Plant Process Computer System for the Point Beach Nuclear Plant PPCS 2000"

G.30 PBF-2034, Rev. 74 – Control Room Log – Unit 1, pages 119,120 and 121

G.31 PBF-2035, Rev. 74 – Control Room Log – Unit 2, pages 119, 120 and 121

G.32 NPC-28427, dated September 1, 1983, "Implementation of Regulatory Guide 1.97 for Emergency Response Capability, Point Beach Nuclear Plant, Units 1 and 2".

G.33 EQML (Environmental Qualification Master List), Page 16 of 30, Rev. 29

G.34 Modification Package MR 99-003, "HELB Walls Doors and Blow-Off Panel in the CCW HX Room to Resolve HELB Issue", completed 12/09/2003

G.35 Wisconsin Electric Nuclear Power Business Unit Design and Installation Guidelines, DG-I02, Rev. 0, "Instrument Scaling Methodology"

G.36 Walkdown Record Regarding Minor Divisions for Low Range Containment Pressure Indicators (PI-945, PI-947 and PI-949) – Attachment B

G.37 DIT No. CRR-I&C-006, dated 2/17/2006, Regarding Elevated Temperature Impacts on Control Room Indicators

G.38 Passport Q-Basis Information for PT-945, PT-947 and PT-949 (in "Attribute" tab)

G.39 SPEC-0852, Rev. 2, "Structural Design Criteria for the Point Beach Nuclear Plant", dated July 1967

G.40 Westinghouse Report WEPB-PCS-NAP-FL-001-FS-02, "WEPB Plant Computer Replacement Project Functional Design Specification Document-Flow and Level Corrections", dated October 10, 2001

G.41 Westinghouse Report WEPB-PCS-NAP-IT-001-FS-02, "WEPB Plant Computer Replacement Project Functional Design Specification Document-Incore Thermocouples", dated October 08, 2001

G.42 Passport Preventive Maintenance frequency check for Computer Analog to Digital Converters (located on D080 panel under PMID 17263)

G.43 PBNP Modification Request MR 98-002-C, "PPCS Changeover from Old to New PPCS", dated April 20, 2005

G.44 NPC-36703, Rev. 1, Seismic Evaluation Report, USNRC Generic Letter 87-02, USI A-46 Resolution, dated January 1996

G.45 Design Information Transmittal (DIT) CRR-I&C-014 dated 8/23/07, Supplement to Section 3.3.8 of PBNP Design Guide DG-I01 Rev 4, Methodology to determine the Operability Limit

4.2 Drawings

D.1 BD-12, Sheet 1, Rev. 4, "Block Diagram-Instrument, Reactor Protection System, Reactor Coolant Flow & Containment Press.", PBNP Unit 1

D.2 BD-14, Sheet 1, Rev. 8, "Block Diagram-Instrument, Reactor Control System, Pressurizer Level Control", PB NP Unit 1

D.3 BD-12, Rev. 3, "Block Diagram-Instrument, Reactor Protection System, Reactor Coolant Flow & Containment Press.", PBNP. Unit 2

D.4 BD-14, Rev. 9, "Block Diagram-Instrument, Reactor Control System, Pressurizer Level Control", PBNP Unit 2

D.5 SK-1042, Sheets 1, 2 (13754.22-SK-1042-4, Sheets 1 & 2), Rev. 4, "Replacement Instrument Installation 1-PT945"

D.6 SK-1159, Sheets 1, 2 (13754.22-SK-1159-3, Sheets 1 & 2), Rev. 3, "Replacement Instrument Installation 2-PT945"

D.7 SK-1077 Job WP 22, Sheets 1, 2, 3 (13754.22-SK-1077-4, Sheets 1, 2 & 3), Rev. 4, "Replacement Instrument Installation, 1-PT947 & 1-PT948"

D.8 SK-1132, Sheets 1, 2 (13754.22-SK-1132-4, Sheets 1 & 2), Rev. 4, "Replacement Instrument Installation, 2-PT947 & 2-PT948"

D.9 SK-1056, Sheets 1, 2 (13754.22-SK-1056-4, Sheets 1 & 2), Rev. 4, "Replacement Instrument Installation 1-PT949"

D.10 SK-1127, Sheets 1, 2 (13754.22-SK-1127-3, Sheets 1 & 2), Rev. 3, "Replacement Instrument Installation 2-PT949"

D.11 0082, Sheet 10 (977-82, Sheet 10), Rev. 9, "Cable Spreading Room Air Conditioning System Rack C58"

D.12 CD-3 JOB 10668, Sheet 2, Rev. 8, "Wiring Diagram – Interconnect, Reactor Control System Rack 1R2 (1C112) Bottom", PBNP Unit 1

D.13 CD-5 JOB 10668, Sheet 3, Rev. 4, "Wiring Diagram – Interconnect, Reactor Protection System Rack 1W2 (1C114) Bottom", PBNP Unit 1

D.14 CD-7 JOB 10668, Sheet 3, Rev. 5, "Wiring Diagram – Interconnect, Reactor Control System Rack 1B2 (1C115) Bottom", PBNP Unit 1

D.15 CD-3 JOB 10665, Sheet 2, Rev. 6, "Wiring Diagram – Interconnect, Reactor Control System Rack 2R2 (2C112) Bottom", PBNP Unit 2

D.16 CD-5 JOB 10665, Sheet 3, Rev. 3, "Wiring Diagram – Interconnect, Reactor Protection System Rack 2W2 (2C114) Bottom", PBNP Unit 2

D.17 CD-7 JOB 10665, Sheet 3, Rev. 2, "Wiring Diagram – Interconnect, Reactor Control System Rack 2B2 (2C115) Bottom", PBNP Unit 2

4.3 Procedures

P.1 1ICP 13.016L, Rev. 5, "Reactor Protection and Safeguards Analog Racks Containment Pressure 18 Month Calibration"

P.2 2ICP 13.016L, Rev. 5, "Reactor Protection and Safeguards Analog Racks Containment Pressure 18 Month Calibration"

P.3 1ICP 04.006-2, Rev. 7, "Containment Pressure Transmitter Outage Calibrations"

P.4 2ICP 04.006-2, Rev. 8, "Containment Pressure Transmitter Outage Calibrations"

P.5 Deleted per Rev. 2 of this calculation

P.6 Deleted per Rev. 2 of this calculation

P.7 Deleted per Rev. 2 of this calculation

P.8 Deleted per Rev. 2 of this calculation

P.9 Deleted per Rev. 2 of this calculation.

P.10 Deleted per Rev. 2 of this calculation

P.11 Deleted per Rev. 2 of this calculation.

P.12 Deleted per Rev. 2 of this calculation.

P.13 1ICP 02.001RD, Rev. 9, "Reactor Protection and Engineered Safety Features Red Channel Analog 92 Day Surveillance Test"

P.14 2ICP 02.001RD, Rev. 11, "Reactor Protection and Engineered Safety Features Red Channel Analog 92 Day Surveillance Test"

P.15 1ICP 02.001BL, Rev. 12, "Reactor Protection and Engineered Safety Features Blue Channel Analog 92 Day Surveillance Test"

P.16 2ICP 02.001BL, Rev. 15, "Reactor Protection and Engineered Safety Features Blue Channel Analog 92 Day Surveillance Test"

P.17 1ICP 02.001WH, Rev. 11, "Reactor Protection and Engineered Safety Features White Channel Analog 92 Day Surveillance Test"

P.18 2ICP 02.001WH, Rev. 11, "Reactor Protection and Engineered Safety Features White Channel Analog 92 Day Surveillance Test"

P.19 ICI 12, Rev. 8, "Selection of M&TE for Field Calibrations"

P.20 Fleet Procedure FP-E-RTC-02, Rev. 1, "Equipment Classification – Q-List"

P.21 1ICP 02.020BL, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF Blue Channel Analog Surveillance Test"

P.22 1ICP 02.020RD, Rev. 11, "Post-Refueling Pre-Startup RPS and ESF Red Channel Analog Surveillance Test"

P.23 1ICP 02.020WH, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF White Channel Analog Surveillance Test"

P.24 2ICP 02.020BL, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF Blue Channel Analog Surveillance Test"

P.25 2ICP 02.020RD, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF Red Channel Analog Surveillance Test"

P.26 2ICP 02.020WH, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF White Channel Analog Surveillance Test"

P.27 OM 1.1, Rev. 28, "Conduct of Plant Operations, PBNP Specific"

P.28 ARP 1-PPCS-018, Rev 0, "Priority Alarm Containment Pressure Unit 1"

P.29 ARP 2-PPCS-018, Rev 0, "Priority Alarm Containment Pressure Unit 2"

4.4 Vendor

V.1 Foxboro EQ Transmitters Manual, VTM #00432, Rev. 21

V.2 Foxboro Corporate Product Specification CPS-0804, Rev. G, "Nuclear Electronic Gauge Pressure Transmitters N-E11GM Series, Style A&B", VTM #00432, Rev. 21

V.3 Foxboro Instrumentation Composite Book 4, VTM #00623A4, Rev. 11 – Foxboro Technical Information 18-692, dated January 1969, "Model 63U-B Duplex Alarm / Model 63U-F Duplex Difference Alarm"

V.4 Westinghouse Component Instruction Manual, Main Control Board – Part 1, VTM #00132A, Rev. 25

V.5 Foxboro Instrumentation Composite Book 4, VTM #00623A4, Rev. 11 – Foxboro Technical Information 39-162c, dated February 1968, "66B Series Current Repeater, Style D"

V.6 Combustion Engineering, Inc. 1485-ICE 1234, Rev. 2, "Functional Design Description for Seismic Safety Parameter Display System (SSPDS)", PBNP VTM #01209, Book 4, Rev. 21

V.7 Johnson Controls Temperature Composite Book 2, VTM #00309B, Rev. 5 – T-4000 Series Pneumatic Room Thermostats (Tab – Thermostats & Thermometers)

V.8 Foxboro Instrumentation Composite Book 4, VTM #00623A4, Rev. 11 – Foxboro Technical Information 18-635, dated November 1969, "Model 610A Power Supply, Styles B and C"

V.9 Combustion Engineering, Inc. 1485-ICE 1239, Rev. 2, "Functional Design Description for Safety Assessment System and Plant Process Computer System", PBNP VTM #01209, Book 5, Rev. 21

V.10 Combustion Engineering, Inc., "SAS/PPCS Computer System – Volume 21 – Manual Reinstated 5/30/03 Equipment in Plant", PBNP VTM #01055U, Revision 11, Tab F, "RTP7436/10 Digital and Analog Loopback and Calibration Card"

V.11 User Guide HP 34401A Multimeter, VTM # 01692, Rev. 0

4.5 Calculations

C.1 PBNP-IC-13, Rev. 0, "Foxboro N-E11GM Transmitters Drift Calculation"

C.2 PBNP-IC-06, Rev. 0, "Foxboro 63U-BC Bistable Drift Calculation"

C.3 PBNP-IC-07, Rev. 0, "Westinghouse 252 Indicator Drift Calculation"

C.4 Engineering Evaluation No. 2005-0006, Rev. 0, "Drift Calculations Evaluation"

C.5 M-09334-357-HE.1, Appendix L, Rev. 3, "Environmental Effects of a HELB in the CCW Heat Exchanger Room with Vent Path to the Turbine Building"

C.6 Deleted

C.7 97-0140, Rev. 2, "Revised Radiation Dose to Equipment Outside of Containment Following a Design Basis LOCA"

C.8 Engineering Evaluation No. 2001-0032 Rev 6, "Parametric Values"

5.0 ASSUMPTIONS

5.1 Validated Assumptions

5.1.1 Deleted per Rev. 2 of this calculation.

5.1.2 Deleted per Rev. 2 of this calculation.

5.1.3 Deleted per Rev. 2 of this calculation.

5.1.4 Deleted per Rev. 2 of this calculation.

5.1.5 It is assumed that the maximum power supply effect for the I/I converters (isolators) is 1.0 % span and this effect is considered a random error.

Basis: PBNP evaluation of A/R 141685 (CR 95-109) (Ref. G.8) indicates that the I/I Converter output fluctuates between 0.5 to 1.0 % due to the effect on the non-regulated portion of the internal 50 volt power supply in which the I/I converter is connected. Furthermore, this error should be treated as random not a bias. Therefore, the maximum fluctuation of ± 1 % is used in this calculation as the power supply effect for the I/I Converter.

5.1.6 Deleted per Rev. 2 of this calculation.

5.1.7 It is assumed that the accuracy of the PPCS display loop is ± 0.51 % of full scale. This accuracy value applies to the loop from the PPCS analog input field terminations to the PPCS printed and/or display output devices. The accuracy value includes the temperature effect, power supply effect, humidity effect, radiation effect, seismic (vibration) effect, and drift over the entire PPCS normal operating range.

Basis: Per Reference G.29, the PPCS replacement modification shall process inputs and outputs from existing I/O devices. As such, the existing signal processing I/O isolation and signal conversion cards were not replaced as a result of Modification Request 98-002. References V.6 and V.9 document that the maximum total system error for the old PPCS computer system, during normal operating environments, from field terminations to the printed and/or display output shall be within ± 0.5 % of the full scale (excluding errors before input of the analog input).

A review of all Westinghouse Plant Computer Replacement Reports revealed that the output values for all newly installed PPCS equipment (not including the existing I/O devices discussed in the above paragraph) shall be within 0.1 % of hand calculated results, with the following two exceptions:

1) For results based on polynomial curves, the output values shall be within 1.0 % of hand calculated results (Reference G.40)
2) For results based on steam tables, the output values shall be within 0.5 % of hand calculated results (References G.40 and G.41).

The PPCS points considered in this calculation display the Low Range Containment Pressure (in units of psig) based on a 10-50 mAdc input signal from the loop rack components. Since the Low Range Containment Pressure loop is not a component of References G.40 or G.41, accuracy values associated with polynomial curves and steam tables are not applicable, and the accuracy of the newly installed PPCS equipment (not including the existing I/O devices) is considered to be 0.1 %.

Therefore, to determine the overall PPCS system accuracy, the specified values of 0.1 % (for newly installed PPCS equipment) and 0.5 % (for existing PPCS equipment) are combined using the SRSS methodology as follows:

$$PPCSa \quad = \pm\sqrt{0.5^2 + 0.1^2} \quad = \pm 0.51\%$$

In accordance with Section 3.3.3.3 of Reference G.1, if the manufacturer does not specify environmental errors associated with the subject normal environmental accuracy ratings these effects are considered to be included in the specified accuracy ratings or are considered to be negligible.

Per Reference V.10, the PPCS analog-to-digital (A/D) converters have a drift value of ± 0.01 % for a period of 1-year. This value is not significant when compared to the much larger accuracy value of ± 0.51 %. Per Reference G.42, the A/D converters are calibrated approximately every 36 weeks to eliminate any potential drift. In addition these components historically never need to be calibrated because they do not drift. Therefore, the vendor specified drift value is considered negligible.

Per Section 3.3.3.15 of Reference G.1, in the absence of a vendor specified drift value, it is typical for the device accuracy to be substituted in place of drift. However, in the case of PPCS, considering an additional ± 0.51 % for calculating the As-Found Tolerance would create a value large enough to allow PPCS degradation to go undetected. Conversely, by assuming that the drift value is included in the accuracy value, the As-Found Tolerance would remain tight enough to detect PPCS degradation prior to system failure. Therefore, the PPCS drift is conservatively encompassed by the ± 0.51 % accuracy value.

5.1.8 It is assumed that the existing As-Left setting tolerances for the instruments evaluated in this calculation are as follows:

Transmitters	= ± 0.20 mAdc
Bistables	= ± 0.002 Vdc; to be reduced to ± 0.001 Vdc*
Current-to-Current Converter	= ± 0.20 mAdc; to be reduced to ± 0.10 mAdc*
Control Board Indicator	= ± 0.80 mAdc; to be reduced to ± 0.70 mAdc*
PPCS Indication	= ± 0.3 psig

<u>Basis:</u> These As-Left setting tolerance values have historically provided acceptable instrument performance and consistency in the calibration program. These As-Left setting tolerances are routinely achievable for the installed instruments, consistent with safety limits and test equipment capability. They are currently used in practice at the station, and implemented by calibration procedures listed in References P.1 through P.4 and P.13 through P.18.

*However, in an effort to minimize the total loop error for trip setpoints and the indicating loop for Tech Spec surveillance to within manageable tolerances, PBNP has decided to reduce the setting tolerance of the I/I Converter, bistable and control room indicator by 0.25% span. Therefore, the setting tolerance for the I/I Converter, bistable and control room indicator used in this calculation is the existing setting tolerance minus 0.25% span.

As-Found setting tolerances are to be determined in this calculation.

5.1.9 It is assumed that the maximum environmental temperature of Control Room and Computer Room instrumentation is 120 °F.

Basis: Table 6-1 of WCAP-8587 (Ref. G.22) states that when the HVAC is non-safety related, a normal temperature of 120 °F (loss of chiller) should be used. Since the Control Room and Computer Room HVAC System chiller is not powered from an essential power bus, the Control Room and Computer Room HVAC System is considered as a non-safety related system (see Assumption 5.1.10 for maximum temperature used for PPCS evaluation).

5.1.10 It is assumed that the maximum environmental operating temperature for the existing installed PPCS system is 95 °F.

Basis: Reference G.43 (Attachments 1 and 5) identifies that the most temperature sensitive component of the new PPCS system is the non-ruggedized Sparc computer, which has an operating temperature limit of 95 °F. Note: the maximum temperature used for evaluating PPCS uncertainties is 85 °F, which is bounded by the PPCS operating temperature limit.

5.1.11 It is assumed that the elevated radiation levels in the Auxiliary Building, which could occur following initiation of containment sump recirculation, have no radiation effect on the Containment High Pressure Safety Injection and containment High-High Pressure Containment Spray initiation setpoints.

Basis: At the time containment sump recirculation is initiated, the level in the Refueling Water Storage Tank (RWST) has fallen significantly. This can only occur if a safety injection has already occurred. Therefore, once containment sump recirculation is initiated, the safety injection function on High Containment Pressure has already occurred. Similarly, during LOCA, containment spray actuation occurs during the injection phase contributing to the RWST depletion prior to recirculation. FSAR section 6.4 (Ref G.24) states that Containment Spray action is only credited during the injection phase and it is expected that Containment Spray is no longer required during the recirculation phase. In any case the automatic CS actuation would only occur during the injection phase. Therefore when the elevated radiation levels in the Auxiliary building following containment sump recirculation could occur, the High-High Pressure Containment Spray initiation function is no longer required.

5.1.12 It is assumed that the elevated radiation levels in the Auxiliary Building, which could occur following initiation of containment sump recirculation, have no radiation effect on the Containment High Pressure Condensate Isolation trip setpoint.

Basis: The condensate isolation function serves as a backup protection function in the event of a steam line break inside containment with a failure of the main feedwater lines to isolate. A single failure of a main feedwater regulating valve to close on a safety injection signal could allow feedwater addition to the faulted steam generator, leading to containment overpressure as described in Section 7 of Tech Spec Bases B3.3.2 (Ref. G.14).

A steam line break inside containment does not release significant radioactivity to the containment (similar to a steam line break outside containment that releases directly to the environment). The CPCI trip will occur rapidly without any transmitter exposure to elevated radiation. Therefore, there is no source of radiation that needs to be considered for the sensor uncertainty in determining the error for this trip function.

5.1.13 It is assumed that the temperature of the containment pressure transmitters located in the PAB will not be above 104°F prior to the time when the High and High-High containment pressure ESFAS trips occur.

Basis: The High Containment Pressure SI actuation function and High-High Containment pressure CS initiation are both credited as primary trips in the steam line break inside containment integrity analysis. The High-High containment pressure CS initiation function is also credited in the LBLOCA containment integrity analysis (Reference letter WEP-06-23). For each of these accidents the containment pressure rapidly increases above the setpoints within the first few minutes of the accident as shown in FSAR section 14 (Ref G.24)

Revision 2 of this calculation used maximum normal operating temperature as 104°F for normal conditions, and 120°F for accident conditions in the auxiliary building. However, the design temperatures for normal operating conditions in the auxiliary building are 65°F in the winter and 85°F in the summer (Ref G.23). Loss of PAB ventilation does not need to be assumed prior to the applicable accidents (Ref G.24), but for conservative purposes, this revision will use 104°F for the maximum temperature conditions of the transmitters to account for local temperature variations. See section 6.4.for further environmental conditions.

5.2 Unvalidated Assumptions

None

6.0 DESIGN INPUTS

6.1 Loop Definitions

The Low Range Containment Pressure Control Loops (channels) analyzed in this calculation are shown in References D.1 through D.4 for Units 1 and 2, explained in more detail in the following sections (6.2 and 6.3).

6.2 Loop Block Diagram

The block diagram below (Fig. 6.2-1) shows the component configuration for the Low Range Containment Pressure instrument loops that are addressed in this calculation. The diagram is generic and applies to loops P-945, P-947 and P-949 for both Units 1 and 2. See References D.1 through D.4 for more details.

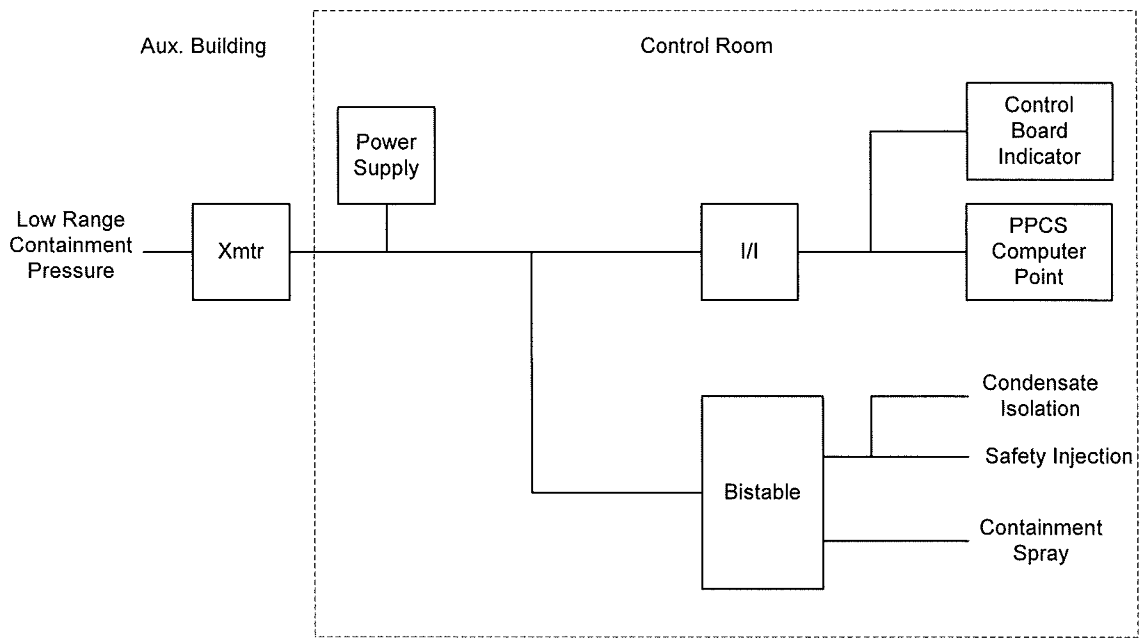


Figure 6.2-1 Low Range Containment Pressure Loop Block Diagram

6.3 Component Models and Tag Numbers

The following table identifies each component shown in Figure 6.2-1 for each of the three Low Range Containment Pressure instrument loops (these tag numbers are applicable to both Units 1 and 2), and provides the associated plant information for use throughout this calculation.

Table 6.3-1 Low Range Containment Pressure Instruments

Component	Model	P-945	P-947	P-949	Reference(s)
Transmitter	Foxboro N-E11GM-HIB1-BEL/AEL	PT-945	PT-947	PT-949	G.27, G.28, V.1, V.2, P.3, P.4, D.1 – D.10
Power Supply	Foxboro 610AC-O	PQ-945	PQ-947	PQ-949	V.8, D.1 – D.4
Containment Pressure Safety Injection/Containment Spray Bistable	Foxboro 63U-BC-OHEA	PC-945A/B	PC-947A/B	PC-949A/B	P.13 – P.18, V.3, D.1 – D.4
Isolator (Current-to-Current Converter)	Foxboro 66BC-O	PM-945	PM-947	PM-949	P.1, P.2, V.5, D.1 – D.4
Low Range Containment Pressure Control Board Indicator	Westinghouse HX-252	PI-945	PI-947	PI-949	P.1, P.2, V.4, D.1 – D.4
PPCS	N/A	P-945	P-947	P-949	P.1, P.2

6.4 Environmental Considerations

The Low Range Containment Pressure channels P-945, P-947 and P-949, shown in block diagram form in Figure 6.2-1, provide input to the Engineered Safety Features Actuation System (ESFAS) and indication in the control room and at the PPCS.

The Control Room Indication and PPCS display are used to monitor Low Range Containment Pressure and are associated with Parametric Values (Ref. G.30 and G.31). Parametric values are limits or tolerances due to indication uncertainties to be included in the operator logs (Ref. G.30 and G.31) to ensure that the Tech Spec limits are not violated. Routine surveillance of instrumentation (in the Control Room) for parametric values to determine Tech Spec Compliance for a specific process is performed during normal plant operating conditions only.

The Control Room Indication to monitor Low Range Containment Pressure also provides input for EOP operator actions. References G.32 and G.38 classify Low Range Containment Pressure as a Regulatory Guide 1.97, Type A, B and C variable. FSAR Table 7.6-1 (Ref. G.24) and the Q Basis codes 7 and 21 in Passport (Ref. G.38) identify the instrumentation as a Category 1 variable (Note: PBNP is in the process of adding Reg. Guide 1.97 Category values into Passport). Q Basis codes 7 and 21 are defined in Fleet Procedure FP-E-RTC-02 (Ref. P.20).

Tech Spec Table 3.3.2-1 (Ref. G.14) indicates that Low Range Containment Pressure channels P-945, P-947 and P-949 provide input to ESFAS by initiating a Safety Injection (SI) Signal on High Containment Pressure and Containment Spray Actuation Signal on High-High Containment Pressure to mitigate a LOCA/HELB event. The Low Range Containment Pressure channels also initiate a Condensate Isolation Signal on High Containment Pressure. The condensate isolation function serves as a backup protection function in the event of a Main Steam Line Break inside the containment with the failure of the Main Feedwater to isolate. Initiation of SI signal, Containment Spray Actuation Signal and Condensate Isolation Signal are safety-related functions.

6.4.1 Auxiliary Building

Per References D.5 through D.10 and G.33, the Low Range Containment Pressure transmitters are located in the non-harsh area of the Auxiliary Building at the following locations:

Table 6.4-1 Transmitter Locations

Transmitters	Location	Room Area
1PT-945	N-10, El. 26'-0"	Pipeway #2
1PT-947	M-10, El. 8'-0"	Pipeway #2
1PT-949	J-8, El. 8'-0"	Pipeway #1
2PT-945	N-13, El. 26'-0"	Pipeway #3
2PT-947	M-13, El. 8'-0"	Pipeway #3
2PT-949	J-15, El. 8'-0"	Pipeway #4

The design temperatures for the Auxiliary Building HVAC system per Ref. G.23 are 65 °F during winter and 85 °F during summer. The HVAC unit keeps the minimum normal temperature above 65 °F during the outage. In accordance with Section 3.3.4.7 of Reference G.1, the minimum calibration temperature may conservatively be used and therefore 65°F is to be used as the calibration temperature in this calculation.

FSAR Section 9.5 (Ref. G.24) states that the Auxiliary Building HVAC is non-safety related. From Table 6-1 of Reference G.22, the Auxiliary Building maximum temperature for normal conditions is 104 °F. For a non-safety related HVAC system, the maximum temperature is 120 °F due to a loss of the HVAC Cooling Unit (Ref. G.22, Table 6-1). Since Tech Spec compliance surveillance is only performed during normal plant operating conditions, for the indication and PPCS loops associated with parametric values, 104 °F is used as the maximum temperature. The trip functions (SI, Condensate Isolation and Containment Spray) will also use 104 °F as the maximum temperature. These trips are shown to happen a short duration after the accident that they are required for (Ref G.24), and the HVAC system can be assumed to be functioning prior to the event (assumption 5.1.13). Previous revisions of this calculation have used 120 °F as the maximum temperature. However, based on the assumed availability of the HVAC system, the trips occurring quickly during a LOCA or MSLB, and the max design temperature of 85°F (Ref G.23) of the PAB; using 104 °F as the maximum temperature is considered conservative. For EOP (Regulatory Guide 1.97 Category 1 variables), 120 °F is used as the maximum temperature since the instrumentation is expected to operate under compromised environmental conditions caused by a loss of the HVAC Cooling Unit.

Per Reference C.5, a new HELB barrier was installed per MR 99-003 (Ref. G.34) to confine postulated HELB to the CCW HX/BAT room and thereby prevent the steam from entering other areas of the Auxiliary Building. Hence, these areas do not experience environmental effects from postulated HELB. The areas where the transmitters are located are not in the CCW HX/BAT room, and therefore, do not experience the elevated temperature effects from the postulated accidents (LOCA or HELB). However, the highest radiation at the transmitter locations due to recirculation of coolant during a LOCA is 7.82×10^5 RADs (Ref. C.7). The elevated radiation effects are not applicable to the Containment High-High Pressure Containment Spray, Containment High Pressure Safety Injection, and Condensate Isolation trip setpoint, since the initiation of the trips are assumed to occur before containment sump recirculation is started (Assumptions 5.1.11 and 5.1.12).

The Auxiliary Building normal humidity of 70 % and radiation of 400 RADs (40-year dose) is documented in Reference G.22.

Table 6.4-2 Auxiliary Building Ambient Environmental Conditions

Function	Calibration Temp. (°F)	Max. Temperature (°F)	Humidity (%)	Radiation (RADS)
Normal (For Parametric Values)	65	104	70	400 (40 year dose)
Normal (For EOP Input)	65	120	70	400 (40 year dose)
Accident (For EOP Input)	65	120	70	7.82×10^5 RADs
Accident (For SI and Condensate Isolation Trips	65	104	70	400 (40 year dose)
Accident (For Containment Spray Trip)	65	104	70	400 (40 year dose)

6.4.2 Control Room and Computer Room

The rack components and control board indicators are located in the Control Room (Ref. P.1 and P.2).

The Control Room HVAC System controls the temperature of the Control Room and the Computer Room at 75 °F per Reference G.23. Per FSAR Section 9.8.1 (Ref. G.24), the temperature can vary ± 10 °F, resulting in a normal temperature range of 65 °F to 85 °F. This temperature variation is supported by the fact that the Johnson Controls T-4002-202 thermostat (Ref. D.11) in the Control Room is capable of controlling the room temperature (Ref.V.7) within these bounds. In accordance with Section 3.3.4.7 of Reference G.1, the minimum calibration temperature may conservatively be used and therefore the minimum temperature of 65°F is used as the calibration temperature for the components in the Control Room and Computer Room.

Since Tech Spec compliance surveillance of Control Room Indicators and PPCS displays associated with parametric values is only performed during normal plant operating conditions, 85 °F is used as the maximum temperature for this function (Note, the maximum temperature limit for the PPCS is 95 °F per Assumption 5.1.10). Per Assumption 5.1.9, the maximum expected temperature is 120 °F. This maximum temperature of 120 °F will be used and is justified by the intended functions of the Low Range Containment Pressure loops (safety-related and Regulatory Guide 1.97 Category 1 variable). These functions necessitate the instrumentation to operate under compromised environmental conditions caused by a loss of the HVAC Cooling Unit. The Control Room humidity of 50% and 95% (loss of chiller) is documented in Reference G.22. Section 11.6.2 (fifth paragraph) of FSAR (Ref. G.24) states that the control room is in Zone I and Table 11.6-1 states the maximum dose rate in Zone I is 1.0 mrem/hr.

Table 6.4-3 Control Room and Computer Room Ambient Environmental Conditions

Function	Calibration Temp. (°F)	Max. Temperature (°F)	Humidity (%)	Radiation (RADs)
For Parametric Values	65	85	50	1 mrem/hr
For Trips and EOP Input	65	120	95	1 mrem/hr

6.5 Existing Analytical Limit (AL), Tech Spec Allowable Value (AV) and Field Trip Setpoint (FTSP)

Per Reference G.25, High Containment Pressure-Safety Injection / High Containment Pressure-Condensate Isolation of 6 psig is credited only in the steam line break (SLB) analyses for PBNP. High-High Containment Pressure-Containment Spray trip of 30 psig is credited in the steam line break (SLB) and the loss of coolant accident (LOCA) analyses for PBNP.

Table 6.5-1 ESFAS Trip Function

ESFAS Trip Function	Analytical Limit (Ref. G.25)	Tech Spec Allowable Value (Ref. G.14)	Field Trip Setpoint (Ref. P.13 through P.18)
High Containment Pressure – Safety Injection and Condensate Isolation	6 psig	≤ 6 psig	5 psig
High-High Containment Pressure – Containment Spray	30 psig	≤ 30 psig	25 psig

6.6 Technical Surveillance Requirement

From the Technical Specifications LCO 3.6.4 (Ref. G.14), the low range containment pressure indication is used by the operators to verify that containment pressure shall be ≥ -2.0 psig and ≤ +2.0 psig.

7.0 METHODOLOGY

7.1 Uncertainty Determination

The uncertainties and loop errors are calculated in accordance with Point Beach Nuclear Plant's Instrument Setpoint Methodology, DG-I01 (Ref. G.1). This methodology uses the square root of the sum of the squares (SRSS) method to combine random and independent errors, and algebraic addition of non-random or bias errors. Clarifications to this methodology are noted below:

A) Treatment of 95/95 and 75/75 Values

To convert 95/95 uncertainty values to 75/75 uncertainty values (when applicable); this calculation uses the conversion factor specified in Section 3.3.3.13 of Reference G.1. All individual instrument uncertainties are evaluated and shown as 95/95 values, and are combined under the Total Loop Error radical as such. Conversion to a 75/75 value is performed after the 95/95 TLE radical is computed.

B) Treatment of Significant Digits and Rounding

This uncertainty calculation will adhere to the rules given below for the treatment of numerical results.

1. For values less than 10^2, the rounding of discrete calculated instrument uncertainties (e.g. reference accuracy, temperature effect, etc.) should be performed such that the numerical value is restricted to three (3) or less digits shown to the right of the decimal point.

   For example, an uncertainty calculated as 0.6847661 should be listed (and carried through the remainder of the calculation) as 0.685.

   An uncertainty calculated as 53.235487 should be listed (and carried through the remainder of the calculation) as 53.235.

2. For values less than 10^3, but greater than or equal to 10^2, the rounding of discrete calculated instrument uncertainties (e.g. reference accuracy, temperature effect, etc.) should be performed such that the numerical value is restricted to two (2) or less digits shown to the right of the decimal point.

   For example, an uncertainty calculated as 131.6539 should be listed (and carried through the remainder of the calculation) as 131.65.

3. For values greater than or equal to 10^3, the rounding of discrete calculated instrument uncertainties (e.g. reference accuracy, temperature effect, etc.) should be performed such that the numerical value is restricted to one (1) or less digits shown to the right of the decimal point.

   For example, an uncertainty calculated as 2251.4533 should be listed (and carried through the remainder of the calculation) as 2251.5.

4. For Total Loop Uncertainties and Channel Check Tolerances, the calculated result should be rounded to the numerical precision that is readable on the

associated loop indication or recorder. If the loop of interest does not have an indicator or recorder, the Total Loop Error should be rounded to the numerical precision currently used in the associated calibration procedure for the end device in that loop (e.g. trip unit or alarm unit).

Note: To avoid excessive rounding in the determination of EOP setpoints in WEP-SPT-29, this calculation will provide the Total Loop Error as calculated for EOP input. WEP-SPT-29 will round resultant EOP setpoint values to the numerical precision that is readable on the associated indicator.

5. For calibration tolerances, the calculated result should be rounded to the numerical precision currently used in the associated calibration procedure.

These rules are intended to preserve a value's accuracy, while minimizing the retention of insignificant or meaningless digits. In all cases, the calculation preparer shall exercise judgment when rounding and carrying numerical values, to ensure that the values are kept practical with respect to the application of interest.

C) Determination of Channel Check Tolerance (CCT)

Per Section 3.3.8.7 of Reference G.1, the CCT value is considered a 75/75 value. However, converting the CCT from 95/95 into a 75/75 value restricts the tolerance allowed for the indication loop devices and essentially makes it more difficult for the plant to meet their requirements. This approach is considered to be overly conservative. Therefore, this calculation will determine CCT as a 95/95 value.

Although Reference G.1 does not discuss the rounding techniques for CCT values, it is typical for tolerance values to be rounded down. This approach tightens the tolerance band, thus creating a conservative tolerance value. However, in the case of CCT, when a channel is determined non-operational, it is most likely to be found grossly out of tolerance, i.e., the difference between the channel readings far surpasses the allowable CCT value. Therefore, in an effort to reduce the occurrence of false out of tolerance CCT readings, this calculation will round the CCT value up to the precision that is readable on the indication device.

D) Seismic Consideration for Trip Setpoints

Seismic uncertainty must be evaluated as a contributor to overall loop error for some (not all) RPS/ESFAS trip setpoints. The specific setpoints that require evaluation for seismic effects are those that are credited as primary trips for accidents/transients that could credibly occur as the result of a seismic event. These setpoints are found in the Seismic Evaluation Report, USNRC Generic Letter 87-02, USI A-46 Resolution (Ref. G.44) and are listed below.

Table 7.1-1 Credible Accidents/Transients During or Following a SSE

FSAR Section	Accident/Transient	Primary Reactor Trip Variable
14.1.3	Rod Cluster Control Assembly (RCCA) Drop	Low Pressurizer Pressure
14.1.6	Reduction in Feedwater Enthalpy	None Required
14.1.7	Excessive Load Increase	None Required
14.1.8	Loss of Reactor Coolant Flow	Low RCS flow
14.1.9	Loss of External Electrical Load	Over Temp – Delta T High Pressurizer Pressure Low-Low S/G Level
14.1.10	Loss of Normal Feedwater	Low-Low S/G Level
14.1.11	Loss of All AC Power to the Auxiliaries	Low-Low S/G Level
14.2.5	Stuck Open Steam Dump or S/G Safety Valve	None Required

Trip setpoints not shown in the above table do not need to include a seismic uncertainty term because their trip function is not required during or following a seismic event.

Seismic versus Harsh Environment

Seismic events do not create a harsh environment. Therefore, seismic uncertainties and harsh environment uncertainties need not be combined in a single calculation of total loop error. If any of the above trips credited during a seismic event are also credited as primary trips during a LOCA/MSLB that creates a harsh environment, then the uncertainty term (seismic or harsh environment) that results in the worst-case (largest) of the two TLEs should be applied for determining the limiting trip setpoint.

E) Seismic Consideration for EOP Inputs

The PBNP EOP setpoints are developed in accordance with the recommendations of the Westinghouse Owners Group Emergency Response Guidelines (ERGs). The NRC reviews and approves the ERGs and plants with a Westinghouse NSSS are expected to follow them, documenting any plant-specific differences.

The ERG Executive Volume provides guidance on the subject of instrument uncertainty as it relates to EOP setpoints,. This guidance includes a discussion of the following components that contribute to the total instrument channel accuracy:

process measurement accuracy
primary element accuracy
sensor allowable deviation
reference accuracy
temperature effect
pressure effect

drift
rack allowable deviation
rack calibration accuracy
rack environmental effects
rack drift
comparator setting accuracy

environmental allowance due to the effects of being exposed to a high-energy line break: temperature, pressure, humidity, radiation, chemical spray, acceleration, vibration, and reference leg heatup

indicator allowable deviation

Nowhere in this detailed guidance is there any mention of a seismic term. (It should be noted that, as is clear from the context, the vibration and acceleration terms mentioned in the above list refer only to the vibration or acceleration associated with a high-energy line break.) That is, the ERG recommendations do not require that seismic effects be included in the determination of instrument uncertainty for EOP setpoints.

Therefore, seismic effects will not be considered in the instrument loop uncertainties used in determining EOP setpoints.

7.1.1 Sources of Uncertainty

Per Reference G.1, the device uncertainties to be considered for normal and adverse environmental conditions include the following:

Process Error	(PE_n and PE_a)
Sensor Accuracy	(Sa)
Sensor Drift	(Sd)
Sensor M&TE	(Sm)
Sensor Setting Tolerance	(Sv)
Sensor Power Supply Effect	(Sp)
Sensor Temperature Effect	(St_{n1}, St_{n2} and St_a)
Sensor Humidity Effect	(Sh_n and Sh_a)
Sensor Radiation Effect	(Sr_n, Sr_{a1} and Sr_{a2})
Sensor Seismic Effect	(Ss_n and Ss_a)
Sensor Static Pressure Effect	($Sspe_n$ and $Sspe_a$)
Sensor Overpressure Effect	($Sope_n$ and $Sope_a$)
Bistable Accuracy	(Ba)
Bistable Drift	(Bd)
Bistable M&TE	(Bm)
Bistable Setting Tolerance	(Bv)
Bistable Power Supply Effect	(Bp)
Bistable Temperature Effect	(Bt)
Bistable Humidity Effect	(Bh)
Bistable Radiation Effect	(Br)
Bistable Seismic Effect	(Bs)

Current-to-Current Converter Accuracy	(I/Ia)
Current-to-Current Converter Drift	(I/Id)
Current-to-Current Converter M&TE	(I/Im)
Current-to-Current Converter Setting Tolerance	(I/Iv)
Current-to-Current Converter Power Supply Effect	(I/Ip)
Current-to-Current Converter Temperature Effect	(I/It)
Current-to-Current Converter Humidity Effect	(I/Ih)
Current-to-Current Converter Radiation Effect	(I/Ir)
Current-to-Current Converter Seismic Effect	(I/Is)
Indicator Accuracy	(Ia)
Indicator Drift	(Id)
Indicator M&TE	(Im)
Indicator Setting Tolerance	(Iv)
Indicator Power Supply Effect	(Ip)
Indicator Temperature Effect	(It)
Indicator Humidity Effect	(Ih)
Indicator Radiation Effect	(Ir)
Indicator Seismic Effect	(Is)
Indicator Readability Effect	(Irea)
PPCS Accuracy	(PPCSa)
PPCS Drift	(PPCSd)
PPCS M&TE	(PPCSm)
PPCS Setting Tolerance	(PPCSv)
PPCS Power Supply Effect	(PPCSp)
PPCS Temperature Effect	(PPCSt)
PPCS Humidity Effect	(PPCSh)
PPCS Radiation Effect	(PPCSr)
PPCS Seismic Effect	(PPCSs)
PPCS Readability Effect	(PPCSrea)

The uncertainties will be generally calculated in percent of span and converted to the process units as required.

Per Section 3.3.3.13 of Ref. G.1, the uncertainties listed above are considered 2 sigma (95% probability/95% confidence) unless otherwise specified.

Per Sections 3.1 and 3.2 of Reference G.1, the Low Range Containment Pressure functions are classified into the following categories:

- The High and High-High Containment Pressure Trip Setpoints, which provide inputs to ESFAS, are classified as a Category A function. Therefore, the total loop error should be expressed as 95/95 (95% probability at a 95% confidence level) value.
- As indicated in Section 6.4, the Control Room indication total loop error, which provides input to EOP operator actions, is a Regulatory Guide 1.97, Type A, B and C, Category 1 variable. Per Section 3.1 of Reference G.1, the instrument loop is classified as Category A and C

functions. Therefore, the total loop error should be expressed as 95/95 and 75/75 values.

- The PPCS display and Control Room Indication are associated with the parametric values per References G.30 and G.31, and are classified as a Category B function. Therefore, the total loop error should be expressed as a 75/75 value.

7.1.2 Total Loop Error (TLE) Equation Summary

The Total Loop Error for instrument loops is determined in accordance with the requirements of Reference G.1. This methodology uses the square root of the sum of the squares (SRSS) method to combine the applicable random and independent errors, and algebraic addition of non-random or bias errors (of like sign).

The equations have been modified accordingly to only include uncertainties applicable to the instrumentation loops treated in this calculation.

7.1.2.1 Total Trip Loop Error (TLE_{TRIP})

Per Figure 6.2-1, the Total Trip Loop Error for the Low Range Containment High Pressure SI / Condensate Isolation and High-High Pressure Containment Spray actuation (TLE_{TRIP}) consists of the following uncertainties (per Assumption 5.1.11 and 5.1.12, high radiation effect is not applicable to these trips):

$$TLE_{TRIP} = \pm \sqrt{\begin{aligned}&Sa^2 + Ba^2 + Sd^2 + Bd^2 + Sm^2 + Bm^2\\&+ Sv^2 + Bv^2 + Sp^2 + Bp^2 + St_{n1}{}^2 + Bt^2\\&+ Sh_a{}^2 + Bh^2 + Sr_{a1}{}^2 + Br^2 + Ss_a{}^2 + Bs^2\\&+ Sspe_a{}^2 + Sope_a{}^2\end{aligned}} \pm PE_a \pm Bias \quad \text{(Eq. 7.1.2-1)}$$

7.1.2.2 Total Indicator Loop Error (TLE_{IND})

Per Figure 6.2-1, the Total Loop Error for the Low Range Containment Pressure Normal and EOP Indications consist of the following uncertainties:

$$TLE_{IND\text{-}NORM} = \pm \sqrt{\begin{aligned}&Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2\\&+ Sm^2 + I/Im^2 + Im^2 + Sv^2 + I/Iv^2 + Iv^2\\&+ Sp^2 + I/Ip^2 + Ip^2 + St_{n1}{}^2 + I/It^2 + It^2\\&+ Sh_n{}^2 + I/Ih^2 + Ih^2 + Sr_n{}^2 + I/Ir^2 + Ir^2\\&+ Ss_n{}^2 + I/Is^2 + Is^2 + Sspe_n{}^2 + Sope_n{}^2 + Irea^2\end{aligned}} \pm PE_n \pm Bias \quad \text{(Eq. 7.1.2-2a)}$$

where:

$TLE_{IND\text{-}NORM}$ = Total Normal Indicator Loop Error

$$TLE_{IND\text{-}EOP\,(normal)} = \pm\sqrt{\begin{aligned}&Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2\\&+ Sm^2 + I/Im^2 + Im^2 + Sv^2 + I/Iv^2 + Iv^2\\&+ Sp^2 + I/Ip^2 + Ip^2 + St_{n2}{}^2 + I/It^2 + It^2\\&+ Sh_n{}^2 + I/Ih^2 + Ih^2 + Sr_{a1}{}^2 + I/Ir^2 + Ir^2\\&+ Ss_n{}^2 + I/Is^2 + Is^2 + Sspe_n{}^2 + Sope_n{}^2 + Irea^2\end{aligned}} \pm PE_n \pm Bias$$

(Eq. 7.1.2-2b)

where:

$TLE_{IND\text{-}EOP(normal)}$ = Total Loop Error for EOP Indication under normal conditions

$$TLE_{IND\text{-}EOP\,(accident)} = \pm\sqrt{\begin{aligned}&Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2\\&+ Sm^2 + I/Im^2 + Im^2 + Sv^2 + I/Iv^2 + Iv^2\\&+ Sp^2 + I/Ip^2 + Ip^2 + St_{n2}{}^2 + I/It^2 + It^2\\&+ Sh_n{}^2 + I/Ih^2 + Ih^2 + Sr_{a2}{}^2 + I/Ir^2 + Ir^2\\&+ Ss_n{}^2 + I/Is^2 + Is^2 + Sspe_n{}^2 + Sope_n{}^2 + Irea^2\end{aligned}} \pm PE_n \pm Bias$$

(Eq. 7.1.2-2c)

where:

$TLE_{IND\text{-}EOP(accident)}$ = Total Loop Error for EOP Indication under accident conditions

7.1.2.3 Total PPCS Loop Error (TLE_{PPCS})

Per Figure 6.2-1, the Total Loop Error for the Low Range Containment Pressure PPCS display consists of the following uncertainties:

$$TLE_{PPCS} = \pm\sqrt{\begin{aligned}&Sa^2 + I/Ia^2 + PPCSa^2 + Sd^2 + I/Id^2 + PPCSd^2\\&+ Sm^2 + I/Im^2 + PPCSm^2 + Sv^2 + I/Iv^2 + PPCSv^2\\&+ Sp^2 + I/Ip^2 + PPCSp^2 + St_{n1}{}^2 + I/It^2 + PPCSt^2\\&+ Sh_n{}^2 + I/Ih^2 + PPCSh^2 + Sr_n{}^2 + I/Ir^2 + PPCSr^2\\&+ Ss_n{}^2 + I/Is^2 + PPCSs^2 + Sspe_n{}^2 + Sope_n{}^2 + PPCSrea^2\end{aligned}} \pm PE_n \pm Bias$$

(Eq. 7.1.2-3)

7.1.3 As-Found Tolerance Equation Summary

As-Found Tolerances are calculated independently for each of the loop components. The equations shown are adapted from Section 3.3.8.6 of Reference G.1 for use in this calculation.

7.1.3.1 Sensor As-Found Tolerance (SAF)

The acceptable As-Found Tolerance for the Sensor is calculated by the following equation:

$$SAF = \pm \sqrt{Sv^2 + Sd^2 + Sm^2} \qquad \text{(Eq. 7.1.3-1)}$$

where:

Sv = Sensor Tolerance
Sd = Sensor Drift
Sm = Sensor M&TE error

7.1.3.2 Bistable As-Found Tolerance (BAF)

The acceptable As-Found Tolerance for the Bistable is calculated by the following equation:

$$BAF = \pm \sqrt{Bv^2 + Bd^2 + Bm^2} \qquad \text{(Eq. 7.1.3-2)}$$

where:

Bv = Bistable Tolerance
Bd = Bistable Drift
Bm = Bistable M&TE error

7.1.3.3 Current-to-Current Converter As-Found Tolerance (I/IAF)

The acceptable As-Found Tolerance for the I/I Converter is calculated by the following equation:

$$I/IAF = \pm \sqrt{I/Iv^2 + I/Id^2 + I/Im^2} \qquad \text{(Eq. 7.1.3-3)}$$

where:

I/Iv = I/I Converter Setting Tolerance
I/Id = I/I Converter Drift
I/Im = I/I Converter M&TE error

7.1.3.4 Indicator As-Found Tolerance (IAF)

The acceptable As-Found Tolerance for the indicator is calculated by the following equation:

$$IAF = \pm \sqrt{Iv^2 + Id^2 + Im^2} \qquad \text{(Eq. 7.1.3-4)}$$

where:

- Iv = Indicator Setting Tolerance
- Id = Indicator Drift
- Im = Indicator M&TE error

7.1.3.5 PPCS As-Found Tolerance (PPCSAF)

The acceptable As-Found Tolerance for the PPCS is calculated by the following equation:

$$PPCSAF = \pm \sqrt{PPCSv^2 + PPCSd^2 + PPCSm^2} \qquad \text{(Eq. 7.1.3-5)}$$

where:

- PPCSv = PPCS Setting Tolerance
- PPCSd = PPCS Drift
- PPCSm = PPCS M&TE error

7.1.4 As-Left Tolerance Equation Summary

Per Section 3.3.8.6 of Reference G.1, the As-Left Tolerances are calculated independently for both the rack and the sensor.

7.1.4.1 Sensor As-Left Tolerance (SAL)

The As-Left Tolerance for the Sensor is equal to the setting tolerance:

$$SAL = \pm Sv \qquad \text{(Eq. 7.1.4-1)}$$

Where:

Sv = Sensor Setting Tolerance

7.1.4.2 Bistable As-Left Tolerance (BAL)

The As-Left Tolerance for the Bistable is equal to the setting tolerance:

$$BAL = \pm Bv \qquad \text{(Eq. 7.1.4-2)}$$

Where:

Bv = Bistable Setting Tolerance

7.1.4.3 Current-to-Current Converter As-Left Tolerance (I/IAL)

The As-Left Tolerance for the I/I Converter is equal to its setting tolerance:

$$I/IAL = \pm I/Iv \qquad \text{(Eq. 7.1.4-3)}$$

Where:

I/Iv = I/I Converter Setting Tolerance

7.1.4.4 Indicator As-Left Tolerance (IAL)

The As-Left Tolerance for the Indicator is equal to its setting tolerance:

$$IAL = \pm Iv \qquad \text{(Eq. 7.1.4-4)}$$

Where:

Iv = Indicator Setting Tolerance

7.1.4.5 PPCS As-Left Tolerance (PPCSAL)

The As-Left Tolerance for the PPCS is equal to its setting tolerance:

$$PPCSAL = \pm PPCSv \qquad \text{(Eq. 7.1.4-5)}$$

Where:

PPCSv = PPCS Setting Tolerance

7.1.5 Channel Check Tolerance (CCT) Equation Summary

Per Reference G.1, the channel check tolerance (CCT) represents the maximum expected deviation between channel indications that monitor the same plant process parameter. The CCT is determined for instrument loops that require a qualitative assessment of channel behavior during operation. This assessment involves an observed comparison of the channel indication/status.

Per Ref. G.1, Section 3.3.8.7, the CCT is determined by combining the reference accuracy (a), setting tolerance (v), drift (d), and readability (rea) of each device, including the sensor, in the indication loop. A channel check involves a comparison of two indications independent of the number of redundant loops. The channel check tolerance is the combination of these uncertainties for each indication loop, ind_a and ind_b (in % span) using the SRSS method shown below:

$$CCT = \pm\sqrt{\begin{aligned}&(Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2 + Sv^2 + I/Iv^2\\ &+ Iv^2 + Irea^2)_{ind\,a} + (Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2\\ &+ Sv^2 + I/Iv^2 + Iv^2 + Irea^2)_{ind\,b}\end{aligned}} \qquad \text{(Eq. 7.1.5-1)}$$

7.1.6 Limiting Trip Setpoint (LTSP) Equation Summary

Per Section 3.3.8.4 of Reference G.1, when a setpoint is approached from one direction and the uncertainties are normally distributed, a reduction factor of 1.645/1.96 = 0.839 may be applied to a 95/95 confidence/probability TLE. Therefore, for a process increasing toward the analytical limit, the calculated Limiting Trip Setpoint is as follows:

$$LTSP\uparrow = AL - (0.839) * TLE \qquad \text{(Eq. 7.1.6-1)}$$

For a process decreasing from normal operation toward the analytical limit, the calculated Limiting Trip Setpoint is determined as follows:

$$LTSP\downarrow = AL + (0.839) * TLE \qquad \text{(Eq. 7.1.6-2)}$$

7.1.7 Operability Limit (OL) Equation Summary

Per Section 3.3.8.2 of Reference G.45, the Operability Limit (OL) is defined as a calculated limiting value that the As-Found bistable setpoint is allowed to have during a Technical Specification surveillance Channel Operational Test (COT), beyond which the instrument channel is considered inoperable and corrective action must be taken. Two OLs are calculated, one on each side of the FTSP as-left tolerance band, based on a calculated 3-sigma (3σ) drift value. A channel found drifting beyond its 3σ drift value is considered to be operating abnormally.

Per Section 3.3.8.4 of Reference G.45, the OL on each side of the FTSP is calculated as follows:

$$OL^{+} = FTSP + [BAL^{2} + Rd_{3\sigma}^{2}]^{1/2} \qquad \text{(Eq. 7.1.7-1)}$$

$$OL^{-} = FTSP - [BAL^{2} + Rd_{3\sigma}^{2}]^{1/2} \qquad \text{(Eq. 7.1.7-2)}$$

Where:

the FTSP is expressed in percent of span
OL^{+} is the Operability Limit above the FTSP
OL^{-} is the Operability Limit below the FTSP
BAL is the rack as-left tolerance (typically the bistable tolerance)
$Rd_{3\sigma}$ is the 3σ rack drift value determined as follows:

$$Rd_{3\sigma} = (1.5)\, Rd_{2\sigma} \qquad \text{(Eq. 7.1.7-3)}$$

The rack drift value ($Rd_{2\sigma}$) is the 2-sigma drift value for components checked during the COT, typically the bistable drift.

7.1.8 Scaling

Per Reference G.35, for an instrument with a linear input and output relationship, the output signal can be determined as follows:

$$y - y_1 = m * (x - x_1) \qquad \text{(Eq. 7.1.8-1)}$$

$$m = (y_2 - y_1) / (x_2 - x_1) \qquad \text{(Eq. 7.1.8-2)}$$

$$y = m * (x - x_1) + y_1 \qquad \text{(Eq. 7.1.8-3)}$$

Where:

- x = Process value variable, a known input (psig)
- x_1 = Process value variable, at 0 % span (psig)
- x_2 = Process value variable, at 100 % span (psig)
- y = Analog value variable, an unknown output (mAdc)
- y_1 = Analog value at 0 % span (mAdc)
- y_2 = Analog value at 100 % span (mAdc)
- m = Slope, or gain of the function, scale factor

7.1.9 Parametric Values

The parametric values are limits for process parameters to validate current limits in operator logs to ensure Tech Spec operating limits are not violated. The parametric values are calculated as follows:

$$\text{Parametric Values} = \pm\,(\text{Tech Spec Limits} - TLE_{IND\text{-}NORM}) \qquad \text{(Eq. 7.1.9-1)}$$

Where:

$TLE_{IND\text{-}NORM}$ =The 75/75 value of the Total Loop Error for the indicator loop and/or PPCS loop as required in the Operator Daily Logsheet

7.2 Drift Considerations

The drift values established in References C.1, C.2 and C.3 will be utilized for the transmitters, bistables and indicators.

Use of the aforementioned drift value (as design input to this calculation) is based on justification provided by Engineering Evaluation 2005-0006 (Ref. C.4). This evaluation reviews the station's M&TE and M&TE control programs, based on requirements imposed by the methodology used to prepare instrument setpoint and uncertainty calculations for the station (Ref. G.1). The evaluation concludes that the station's M&TE and M&TE control programs have remained equivalent or improved since the drift calculations were initially prepared, and therefore, renders the drift calculations acceptable for use in current (present-day) calculation revisions performed for the station.

8.0 BODY OF CALCULATION

8.1 Determination of Process Error (PE)

The Low Range Containment Pressure transmitters monitor the containment pressure. There are no known physical or process conditions that would introduce errors into the measurement.

The transmitters are physically located in the Auxiliary Building (see Section 6.4.1). According to FSAR Section 9.5.2 (Ref. G.24), the Auxiliary Building Ventilation System is balanced to maintain the Auxiliary Building at a slightly negative pressure with respect to outside pressure and adjacent building pressure. This pressure gradient is typically less than 1 inwc. As compared to other errors, this error is small and considered negligible. Therefore,

$$\mathbf{PE_n} = \pm\ \mathbf{0.000\ \%\ span}$$

As stated in Section 6.4.1, the transmitters do not experience environmental effects from postulated accidents (LOCA and HELB). Therefore,

$$\mathbf{PE_a} = \pm\ \mathbf{0.000\ \%\ span}$$

8.2 Device Uncertainty Analysis

This section will introduce all applicable uncertainties for the devices that comprise the Low Range Containment Pressure Instrument Loop shown in Figure 6.2-1.

From Section 3.3.4.3 of Reference G.1, the drift values calculated from As-Found/As-Left instrument calibration data normally include the error effects under normal conditions of drift, accuracy, power supply, plant vibration, calibration temperature, normal radiation, normal humidity, M&TE used for calibration, and instrument readability. If it is determined that the calibration conditions are indicative of the normal operating conditions, the environmental effects need not be included separately. All device uncertainty terms are considered random and independent unless otherwise noted.

From References P.1 through P.4 and P.13 through P.18, the instruments in the Low Range Containment Pressure Loops are calibrated separately.

8.2.1 Sensor Accuracy (Sa)

Reference C.1 has determined the historical drift values for the Low Range Containment Pressure Transmitters. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Sensor Accuracy of the transmitter is included in the instrument drift value. Therefore,

$$\mathbf{Sa} = \pm\ \mathbf{0.000\ \%\ span}$$

8.2.2 Sensor Drift (Sd)

Ref. C.1 has determined the historical drift values for the Low Range Containment Pressure Transmitters. Per SR 3.3.2.8 of Technical Specifications

(Ref. G.14) the channel calibration is performed every 22.5 months (18 months plus a 25% allowance). Per Table 8.1 of Reference C.1, the 95% probability/95% confidence Sensor Drift value (the two-year value is conservatively used) is given as ± 0.518 % span with no bias. Therefore,

Sd = ± 0.518 % span (95/95)

Bias = ± 0.000 % span

8.2.3 Sensor M&TE (Sm)

Ref. C.1 has determined the historical drift values for the Low Range Containment Pressure Transmitters. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Sensor M&TE effects of the transmitter is included in the instrument drift value. Therefore,

Sm = ± 0.000 % span

8.2.4 Sensor Setting Tolerance (Sv)

Per References P.3 and P.4, and Assumption 5.1.8, the sensor setting tolerance is ± 0.20 mAdc, and the calibrated span is 40 mAdc. Therefore,

Sv = (sensor setting tolerance/calibrated span) * 100%
Sv = (± 0.20 mAdc/40 mAdc) * 100%

Sv = ± 0.500 % span (95/95)

8.2.5 Sensor Power Supply Effect (Sp)

Reference C.1 has determined the historical drift values for the Low Range Containment Pressure Transmitters. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Sensor Power Supply Effect of the transmitter is included in the instrument drift value. Therefore,

Sp = ± 0.000 % span

8.2.6 Sensor Temperature Effect (St_n)

From Table 6.3-1, the Low Range Containment Pressure transmitters are Foxboro Model N-E11GM-HIB1-BEL/AEL. Per Reference V.1, the upper span limit of these transmitters is 200 psig. Per References P.3 and P.4, the calibrated span is 60 psig, which is 30% of the upper span limit.

Per Section 6.4.1, the transmitters are evaluated for two different environmental conditions: 65 °F to 104 °F and 65 °F to 120 °F. Reference V.2 specifies a zero shift span error of ± 2.5 % per 100 °F for a calibrated span between 20% and 50% of max span (or upper span limit). Reference V.2 also specifies a span error of ± 1.25 % per 100 °F. These errors are combined using the SRSS method per Reference G.1.

Zero Shift error (St_{-ZERO}) at normal conditions (65 to 104 °F)

St_{-ZERO} = ± (2.5 % span/100 °F) * (104 – 65 °F)
St_{-ZERO} = ± 0.975 % span

Span Shift error (St_{-SPAN}) at normal conditions (65 to 104 °F)

St_{-SPAN} = ± (1.25 % span/100 °F) * (104 – 65 °F)
St_{-SPAN} = ± 0.488 % span

Sensor Temperature Effect at normal conditions (65 to 104 °F) (St_{n1})

$St_{n1} = \pm [(St_{-ZERO})^2 + (St_{-SPAN})^2]^{1/2}$
$St_{n1} = \pm [(0.975 \text{ \% span})^2 + (0.488 \text{ \% span})^2]^{1/2}$

St_{n1} = ± 1.090 % span **(95/95)**

Zero Shift error (St_{-ZERO}) at normal conditions (65 to 120 °F)

St_{-ZERO} = ± (2.5 % span/100 °F) * (120 – 65 °F)
St_{-ZERO} = ± 1.375 % span

Span Shift error (St_{-SPAN}) at normal conditions (65 to 120 °F)

St_{-SPAN} = ± (1.25 % span/100 °F) * (120 – 65 °F)
St_{-SPAN} = ± 0.688 % span

Sensor Temperature Effect at normal conditions (65 to 120 °F) (St_{n2})

$St_{n2} = \pm [(St_{-ZERO})^2 + (St_{-SPAN})^2]^{1/2}$
$St_{n2} = \pm [(1.375 \text{ \% span})^2 + (0.688 \text{ \% span})^2]^{1/2}$

St_{n2} = ± 1.538 % span **(95/95)**

The highest temperature the instruments would experience for the EOP input function during postulated accidents (LOCA and HELB) is 120 °F (Section 6.4.1). Therefore,

St_{n2} = ± 1.538 % span **(95/95)**

The highest temperature the transmitters would experience for the trip functions (SI, Condensate Isolation, Containment Spray) required during postulated accidents is 104 °F (Section 6.4.1). Therefore,

St_{n1} = ± 1.090 % span **(95/95)**

8.2.7 Sensor Humidity Effect (Sh_n and Sh_a)

Per Section 3.3.3.20 of Reference G.1, changes in ambient humidity have a negligible effect on the uncertainty of the instruments used in this calculation. Therefore,

Sh_n = ± 0.000 % span

Sh_a = ± 0.000 % span

8.2.8 Sensor Radiation Effect (Sr_n and Sr_a)

Reference C.1 has determined the historical drift values for the Low Range Containment Pressure Transmitters. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the normal Sensor Radiation Effect of the transmitter is included in the instrument drift value. Therefore,

$$\mathbf{Sr_n = \pm\ 0.000\ \%\ span}$$

The transmitters are located in areas of the Auxiliary Building that may experience high radiation with coolant recirculation during a LOCA event (Section 6.4.1). For Containment High Pressure Safety Injection, Condensate Isolation, and High-High Pressure Containment Spray initiation setpoints, the elevated radiation effects are not applicable (Assumptions 5.1.11 and 5.1.12). This effect is also not applicable to the EOP total loop error (TLE) under normal environment conditions. Therefore,

$$\mathbf{Sr_{a1} = \pm\ 0.000\ \%\ span}$$

Per References V.1 and V.2, the accident radiation effect of the transmitter with a calibrated span less than the upper span limit is ± 6.0 % span. This effect is applicable to the EOP total loop error (TLE) under accident environment (recirculation) conditions. Therefore,

$$\mathbf{Sr_{a2} = \pm\ 6.000\ \%\ span}$$

8.2.9 Sensor Seismic Effect (Ss_n and Ss_a)

Reference C.1 has determined the historical drift values for the Low Range Containment Pressure Transmitters. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the effect of normal vibration is included in the instrument drift value. Therefore,

$$\mathbf{Ss_n = \pm\ 0.000\ \%\ span}$$

Containment Pressure is not a trip variable included in Table 7.1-1, and hence, seismic effects are not considered for the trip function. Per Section 7.1.E, seismic effects are also not considered for EOP inputs. Furthermore, per Section 3.3.3.10 of Reference G.1, it is assumed that instrumentation will be recalibrated prior to any subsequent accident, thus negating any permanent shift that may have occurred due to the seismic event. Therefore,

$$\mathbf{Ss_a = \pm\ 0.000\ \%\ span}$$

8.2.10 Sensor Static Pressure Effect ($Sspe_n$ and $Sspe_a$)

Per Reference G.1, Section 3.3.4.11, static pressure effects due to changes in process pressure only apply to differential pressure instruments in direct contact with the process. Therefore,

$Sspe_n$ = ± 0.000 % span

$Sspe_a$ = ± 0.000 % span

8.2.11 Sensor Overpressure Effect ($Sope_n$ and $Sope_a$)

The Low Range Containment transmitters are rated for a maximum over-range pressure of 350 psig (Ref. V.1), which is well above the containment design pressure (accident) of 60 psig (Ref. G.39). Therefore, the sensor overpressure effect is considered negligible.

$Sope_n$ = ± 0.000 % span

$Sope_a$ = ± 0.000 % span

8.2.12 Bistable Accuracy (Ba)

Reference C.2 has determined the historical drift values for Foxboro Model 63U-BC bistables. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Accuracy of the bistable is included in the instrument drift value. Therefore,

Ba = ± 0.000 % span

8.2.13 Bistable Drift (Bd)

Reference C.2 has determined the historical drift values for Foxboro Model 63U-BC bistables. Per References P.13 through P.18, the containment pressure bistables are calibrated every 92 days or quarterly. Per Table 8.2 of Reference C.2, the quarterly 95% probability/95% confidence Bistable Drift value is ±0.212 % span with no bias. Therefore,

Bd = ± 0.212% span

Bias = ± 0.000 % span

8.2.14 Bistable M&TE Effect (Bm)

Reference C.2 has determined the historical drift values for Foxboro Model 63U-BC bistables. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the M&TE Effect of the bistable is included in the instrument drift value. Therefore,

Bm = ± 0.000 % span

8.2.15 Bistable Setting Tolerance (Bv)

Per References P.13 through P.18, the bistable setting tolerance is +0/- 0.002 VDC and the calibrated span is 0.4 VDC. Per Assumption 5.1.8, this value is a symmetrical ± 0.002 Vdc ((Note, the signal is in Vdc due to a 10 Ω resistor connected across the calibration point per Ref. D.12 through D.17). Therefore,

Bv = (bistable setting tolerance/calibrated span) * 100%
Bv = (± 0.002 VDC/0.4 VDC) * 100%
Bv = ± 0.500 % span

Per Assumption 5.1.8, the existing setting tolerance is reduced by 0.25 % span. Therefore,

Bv = ± (0.500 % span – 0.250 % span)

Bv = ± 0.250 % span

8.2.16 Bistable Power Supply Effect (Bp)

Reference C.2 has determined the historical drift values for Foxboro Model 63U-BC bistables. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Power Supply Effect of the bistable is included in the instrument drift value. Therefore,

Bp = ± 0.000 % span

8.2.17 Bistable Temperature Effect (Bt)

Per Section 6.4.2, the bistables are rack components located in the Control Room, which has a worst-case ambient temperature between 65 °F and 120 °F. From vendor information (Ref. V.3), the bistables have a normal operating range of +40°F to +120 °F with no associated temperature effect. Therefore,

Bt = ± 0.000 % span

8.2.18 Bistable Humidity Effect (Bh)

Per Section 3.3.3.20 of Reference G.1, changes in ambient humidity have a negligible effect on the uncertainty of the instruments used in this calculation. Therefore,

Bh = ± 0.000 % span

8.2.19 Bistable Radiation Effect (Br)

Per Section 6.4.2, the bistables are rack components located in the Computer Room, which is a radiologically mild environment. Reference C.2 has determined the historical drift values for Foxboro Model 63U-BC bistables. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Radiation Effect of the bistable is included in the instrument drift value. Therefore,

Br = ± 0.000 % span

8.2.20 Bistable Seismic Effect (Bs)

There is no seismic effect provided by the vendor for the bistables (Ref. V.3). Per Section 3.3.4.10 of Reference G.1, the effects of seismic or vibration events for non-mechanical instrumentation are considered zero unless vendor or industry experience indicates otherwise. Therefore,

Bs = ± 0.000 % span

8.2.21 Current-to-Current Converter Accuracy (I/Ia)

Per Reference V.5, the accuracy of the I/I Converter is ± 0.5 % span. Therefore,

I/Ia = ± 0.500 % span

8.2.22 Current-to-Current Converter Drift (I/Id)

Reference V.5 does not provide a drift specification for the I/I Converter. Per Section 3.3.3.15 of Reference G.1, when drift is not specified by the vendor, the accuracy of the component is used as the drift for the entire calibration period. Therefore,

I/Id = ± 0.500 % span

8.2.23 Current-to-Current Converter M&TE Effect (I/Im)

Per References P.1 and P.2, the I/I Converters are calibrated using a multimeter appropriate for 0.1-0.5 Vdc at the Converter input (a 10 Ω dropping resistor is connected at the input test point per Ref. D.12 through D.17), and a multimeter appropriate for 10-50 mAdc at the output. The M&TE effect is due to the multimeters used at the I/I Converter input and output. According to calibration procedure ICI 12 (Ref. P.19), the following M&TE are capable of performing this measurement.

<u>Fluke 45, fast rate (5 digit display, 100 mAdc range) - Output</u>

RA_{mte} = uncertainty * calibrated span
RA_{mte} = ± 0.05% reading * 50 mAdc
RA_{mte} = ± 0.025 mAdc
RA_{std} = 0
RD_{mte} = ± 3 DGTS * 0.001 mAdc
RD_{mte} = ± 0.003 mAdc

From Section 3.3.4.4 of Reference G.1, M&TE uncertainty is calculated using the following equation:

$$m = \pm\sqrt{RA^2{}_{mte} + RA^2{}_{std} + RD^2{}_{mte}}$$

$$m_{45} = \pm\sqrt{0.025^2 + 0^2 + 0.003^2} = \pm 0.025 \text{ mAdc}$$

HP 34401A multimeter (6.5 digit display, 100 mAdc range) (Ref. V.11) - Output:

RA_{mte} = ± (0.050 % reading + 0.005 % range)
RA_{mte} = ± [0.050 % (50 mAdc) + 0.005 % (100 mAdc)]
RA_{mte} = ± 0.030 mAdc
RA_{std} = 0
RD_{mte} = ± 0.0001 mAdc

From Section 3.3.4.4 of Reference G.1, M&TE uncertainty is calculated using the following equation:

$$m = \pm\sqrt{RA^2{}_{mte} + RA^2{}_{std} + RD^2{}_{mte}}$$

$$m_{HP} = \pm\sqrt{0.030^2 + 0^2 + 0.0001^2} = \pm 0.030 \text{ mAdc}$$

The uncertainty of HP 34401A (m_{HP} = ± 0.030 mAdc) is used as the bounding output M&TE because it is the less accurate of the two M&TE.

Converting to % span,

m_{HP} = ± (0.030 mAdc / 40 mAdc) * 100 % span

m_{HP} = ± 0.075 % span

HP 34401A multimeter (6.5 digit display, 1.0 Vdc range) (Ref. V.11) – Input

RA_{mte} = ± (0.0040 % reading + 0.0007 % range)
RA_{mte} = ± [0.0040 % (0.5 Vdc) + 0.0007 % (1.0 Vdc)]
RA_{mte} = ± 0.000027 Vdc
RA_{std} = 0
RD_{mte} = ± 0.000001 Vdc

From Section 3.3.4.4 of Reference G.1, M&TE uncertainty is calculated using the following equation:

$$m = \pm\sqrt{RA^2{}_{mte} + RA^2{}_{std} + RD^2{}_{mte}}$$

$$m_{HP} = \pm\sqrt{0.000027^2 + 0^2 + 0.000001^2} = \pm 0.000027 \text{ Vdc}$$

Fluke 45 multimeter (5 digit display, 3.0 Vdc range) – Input

RA_{mte} = uncertainty * max reading
RA_{mte} = ± 0.025% reading * 0.5 Vdc
RA_{mte} = ± 0.000125 Vdc
RA_{std} = 0
RD_{mte} = ± 2 DGTS * 0.0001 Vdc
RD_{mte} = ± 0.0002 Vdc

From Section 3.3.4.4 of Reference G.1, M&TE uncertainty is calculated using the following equation:

$$m = \pm\sqrt{RA^2{}_{mte} + RA^2{}_{std} + RD^2{}_{mte}}$$

$$m_{45} = \pm\sqrt{0.000125^2 + 0^2 + 0.0002^2} = \pm 0.000236\,\text{Vdc}$$

<u>Fluke 8842A multimeter (6.5 digit display, 2.0 Vdc range) – Input</u>

RA_{mte}	= uncertainty * max reading
RA_{mte}	= ± 0.003% reading * 0.5 Vdc
RA_{mte}	= ± 0.000015 Vdc
RA_{std}	= 0
RD_{mte}	= ± 2 DGTS * 0.00001 Vdc
RD_{mte}	= ± 0.00002 Vdc

From Section 3.3.4.4 of Reference G.1, M&TE uncertainty is calculated using the following equation:

$$m = \pm\sqrt{RA^2{}_{mte} + RA^2{}_{std} + RD^2{}_{mte}}$$

$$m_{8842} = \pm\sqrt{0.000015^2 + 0^2 + 0.00002^2} = \pm 0.000025\,\text{Vdc}$$

The uncertainty of Fluke 45 (m_{45} = ± 0.000236 Vdc) is used as the bounding input M&TE because it is the less accurate of the two M&TE.

Converting to % span,

m_{45} = ± (0.000236 Vdc / 0.4 Vdc) * 100 % span

m_{45} = ± 0.059 % span

The total M&TE uncertainty for the calibration of the I/I Converter is calculated using the multiple M&TE equation given in Section 3.3.4.4 of Reference G.1:

$$M = \pm\sqrt{m_1{}^2 + m_2{}^2 + \ldots. m_n{}^2}$$

$$I/Im = \pm\sqrt{m_{45}{}^2 + m_{HP}{}^2}$$

$$I/Im = \pm\sqrt{0.059^2 + 0.075^2}$$

I/Im = ± 0.095 % span

8.2.24 Current-to-Current Converter Setting Tolerance (I/Iv)

Per References P.1 and P.2, and Assumption 5.1.8, the setting tolerance of the I/I Converter is ± 0.2 mAdc, and the calibrated span is 40 mAdc. Therefore,

I/Iv = ± (setting tolerance / calibrated span) * 100%
I/Iv = ± (0.2 mAdc / 40 mAdc) * 100%
I/Iv = ± 0.500 % span

Per Assumption 5.1.8, the existing setting tolerance is reduced by 0.25 % span. Therefore,

I/Iv = ± (0.500 % span – 0.250 % span)

I/Iv = ± 0.250 % span

8.2.25 Current-to-Current Converter Power Supply Effect (I/Ip)

From Reference G.8, the I/I Converter has been shown to experience a random power supply effect caused by the non-regulated portion of the internal 50-volt power supply. This primarily affects only the I/I converters or isolators. Therefore, per Assumption 5.1.5,

I/Ip = ± 1.000 % span

8.2.26 Current-to-Current Converter Temperature Effect (I/It)

Per Section 6.4.2, the I/I Converter is located in the Computer Room, which has a worst-case ambient temperature range of 65 °F to 120 °F. From vendor information (Ref. V.5), the I/I Converter has a normal operating range of +40°F to +120 °F with no associated temperature effect. Therefore, the temperature effect is considered negligible.

I/It = ± 0.000 % span

8.2.27 Current-to-Current Converter Humidity Effect (I/Ih)

Per Section 3.3.3.20 of Reference G.1, changes in ambient humidity have a negligible effect on the uncertainty of the instruments used in this calculation. Therefore,

I/Ih = ± 0.000 % span

8.2.28 Current-to-Current Converter Radiation Effect (I/Ir)

As stated in Section 6.4.2, the I/I Converter is located in the Computer Room, which has a mild radiological environment under all plant conditions. Per Section 3.3.3.21 of Reference G.1, radiation errors are considered to be included in the drift error. Therefore,

I/Ir = ± 0.000 % span

8.2.29 Current-to-Current Converter Seismic Effect (I/Is)

There is no seismic effect provided by the vendor for the I/I Converter (Ref. V.5). Per Section 3.3.4.10 of Reference G.1, the effects of seismic or vibration events for non-mechanical instrumentation are considered zero unless vendor or industry experience indicates otherwise. Therefore,

I/Is = ± 0.000 % span

8.2.30 Indicator Accuracy (Ia)

Reference C.3 has determined the historical drift values for the indicator. Per Ref. G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Accuracy of the indicator is included in the drift value. Therefore,

Ia = ± 0.000 % span

8.2.31 Indicator Drift (Id)

Per References P.1 and P.2, the Low Range Pressure Indicators are Westinghouse HX-252 switchboard indicators. Reference C.3 is the As-Found/As-Left drift analysis for Westinghouse HX-252 indicators. Although the drift analysis performed in Reference C.3 does not include the As-Found/As-Left data for the Low Containment Pressure indicators, the 95%/95% drift value calculated therein is considered representative of the Westinghouse HX-252 indicators experienced at PBNP, and therefore, is used to represent the drift of the Low Containment Pressure indicators. Since the Low Containment Pressure indicators are calibrated every 18 months (Ref. P.1 and P.2), the 100%, 2-year 95%/95% drift value of ± 1.028 % span with no bias from Table 8.2 of Reference C.3 is conservatively used. Therefore,

Id = ± 1.028 % span

Bias = ± 0.000 % span

8.2.32 Indicator M&TE Effect (Im)

Reference C.3 has determined the historical drift values for the indicator. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the M&TE Effect of the indicator is included in the drift value. Therefore,

Im = ± 0.000 % span

8.2.33 Indicator Setting Tolerance (Iv)

Per References P.1 and P.2, and Assumption 5.1.8, the setting tolerance is ± 0.8 mA, and the calibrated span is 40 mA. Therefore,

Iv = ± (setting tolerance / calibrated span) * 100%

Iv = ± (0.8 mA / 40 mA) * 100%
Iv = ± 2.000 % span

Per Assumption 5.1.8, the existing setting tolerance is reduced by 0.25 % span. Therefore,

Iv = ± (2.000 % span – 0.250 % span)

Iv = ± 1.750 % span

8.2.34 Indicator Power Supply Effect (Ip)

Reference C.3 has determined the historical drift values for the indicator. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Power Supply Effect of the indicator is included in the drift value. Therefore,

Ip = ± 0.000 % span

8.2.35 Indicator Temperature Effect (It)

Per Section 6.4.2, the indicators are located in the Control Room, which has a worst-case ambient temperature between 65 °F to 120 °F. From vendor information (Ref. V.4), the indicators have a normal operating range of +40°F to +120 °F. Per Reference G.37, the temperature effect is included in the drift value. Therefore,

It = ± 0.000 % span

8.2.36 Indicator Humidity Effect (Ih)

Per Section 3.3.3.20 of Reference G.1, changes in ambient humidity have a negligible effect on the uncertainty of the instruments used in this calculation. Therefore,

Ih = ± 0.000 % span

8.2.37 Indicator Radiation Effect (Ir)

Per Section 6.4.2, the indicators are located in the Control Room, which is a radiologically mild environment. Reference C.3 has determined the historical drift values for the indicator. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Radiation Effect of the indicator is included in the drift value. Therefore,

Ir = ± 0.000 % span

8.2.38 Indicator Seismic Effect (Is)

There is no seismic effect provided by the vendor for the indicators (Ref. V.4). Vendor information also shows that the indicators are seismically qualified with no additional seismic effect specified. Therefore,

Is = ± 0.000 % span

8.2.39 Indicator Readability Effect (Irea)

Reference C.3 has determined the historical drift values for the indicator. Per Reference G.1, when drift error values have been statistically derived from As-Found/As-Left calibration data, the Readability Effect of the indicator is included in the drift value. Therefore,

Irea = ± 0.000 % span

8.2.40 PPCS Accuracy (PPCSa)

Per Assumption 5.1.7, the PPCS accuracy is ± 0.510% span. Therefore,

PPCSa = ± 0.510% span

8.2.41 PPCS Drift (PPCSd)

Per Assumption 5.1.7, the drift for the PPCS is included in the accuracy term. Therefore,

PPCSd = ± 0.000% span

8.2.42 PPCS M&TE Effect (PPCSm)

Per References P.1 and P.2, the Low Range Containment Pressure PPCS display is calibrated using a multimeter appropriate for 10-50 mAdc at the PPCS input and reading the PPCS display at the output (the readability effect is accounted for in Section 8.2.49). The M&TE effect is due to the multimeter used at the PPCS input. According to calibration procedure ICI 12 (Ref. P.19), the following M&TE are capable of performing this measurement.

Fluke 45 multimeter (fast resolution, 5 digit display, 100 mAdc range):

RA_{mte} = uncertainty * max reading
RA_{mte} = ±0.05% reading * 50 mAdc
RA_{mte} = ±0.025 mAdc
RA_{std} = 0
RD_{mte} = ± 3 DGTS * 0.001 mAdc
RD_{mte} = ± 0.003 mAdc

From Section 3.3.4.4 of Reference G.1, M&TE uncertainty is calculated using the following equation:

$$m = \pm\sqrt{RA^2{}_{mte} + RA^2{}_{std} + RD^2{}_{mte}}$$

$$m_{45} = \pm\sqrt{0.025^2 + 0^2 + 0.003^2} \quad \pm 0.025 \text{ mAdc}$$

HP 34401A multimeter (6.5 digit display, 100 mAdc range) (Ref. V.11)

RA_{mte} = ± (0.050 % reading + 0.005 % range)
RA_{mte} = ± [0.050 % (50 mAdc) + 0.005 % (100 mAdc)]
RA_{mte} = ± 0.030 mAdc
RA_{std} = 0
RD_{mte} = ± 0.0001 mAdc

From Section 3.3.4.4 of Reference G.1, M&TE uncertainty is calculated using the following equation:

$$m = \pm\sqrt{RA^2{}_{mte} + RA^2{}_{std} + RD^2{}_{mte}}$$

$$m_{HP} = \pm\sqrt{0.030^2 + 0^2 + 0.0001^2} = \pm 0.030 \text{ mAdc}$$

The uncertainty of HP 34401A (m_{HP} = ± 0.030 mAdc) is used as the bounding input M&TE because it is the less accurate of the two M&TE.

Converting to % span,

m_{HP} = ± (0.030 mAdc / 40 mAdc) * 100 % span

m_{HP} = ± 0.075 % span

Therefore, the M&TE uncertainty for the calibration of the PPCS is:

PPCSm = ± 0.075 % span

8.2.43 PPCS Setting Tolerance (PPCSv)

Per Reference P.1 and P.2, and Assumption 5.1.8, the setting tolerance is ± 0.3 psig, and the calibrated span is 60 psig. Therefore,

PPCSv = ± (setting tolerance / calibrated span) * 100%
PPCSv = ± (0.3 psig / 60 psig) * 100% span

PPCSv = ± 0.500 % span

8.2.44 PPCS Power Supply Effect (PPCSp)

Per Assumption 5.1.7, the power supply effect for the PPCS is included in the accuracy term. Therefore,

PPCSp = ± 0.000 % span

8.2.45 PPCS Temperature Effect (PPCSt)

Per Assumption 5.1.7, the temperature effect for the PPCS is included in the accuracy term. Therefore,

PPCSt = ± 0.000 % span

8.2.46 PPCS Humidity Effect (PPCSh)

Per Assumption 5.1.7, the humidity effect for the PPCS is included in the accuracy term. Therefore,

PPCSh = ± 0.000 % span

8.2.47 PPCS Radiation Effect (PPCSr)

Per Assumption 5.1.7, the radiation effect for the PPCS is included in the accuracy term. Therefore,

PPCSr = ± 0.000 % span

8.2.48 PPCS Seismic Effect (PPCSs)

Per Assumption 5.1.7, the seismic effect for the PPCS is included in the accuracy term. Therefore,

PPCSs = ± 0.000 % span

8.2.49 PPCS Readability Effect (PPCSrea)

Per Reference P.1 and P.2, the PPCS display has 2 decimal places and the span is 60 psig. Per Reference G.1, Section 3.3.5.3, the readability error for a digital display is the least significant digit. Therefore,

PPCSrea = ± (reading error / calibrated span) * 100%
PPCSrea = ± (0.01 psig / 60 psig) * 100%

PPCSrea = ± 0.017 % span

8.3 Device Uncertainty Summary

8.3.1 Sensor Uncertainties

Parameter	Uncertainty (% span) (95/95) Normal Conditions	Accident Conditions	Reference Section
Sensor Accuracy (Sa)	± 0.000 % span	± 0.000 % span	8.2.1
Sensor Drift (Sd) (Bias)	± 0.518 % span ± 0.000 % span	± 0.518 % span ± 0.000 % span	8.2.2
Sensor M&TE Effect (Sm)	± 0.000 % span	± 0.000 % span	8.2.3
Sensor Setting Tolerance (Sv)	± 0.500 % span	± 0.500 % span	8.2.4
Sensor Power Supply Effect (Sp)	± 0.000 % span	± 0.000 % span	8.2.5
Sensor Temperature Effect (St)	± 1.090 % span (St_{n1}) ± 1.538 % span (St_{n2})	± 1.090 % span (St_{n1}) ± 1.538 % span(EOP)	8.2.6
Sensor Humidity Effect (Sh)	± 0.000 % span	± 0.000 % span	8.2.7
Sensor Radiation Effect (Sr)	± 0.000 % span	± 0.000 % span (Sr_a) ± 6.000 % span (Sr_{a2})	8.2.8
Sensor Seismic Effect (Ss)	± 0.000 % span	± 0.000 % span	8.2.9

Sensor Static Pressure Effect (Sspe))	± 0.000 % span	± 0.000 % span	8.2.10
Sensor Overpressure Effect (Sope)	± 0.000 % span	± 0.000 % span	8.2.11

8.3.2 Bistable Uncertainties

Parameter	Uncertainty (% span) (95/95) Normal Conditions	Uncertainty (% span) (95/95) Accident Conditions	Reference Section
Bistable Accuracy (Ba)	± 0.000 % span	± 0.000 % span	8.2.12
Bistable Drift (Bd) (Bias)	± 0.212 % span ± 0.000 % span	± 0.212 % span ± 0.000 % span	8.2.13
Bistable M&TE Effect (Bm)	± 0.000 % span	± 0.000 % span	8.2.14
Bistable Setting Tolerance (Bv)	± 0.250 % span	± 0.250 % span	8.2.15
Bistable Power Supply Effect (Bp)	± 0.000 % span	± 0.000 % span	8.2.16
Bistable Temperature Effect (Bt)	± 0.000 % span	± 0.000 % span	8.2.17
Bistable Humidity Effect (Bh)	± 0.000 % span	± 0.000 % span	8.2.18
Bistable Radiation Effect (Br)	± 0.000 % span	± 0.000 % span	8.2.19
Bistable Seismic Effect (Bs)	± 0.000 % span	± 0.000 % span	8.2.20

8.3.3 Current-to-Current Converter Uncertainties

Parameter	Uncertainty (% span) (95/95) Normal Conditions	Uncertainty (% span) (95/95) Accident Conditions	Reference Section
Current-to-Current Converter Accuracy (I/Ia)	± 0.500 % span	± 0.500 % span	8.2.21
Current-to-Current Converter Drift (I/Id)	± 0.500 % span	± 0.500 % span	8.2.22
Current-to-Current Converter M&TE Effect (I/Im)	± 0.095 % span	± 0.095 % span	8.2.23
Current-to-Current Converter Setting Tolerance (I/Iv)	± 0.250 % span	± 0.250 % span	8.2.24
Current-to-Current Converter Power Supply Effect (I/Ip)	± 1.000 % span	± 1.000 % span	8.2.25
Current-to-Current Converter Temperature Effect (I/It)	± 0.000 % span	± 0.000 % span	8.2.26
Current-to-Current Converter Humidity Effect (I/Ih)	± 0.000 % span	± 0.000 % span	8.2.27
Current-to-Current Converter Radiation Effect (I/Ir)	± 0.000 % span	± 0.000 % span	8.2.28
Current-to-Current Converter Seismic Effect (I/Is)	± 0.000 % span	± 0.000 % span	8.2.29

8.3.4 Indicator Uncertainties

Parameter	Uncertainty (% span) (95/95)		Reference Section
	Normal Conditions	Accident Conditions	
Indicator Accuracy (Ia)	± 0.000 % span	± 0.000 % span	8.2.30
Indicator Drift (Id) (Bias)	± 1.028 % span ± 0.000 % span	± 1.028 % span ± 0.000 % span	8.2.31
Indicator M&TE Effect (Im)	± 0.000 % span	± 0.000 % span	8.2.32
Indicator Setting Tolerance (Iv)	± 1.750 % span	± 1.750 % span	8.2.33
Indicator Power Supply Effect (Ip)	± 0.000 % span	± 0.000 % span	8.2.34
Indicator Temperature Effect (It)	± 0.000 % span	± 0.000 % span	8.2.35
Indicator Humidity Effect (Ih)	± 0.000 % span	± 0.000 % span	8.2.36
Indicator Radiation Effect (Ir)	± 0.000 % span	± 0.000 % span	8.2.37
Indicator Seismic Effect (Is)	± 0.000 % span	± 0.000 % span	8.2.38
Indicator Readability Effect (Irea)	± 0.000 % span	± 0.000 % span	8.2.39

8.3.5 PPCS Uncertainties

Parameter	Uncertainty (% span) (95/95)		Reference Section
	Normal Conditions	Accident Conditions	
PPCS Accuracy (PPCSa)	± 0.510 % span	± 0.510 % span	8.2.40
PPCS Drift (PPCSd)	± 0.000 % span	± 0.000 % span	8.2.41
PPCS M&TE Effect (PPCSm)	± 0.075 % span	± 0.075 % span	8.2.42
PPCS Setting Tolerance (PPCSv)	± 0.500 % span	± 0.500 % span	8.2.43
PPCS Power Supply Effect (PPCSp)	± 0.000 % span	± 0.000 % span	8.2.44
PPCS Temperature Effect (PPCSt)	± 0.000 % span	± 0.000 % span	8.2.45
PPCS Humidity Effect (PPCSh)	± 0.000 % span	± 0.000 % span	8.2.46
PPCS Radiation Effect (PPCSr)	± 0.000 % span	± 0.000 % span	8.2.47
PPCS Seismic Effect (PPCSs)	± 0.000 % span	± 0.000 % span	8.2.48
PPCS Readability Effect (PPCSrea)	± 0.017 % span	± 0.017 % span	8.2.49

8.3.6 Process Considerations

Parameter	Uncertainty (% span) (95/95) Normal Conditions	Accident Conditions	Reference Section
Process Error (PE)	± 0.000 % span	± 0.000 % span	8.1

8.4 Total Loop Errors

8.4.1 Total Trip Loop Error (TLE_{TRIP})

As stated in Section 7.1.1 of this calculation, Containment High and High-High Trip Setpoints are Category A functions and are combined into a 95/95 total loop error. Applicable uncertainties are listed in Section 8.2 and summarized in Section 8.3.

Using Equation 7.1.2-1, the Total Trip Loop Error (TLE_{TRIP}) for the Low Range Containment High Pressure SI / Condensate Isolation and High-High Pressure Containment Spray actuation is determined as follows:

$$TLE_{TRIP} = \pm\sqrt{\begin{aligned}&Sa^2 + Ba^2 + Sd^2 + Bd^2 + Sm^2 + Bm^2\\&+ Sv^2 + Bv^2 + Sp^2 + Bp^2 + St_{nl}{}^2 + Bt^2\\&+ Sh_a{}^2 + Bh^2 + Sr_a{}^2 + Br^2 + Ss_a{}^2 + Bs^2\\&+ Sspe_a{}^2 + Sope_a{}^2\end{aligned}} \pm PE_a \pm Bias$$

Substituting for the Total Trip Loop Error (TLE_{TRIP}) for Low Range Containment High Pressure SI / Condensate Isolation and High-High Pressure Containment Spray actuation:

$$TLE_{TRIP} = \pm\sqrt{\begin{aligned}&0^2 + 0^2 + 0.518^2 + 0.212^2 + 0^2 + 0^2\\&+ 0.500^2 + 0.250^2 + 0^2 + 0^2 + 1.090^2 + 0^2\\&+ 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2\end{aligned}} + 0 + 0$$

$$\mathbf{TLE_{TRIP} = \pm 1.347\ \%\ span} \qquad \mathbf{(95/95)}$$

Per References P.3 and P.4, the calibrated span in engineering units is 60 psi. Converting the Total Trip Loop Error (TLE_{TRIP}) for Low Range Containment High Pressure SI / Condensate Isolation and High-High Pressure Containment Spray actuation to process units gives,

$$TLE_{TRIP} = \pm (1.347\ \%\ span) * (60\ psi) / 100\%$$

$$\mathbf{TLE_{TRIP} = \pm 0.808\ psi} \qquad \mathbf{(95/95)}$$

8.4.2 Total Indicator Loop Error ($TLE_{IND\text{-}EOP}$) for EOP Input

As stated in Section 7.1.1 of this calculation, Low Range Containment Pressure control room indication for EOP operator action has both Category A and C functions and is combined into 95/95 and 75/75 total loop errors. Applicable uncertainties are listed in Section 8.2 and summarized in Section 8.3.

Using Equation 7.1.2-2b, the Total Loop Error for EOP Indication under normal environmental conditions ($TLE_{IND\text{-}EOP(normal)}$) is determined as follows:

$$TLE_{IND\text{-}EOP(normal)} = \pm \sqrt{\begin{array}{l} Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2 \\ + Sm^2 + I/Im^2 + Im^2 + Sv^2 + I/Iv^2 + Iv^2 \\ + Sp^2 + I/Ip^2 + Ip^2 + St_{n2}{}^2 + I/It^2 + It^2 \\ + Sh_n{}^2 + I/Ih^2 + Ih^2 + Sr_{a1}{}^2 + I/Ir^2 + Ir^2 \\ + Ss_n{}^2 + I/Is^2 + Is^2 + Sspe_n{}^2 + Sope_n{}^2 + Irea^2 \end{array}} \pm PE_n \pm Bias$$

Substituting for the Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP(normal)}$):

$$TLE_{IND\text{-}EOP(normal)} = \pm \sqrt{\begin{array}{l} 0^2 + 0.500^2 + 0^2 + 0.518^2 + 0.500^2 + 1.028^2 \\ + 0^2 + 0.095^2 + 0^2 + 0.500^2 + 0.250^2 + 1.750^2 \\ + 0^2 + 1.000^2 + 0^2 + 1.538^2 + 0^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 \end{array}} + 0 + 0$$

$TLE_{IND\text{-}EOP(normal)} = \pm$ 2.928 % span **(95/95)**

Per Reference P.3 and P.4, the calibrated span in engineering units is 60 psi. Converting the 95/95 Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP}$) to process units gives,

$TLE_{IND\text{-}EOP(normal)} = \pm$ (2.928 % span) * (60 psi) / 100%

$TLE_{IND\text{-}EOP(normal)} = \pm$ 1.757 psi **(95/95)**

Per Section 3.3.3.13 of Reference G.1, the Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP}$) is converted from 95/95 to 75/75 statistics as follows:

$TLE_{IND\text{-}EOP(normal)} = \pm$ 2.928 % span * (1.15/1.96)

$TLE_{IND\text{-}EOP(normal)} = \pm$ 1.718 % span **(75/75)**

Per Reference P.3 and P.4, the calibrated span in engineering units is 60 psi. Converting the 75/75 Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP}$) to process units gives,

$TLE_{IND\text{-}EOP(normal)} = \pm (1.718\ \%\ span) * (60\ psi) / 100\%$

$TLE_{IND\text{-}EOP(normal)} = \pm$ 1.031 psi **(75/75)**

Using Equation 7.1.2-2c, the Total Loop Error for EOP Indication under accident environmental conditions ($TLE_{IND\text{-}EOP(accident)}$) is determined as follows:

$$TLE_{IND\text{-}EOP(accident)} = \pm \sqrt{\begin{array}{l} Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2 \\ + Sm^2 + I/Im^2 + Im^2 + Sv^2 + I/Iv^2 + Iv^2 \\ + Sp^2 + I/Ip^2 + Ip^2 + St_{n2}{}^2 + I/It^2 + It^2 \\ + Sh_n{}^2 + I/Ih^2 + Ih^2 + Sr_{a2}{}^2 + I/Ir^2 + Ir^2 \\ + Ss_n{}^2 + I/Is^2 + Is^2 + Sspe_n{}^2 + Sope_n{}^2 + Irea^2 \end{array}} \pm PE_n \pm Bias$$

Substituting for the Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP(accident)}$):

$$TLE_{IND\text{-}EOP(accident)} = \pm \sqrt{\begin{array}{l} 0^2 + 0.500^2 + 0^2 + 0.518^2 + 0.500^2 + 1.028^2 \\ + 0^2 + 0.095^2 + 0^2 + 0.500^2 + 0.250^2 + 1.750^2 \\ + 0^2 + 1.000^2 + 0^2 + 1.538^2 + 0^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 6.000^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 \end{array}} + 0 + 0$$

$TLE_{IND\text{-}EOP(accident)} = \pm$ 6.676 % span **(95/95)**

Per Reference P.3 and P.4, the calibrated span in engineering units is 60 psi. Converting the 95/95 Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP}$) to process units gives,

$TLE_{IND\text{-}EOP(accident)} = \pm (6.676\ \%\ span) * (60\ psi) / 100\%$

$TLE_{IND\text{-}EOP(accident)} = \pm$ 4.006 psi **(95/95)**

Per Section 3.3.3.13 of Reference G.1, the Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP}$) is converted from 95/95 to 75/75 statistics as follows:

$TLE_{IND\text{-}EOP(accident)} = \pm 6.676\ \%\ span * (1.15/1.96)$

$TLE_{IND\text{-}EOP(accident)} = \pm$ 3.917 % span **(75/75)**

Per Reference P.3 and P.4, the calibrated span in engineering units is 60 psi. Converting the 75/75 Total Loop Error for EOP Indication ($TLE_{IND\text{-}EOP}$) to process units gives,

$TLE_{IND\text{-}EOP(accident)} = \pm (3.917\ \%\ span) * (60\ psi) / 100\%$

$$\mathbf{TLE_{IND\text{-}EOP(accident)} = \pm\ 2.350\ psi} \qquad \mathbf{(75/75)}$$

8.4.3 Total Normal Indicator Loop Error ($TLE_{IND\text{-}NORM}$)

As stated in Section 6.4 of this calculation, Low Range Containment Pressure control room indication is associated with a parametric value, classified as a Category B function, and is combined into a 75/75 total loop error. Applicable uncertainties are listed in Section 8.2 and summarized in Section 8.3.

Per Section 6.4, routine surveillance of the indicator loop associated with a parametric value is performed only during normal operating conditions. Using Equation 7.1.2-2a, the Total Normal Indicator Loop Error ($TLE_{IND\text{-}NORM}$) is determined as follows:

$$TLE_{IND\text{-}NORM} = \pm \sqrt{\begin{matrix} Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2 \\ + Sm^2 + I/Im^2 + Im^2 + Sv^2 + I/Iv^2 + Iv^2 \\ + Sp^2 + I/Ip^2 + Ip^2 + St_{n1}{}^2 + I/It^2 + It^2 \\ + Sh_n{}^2 + I/Ih^2 + Ih^2 + Sr_n{}^2 + I/Ir^2 + Ir^2 \\ + Ss_n{}^2 + I/Is^2 + Is^2 + Sspe_n{}^2 + Sope_n{}^2 + Irea^2 \end{matrix}} \pm PE_n \pm Bias$$

Substituting for the Total Normal Indicator Loop Error ($TLE_{IND\text{-}NORM}$):

$$TLE_{IND\text{-}NORM} = \pm \sqrt{\begin{matrix} 0^2 + 0.500^2 + 0^2 + 0.518^2 + 0.500^2 + 1.028^2 \\ + 0^2 + 0.095^2 + 0^2 + 0.500^2 + 0.250^2 + 1.750^2 \\ + 0^2 + 1.000^2 + 0^2 + 1.090^2 + 0^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 \end{matrix}} + 0 + 0$$

$$TLE_{IND\text{-}NORM} = \pm\ 2.720\ \%\ span \qquad (95/95)$$

Per Section 3.3.3.13 of Reference G.1, the Total Normal Indicator Loop Error ($TLE_{IND\text{-}NORM}$) is converted from 95/95 to 75/75 statistics as follows:

$$TLE_{IND\text{-}NORM} = \pm\ 2.720\ \%\ span * (1.15/1.96)$$

$$\mathbf{TLE_{IND\text{-}NORM} = \pm\ 1.596\ \%\ span} \qquad \mathbf{(75/75)}$$

Per Reference P.1 and P.2, the calibrated span in engineering units is 60 psi. Converting the 75/75 Total Normal Indicator Loop Error ($TLE_{IND\text{-}NORM}$) to process units gives,

$TLE_{IND\text{-}NORM}$ = ± (1.596 % span) * (60 psi) / 100%

$TLE_{IND\text{-}NORM}$ = ± 0.958 psi **(75/75)**

Per Reference G.36, the Control Room indication for Low Range Containment Pressure (PI-945, PI-947 and PI-949) has a minor division of 1 psi. Per Section 7.1, the $TLE_{IND\text{-}NORM}$ value should be rounded to the precision that is readable on the associated loop indicator. Per Section 3.3.5.3 of Reference G.1, the readability of these indicators is ± ½ the smallest division (or 0.5 psig). Therefore, the $TLE_{IND\text{-}NORM}$ value is conservatively rounded up to the nearest 0.5 psig interval.

$TLE_{IND\text{-}NORM}$ = ± 1.00 psi **(75/75)**

The parametric values are determined using Eq. 7.1.9-1. The Tech Spec limits per Section 6.6 are ≥ -2.0 psig and ≤ +2.0 psig. Therefore,

Parametric Values = ± (2 psig – 1.0 psi) = ± 1.0 psig

Low Range Containment Pressure Parametric Limits (Control Board Indicators PI-945, PI-947 and PI-949) are:

≥ -1.0 psig and ≤ +1.0 psig **(75/75)**

8.4.4 Total PPCS Loop Error (TLE_{PPCS})

As stated in Section 7.1.1 of this calculation, Low Range Containment Pressure PPCS indication is a parametric value, classified as a Category B function, and is combined into a 75/75 total loop error. Applicable uncertainties are listed in Section 8.2 and summarized in Section 8.3.

Using Equation 7.1.2-3, the Total PPCS Loop Error (TLE_{PPCS}) is determined as follows:

$$TLE_{PPCS} = \pm \sqrt{\begin{array}{l} Sa^2 + I/Ia^2 + PPCSa^2 + Sd^2 + I/Id^2 + PPCSd^2 \\ + Sm^2 + I/Im^2 + PPCSm^2 + Sv^2 + I/Iv^2 + PPCSv^2 \\ + Sp^2 + I/Ip^2 + PPCSp^2 + St_{nl}{}^2 + I/It^2 + PPCSt^2 \\ + Sh_n{}^2 + I/Ih^2 + PPCSh^2 + Sr_n{}^2 + I/Ir^2 + PPCSr^2 \\ + Ss_n{}^2 + I/Is^2 + PPCSs^2 + Sspe_n{}^2 + Sope_n{}^2 + PPCSrea^2 \end{array}} \pm PE_n \pm Bias$$

Substituting for normal Total PPCS Loop Error (TLE_{PPCS}):

$$TLE_{PPCS} = \pm\sqrt{\begin{array}{l}0^2 + 0.500^2 + 0.510^2 + 0.518^2 + 0.500^2 + 0^2 \\ + 0^2 + 0.095^2 + 0.075^2 + 0.500^2 + 0.250^2 + 0.500^2 \\ + 0^2 + 1.000^2 + 0^2 + 1.090^2 + 0^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 \\ + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0.017^2\end{array}} + 0 + 0$$

TLE_{PPCS} $= \pm$ 1.948 % span (95/95)

Per Section 3.3.3.13 of Reference G.1, the Total PPCS Loop Error (TLE_{PPCS}) is converted from 95/95 to 75/75 statistics as follows:

TLE_{PPCS} $= \pm$ 1.948 % span * (1.15/1.96)

TLE_{PPCS} $= \pm$ 1.143 % span (75/75)

Per Reference P.1 and P.2, the calibrated span in engineering units is 60 psi. Converting the 75/75 Total PPCS Loop Error (TLE_{PPCS}) to process units and rounding to the calibration procedure precision.

TLE_{PPCS} $= \pm$ (1.143 % span) * (60 psi) / 100%

TLE_{PPCS} $= \pm$ 0.7 psi (75/75)

The parametric values are determined using Eq. 7.1.9-1. The Tech Spec limits per Section 6.6 are ≥ - 2.0 psig and ≤ +2.0 psig. Therefore,

Parametric Values = ± (2 psig – 0.7 psi) = ± 1.3 psig

Low Range Containment Pressure Parametric Limits (PPCS P-945, P-947 and P-949) are:

≥ - 1.3 psig and ≤ +1.3 psig (75/75)

8.5 Acceptable As-Left and As-Found Calibration Tolerances

8.5.1 Acceptable As-Left Calibration Tolerances

Per Section 3.3.8.6 of Reference G.1, the As-Left Tolerance is determined using the equations shown in Section 7.1.4 of this calculation.

References P.1 through P.4 and P.13 through P.18 show that each device analyzed in this calculation is calibrated separately. Therefore, the As-Left Tolerance for each device is calculated independently. The tolerances are calculated with the 95/95 uncertainty values.

8.5.1.1 Sensor As-Left Tolerances (SAL)

Using Equation 7.1.4-1, the Acceptable As-Left Tolerance for the Sensor (transmitter) is:

SAL = ± Sv
SAL = ± 0.500 % span Section 8.2.4

Converting to mAdc and rounding to procedure precision:

SAL = ± 0.5 % span * (40 mAdc / 100 %)

SAL = ± 0.20 mAdc

8.5.1.2 Bistable As-Left Tolerances (BAL)

Using Equation 7.1.4-2, the Acceptable As-Left Tolerance for the Bistable is:

BAL = ± Bv
BAL = ± 0.250 % span Section 8.2.15

Converting to Vdc and rounding to procedure precision (BAL is in Vdc due to the 10-ohm dropping resistor at the Test Point per Ref. D.12 through D.17):

BAL = ± 0.250 % span * (40 mAdc / 100 %) * (10 Ω / 1000 mAdc / A)

BAL = ± 0.001 Vdc

Converting to psig, using calibrated span of 60 psig (Ref. P.1 and P.2):

BAL = ± 0.250 % span * (60 psig / 100 %)

BAL = ± 0.15 psig

8.5.1.3 Current-to-Current Converter As-Left Tolerance (I/IAL)

Using Equation 7.1.4-3, the Acceptable As-Left Tolerance for the I/I Converter is:

I/IAL = ± I/Iv
I/IAL = ± 0.250 % span Section 8.2.24

Converting to mAdc and rounding to procedure precision:

I/IAL = ± 0.250 % span * (40 mAdc / 100 %)

I/IAL = ± 0.10 mAdc

8.5.1.4 Indicator As-Left Tolerances (IAL)

Using Equation 7.1.4-4, the Acceptable As-Left Tolerance for the Indicator is:

IAL	= ± Iv	
IAL	= ± 1.750 % span	Section 8.2.33

Converting to mAdc and rounding to procedure precision:

IAL = ± 1.750 % span * (40 mAdc / 100 %)

IAL = ± 0.70 mAdc

8.5.1.5 PPCS As-Left Tolerances (PPCSAL)

Using Equation 7.1.4-5, the Acceptable As-Left Tolerance for the PPCS is:

PPCSAL	= ± PPCSv	
PPCSAL	= ± 0.500 % span	Section 8.2.43

Converting to pressure units and rounding to procedure precision:

PPCSAL = ± 0.500 % span * (60 psig/ 100 %)

PPCSAL = ± 0.3 psig

8.5.2 Acceptable As-Found Calibration Tolerances

Per Section 3.3.8.6 of Reference G.1, the As-Found Tolerance is determined using the equations shown in Section 7.1.3 of this calculation.

Per References P.1 through P.4 and P.13 through P.18 each device analyzed in this calculation is calibrated separately. Therefore, the As-Found Tolerance for each device is calculated independently. The tolerances are calculated with the 95/95 uncertainty values.

8.5.2.1 Sensor As-Found Tolerance (SAF)

Using Equation 7.1.3-1, the Acceptable As-Found Tolerance for the Sensor (transmitter) is:

$$SAF = \pm\sqrt{Sv^2 + Sd^2 + Sm^2}$$

where:

Sv	= ± 0.500 % span	Section 8.2.4
Sd	= ± 0.518 % span	Section 8.2.2
Sm	= ± 0.000 % span	Section 8.2.3

$$SAF = \pm \sqrt{0.500^2 + 0.518^2 + 0.000^2}$$

$$SAF = \pm 0.720 \text{ \% span}$$

Converting to mAdc and rounding to procedure precision:

SAF = ± 0.720 % span * (40 mAdc / 100 %)

SAF = ± 0.29 mAdc

8.5.2.2 Bistable As-Found Tolerance (BAF)

Using Equation 7.1.3-2, the Acceptable As-Found Tolerance for the Bistable is:

$$BAF = \pm \sqrt{Bv^2 + Bd^2 + Bm^2}$$

where:

Bv	= ± 0.250 % span	Section 8.2.15
Bd	= ± 0.212 % span	Section 8.2.13
Bm	= ± 0.000 % span	Section 8.2.14

$$BAF = \pm \sqrt{0.250^2 + 0.212^2 + 0^2}$$

$$BAF = \pm 0.328 \text{ \% span}$$

Converting to Vdc and rounding to procedure precision (BAF is in Vdc due to the 10-ohm dropping resistor at the Test Point per Ref. D.12 through D.17):

BAF = ± 0.328 % span * (40 mAdc / 100 %) * (10 Ω / 1000 mAdc / A)

BAF = ± 0.0013 Vdc

Converting to psig, using calibrated span of 60 psig (Ref. P.1 and P.2):

BAF = ± 0.328 % span * (60 psig / 100 %)

BAF = ± 0.20 psig

8.5.2.3 Current-to-Current Converter As-Found Tolerance (I/IAF)

Using Equation 7.1.3-3, the Acceptable As-Found Tolerance for the I/I Converter is:

$$I/IAF = \pm \sqrt{I/Iv^2 + I/Id^2 + I/Im^2}$$

where:

I/Iv	= ± 0.250 % span	Section 8.2.24
I/Id	= ± 0.500 % span	Section 8.2.22
I/Im	= ± 0.095 % span	Section 8.2.23

$$\text{I/IAF} = \pm\sqrt{0.250^2 + 0.500^2 + 0.095^2}$$

I/IAF = ± 0.567 % span

Converting to mAdc and rounding to procedure precision:

I/IAF = ± 0.567 % span * (40 mAdc / 100 %)

I/IAF = ± 0.23 mAdc

8.5.2.4 Indicator As-Found Tolerance (IAF)

Using Equation 7.1.3-4, the Acceptable As-Found Tolerance for the Indicator is:

$$\text{IAF} = \pm\sqrt{\text{Iv}^2 + \text{Id}^2 + \text{Im}^2}$$

where:

Iv	= ± 1.750 % span	Section 8.2.33
Id	= ± 1.028 % span	Section 8.2.31
Im	= ± 0.000 % span	Section 8.2.32

$$\text{IAF} = \pm\sqrt{1.750^2 + 1.028^2 + 0^2}$$

IAF = ± 2.030 % span

Converting to mAdc and rounding to procedure precision:

IAF = ± 2.030 % span * (40 mAdc / 100 %)

IAF = ± 0.81 mAdc

8.5.2.5 PPCS As-Found Tolerance (PPCSAF)

Using Equation 7.1.3-5, the Acceptable As-Found Tolerance for the PPCS is:

$$\text{PPCSAF} = \pm\sqrt{\text{PPCSv}^2 + \text{PPCSd}^2 + \text{PPCSm}^2}$$

where:

PPCSv = ± 0.500 % span	Section 8.2.43
PPCSd = ± 0.000 % span	Section 8.2.41
PPCSm = ± 0.075 % span	Section 8.2.42

$$PPCSAF = \pm \sqrt{0.500^2 + 0.000^2 + 0.065^2}$$

PPCSAF = ± 0.506 % span

Converting to psig and rounding to procedure precision:

PPCSAF = ± 0.506 % span * (60 psig / 100 %)

PPCSAF = ± 0.30 psig

8.6 Setpoint Evaluations

8.6.1 High Containment Pressure – Safety Injection and Condensate Isolation Actuation Setpoint Evaluation

For an increasing setpoint towards Analytical Limit, Equation 7.1.6-1 is used.

$$LTSP = AL - (0.839) * TLE_{TRIP}$$

Where:

AL	= 6 psig	Section 6.5
TLE_{TRIP}	= ± 0.808 psi	Section 8.4.1

Substituting,

$$LTSP = 6 - (0.839) * 0.808 \text{ psi}$$

LTSP = 5.322 psig **(95/95)**

From Section 6.5, the Field Trip Setpoint (FTSP) for High Containment Pressure – Safety Injection and High Containment Pressure – Condensate Isolation is 5 psig. The FTSP is conservative compared to the calculated LTSP. Per Section 2.0, this setpoint is acceptable, and may be retained.

The margin between LTSP and FTSP is calculated in accordance with Section 3.3.8.5 of Reference G.1:

$$Margin = LTSP - FTSP$$

Where:

LTSP	= 5.322 psig	
FTSP	= 5.0 psig	Section 6.5

Substituting,

$$Margin = 5.322 \text{ psig} - 5.0 \text{ psig}$$

Margin = 0.322 psi

8.6.2 High-High Containment Pressure – Containment Spray Trip Setpoint Evaluation

For an increasing setpoint towards Analytical Limit, Equation 7.1.6-1 is used.

$$LTSP = AL - (0.839) * TLE_{TRIP}$$

Where:

AL	= 30 psig	Section 6.5
TLE_{TRIP}	= ± 0.808 psi	Section 8.4.1

Substituting,

$$LTSP = 30 - (0.839) * 0.808 \text{ psi}$$

LTSP = 29.322 psig **(95/95)**

From Section 6.5, the Field Trip Setpoint (FTSP) for High-High Containment Pressure – Containment Spray Actuation setpoint is 25 psig. The FTSP is conservative compared to the calculated LTSP. Per Section 2.0, this setpoint is acceptable, and may be retained.

The margin between LTSP and FTSP is calculated in accordance with Section 3.3.8.5 of Reference G.1:

Margin = LTSP – FTSP

Where:

LTSP	= 29.322 psig	
FTSP	= 25.0 psig	Section 6.5

Substituting,

Margin = 29.322 psig – 25.0 psig

Margin = 4.322 psi

8.7 Operability Limit (OL) Evaluations

This section determines Operability Limits for the low range containment pressure ESFAS protective functions. Operability Limits are limits for the as-found value of the trip bistable during the Tech Spec Channel Operational Test (COT) surveillance, to determine if the bistable is operating within its 3-sigma drift limits. There are two Operability Limits per trip function, one on each side of the FTSP.

Per Section 7.1.7 the OL on each side of the FTSP is calculated by applying the square-root-sum-of-the-squares combination of the bistable As-Left tolerance and 3σ drift to the FTSP.

8.7.1 High Containment Pressure – Safety Injection and Condensate Isolation Actuation Operability Limit Evaluation

Using Equation 7.1.7-3 to determine the bistable 3σ drift value,

$Rd_{3\sigma} = (1.5)\ Rd_{2\sigma}$ (Eq. 7.1.7-3)

$Rd_{3\sigma} = (1.5)\ 0.212\ \%\ \text{span}$ ($Rd_{2\sigma}$ from Section 8.2.13)

$Rd_{3\sigma} = \pm\ 0.318\ \%\ \text{span}$

For the transmitter range of -6 psig to 54 psig, the FTSP for the high containment pressure – safety injection and condensate isolation actuation of 5 psig, expressed as percent span, is:

$$FTSP = ([5 - (-6)] \div 60) * 100 = 18.333\ \%\ \text{span}$$

Using Equation 7.1.7-1, the OL^+ is determined as:

$OL^+ = FTSP + [BAL^2 + Rd_{3\sigma}^2]^{½}$ (Eq. 7.1.7-1)

$OL^+ = 18.333\ \% + (0.250^2 + 0.318^2)^{½}$ (BAL from Section 8.5.1.2)

$OL^+ = 18.333\ \% + 0.405$

$OL^+ = 18.738\ \%\ \text{span}$

Expressed in psig, $OL^+ = (0.18738 * 60) + (-6) =$ **5.24 psig**

Using Equation 7.1.7-2, the OL^- is determined as:

$OL^- = FTSP - [BAL^2 + Rd_{3\sigma}^2]^{½}$ (Eq. 7.1.7-2)

$OL^- = 18.333\ \% - (0.250^2 + 0.318^2)^{½}$

$OL^- = 18.333\ \% - 0.405$

$OL^- = 17.928\ \%\ \text{span}$

Expressed in psig, $OL^- = (0.17928 * 60) + (-6) =$ **4.76 psig**

Because the High Containment Pressure – Safety Injection and Condensate Isolation actuation is an increasing trip, the positive OL^+ value of 5.24 psig should be the limit compared to the COT as-found value to determine Technical Specification operability of the channel. However, an as-found value found outside either the OL^+ or OL^- indicates that the channel is operating abnormally.

8.7.2 High-High Containment Pressure – Containment Spray Operability Limit Evaluation

Using Equation 7.1.7-3 to determine the bistable 3σ drift value,

$Rd_{3\sigma} = (1.5)\ Rd_{2\sigma}$ (Eq. 7.1.7-3)
$Rd_{3\sigma} = (1.5)\ 0.212\ \%\ \text{span}$ ($Rd_{2\sigma}$ from Section 8.2.13)
$Rd_{3\sigma} = \pm\ 0.318\ \%\ \text{span}$

For the transmitter range of -6 psig to 54 psig, the FTSP for the High-High Containment Pressure – Containment Spray of 25 psig, expressed as percent span, is:

$$FTSP = ([25 - (-6)] \div 60) * 100 = 51.667\ \%\ \text{span}$$

Using Equation 7.1.7-1, the OL^+ is determined as:

$OL^+ = FTSP + [BAL^2 + Rd_{3\sigma}{}^2]^{½}$ (Eq. 7.1.7-1)
$OL^+ = 51.667\ \% + (0.250^2 + 0.318^2)^{½}$ (BAL from Section 8.5.1.2)
$OL^+ = 51.667\ \% + 0.405$
$OL^+ = 52.072\ \%\ \text{span}$

Expressed in psig, $OL^+ = (0.52072 * 60) + (-6) =$ **25.24 psig**

Using Equation 7.1.7-2, the OL^- is determined as:

$OL^- = FTSP - [BAL^2 + Rd_{3\sigma}{}^2]^{½}$ (Eq. 7.1.7-2)
$OL^- = 51.667\ \% - (0.250^2 + 0.318^2)^{½}$
$OL^- = 51.667\ \% - 0.405$
$OL^- = 51.262\ \%\ \text{span}$

Expressed in psig, $OL^- = (0.51262 * 60) + (-6) =$ **24.76 psig**

Because the High-High Containment Pressure – Containment Spray is an increasing trip, the positive OL^+ value of 25.24 psig should be the limit compared to the COT as-found value to determine Technical Specification operability of the channel. However, an as-found value found outside either the OL^+ or OL^- indicates that the channel is operating abnormally.

8.8 Channel Check Tolerances

Using Equation 7.1.5-1, the Channel Check Tolerance is determined as follows (at a 95/95 confidence value):

$$CCT = \pm\sqrt{\begin{array}{l}(Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2 + Sv^2 + I/Iv^2 \\ + Iv^2 + Irea^2)_{ind\ a} + (Sa^2 + I/Ia^2 + Ia^2 + Sd^2 + I/Id^2 + Id^2 \\ + Sv^2 + I/Iv^2 + Iv^2 + Irea^2)_{ind\ b}\end{array}}$$

where:

Sa	= ± 0.000 % span	Section 8.2.1
Sd	= ± 0.518 % span	Section 8.2.2
Sv	= ± 0.500 % span	Section 8.2.4
I/Ia	= ± 0.500 % span	Section 8.2.21
I/Id	= ± 0.500 % span	Section 8.2.22
I/Iv	= ± 0.250 % span	Section 8.2.24
Ia	= ± 0.000 % span	Section 8.2.30
Id	= ± 1.028 % span	Section 8.2.31
Iv	= ± 1.750 % span	Section 8.2.33
Irea	= ± 0.000 % span	Section 8.2.39

Substituting to calculate a 95/95 confidence value:

$$CCT = \pm\sqrt{\begin{array}{l}(0^2 + 0.500^2 + 0^2 + 0.518^2 + 0.500^2 + 1.028^2 + 0.500^2 + 0.250^2 \\ + 1.750^2 + 0^2)_{ind\ a} + (0^2 + 0.500^2 + 0^2 + 0.518^2 + 0.500^2 + 1.028^2 \\ + 0.500^2 + 0.250^2 + 1.750^2 + 0^2)_{ind\ b}\end{array}}$$

CCT = ± 3.225 % span **(95/95)**

Converting to process units,

CCT = ± (3.225 % span * 60 psig) / 100 %

CCT = ± 1.935 psig **(95/95)**

Per Reference G.36, the Control Room indication for Low Range Containment Pressure (LI-945, LI-947 and LI-949) has a minor division of 1 psig. Per Section 7.1, the CCT value should be rounded to the precision that is readable on the associated loop indicator. Per Section 3.3.5.3 of Reference G.1, the readability of these indicators is ± ½ the smallest division (or 0.5 psig). Therefore, the CCT value is rounded up to the nearest 0.5 psig interval.

CCT = ± 2.00 psig **(95/95)**

The operator uses the CCT in the periodic surveillance of the Low Range Containment Pressure per References G.30 and G.31. From References G.30 and G.31, the existing CCT for Low Range Containment Pressure is ± 1.5 psig. The existing CCT is less than the calculated CCT. Per Section 2.0, the existing CCT is acceptable and may be retained.

8.9 Scaling

8.9.1 High Containment Pressure – Safety Injection and Condensate Isolation FTSP and Operability Limits

From Table 6.3-1, the model number of the transmitters is Foxboro N-E11GM-HIB1-BEL/AEL. From Reference V.2, the transmitters have a 10 to 50 mAdc output range corresponding to an input of –6 to 54 psig (Ref. P.3 and P.4).

$m = (y_2 - y_1) / (x_2 - x_1)$ Equation 7.1.8-2

Where:

x_1 = -6 psig
x_2 = 54 psig
y_1 = 10 mAdc
y_2 = 50 mAdc

Substituting,

m = [(50 mAdc) - (10 mAdc)] / [(54 psig) - (-6 psig)]
m = 40 mAdc/ 60 psi

Solving for the equivalent signal in mAdc corresponding to the FTSP of 5 psig

$y = m * (x - x_1) + y_1$ Equation 7.1.8-3

where:

x = 5 psig Section 8.7.1
x_1 = -6 psig
y = FTSP (mAdc)
y_1 = 10 mAdc

Substituting,

y = [(40 mAdc/ 60 psi) * (5 psig – (-6 psig))] + 10 mAdc

y = 17.33 mAdc

Converting to Vdc due to a 10 Ω resistor across the calibration point (Ref. D.12 through D.17)

y = 17.33 mAdc * 10 Ω / 1000 mVdc per Vdc

y = 0.1733 Vdc

For an OL^+ of 5.24 psig (Section 8.7.1) the equivalent equation is:

$y = m * (x - x_1) + y_1$ Equation 7.1.8-3

where:

x = 5.24 psig
x_1 = -6 psig
y = OL^+ (mAdc)
y_1 = 10 mAdc

Substituting,

$y \quad = [(40 \text{ mAdc}/ 60 \text{ psi}) * (5.24 \text{ psig} - (-6 \text{ psig}))] + 10 \text{ mAdc}$

$\mathbf{y \quad = 17.49 \text{ mAdc}}$

Converting to Vdc due to a 10 Ω resistor across the calibration point (Ref. D.12 through D.17)

$y \quad = 17.49 \text{ mAdc} * 10\ \Omega / 1000 \text{ mVdc per Vdc}$

$\mathbf{y \quad = 0.1749 \text{ Vdc}}$

For an OL^- of 4.76 psig (Section 8.7.1) the equivalent equation is:

$y \quad = m * (x - x_1) + y_1$ Equation 7.1.8-3

where:

$x \quad = 4.76$ psig
$x_1 \quad = -6$ psig
$y \quad = OL^-$ (mAdc)
$y_1 \quad = 10$ mAdc

Substituting,

$y \quad = [(40 \text{ mAdc}/ 60 \text{ psi}) * (4.76 \text{ psig} - (-6 \text{ psig}))] + 10 \text{ mAdc}$

$\mathbf{y \quad = 17.17 \text{ mAdc}}$

Converting to Vdc due to a 10 Ω resistor across the calibration point (Ref. D.12 through D.17)

$y \quad = 17.17 \text{ mAdc} * 10\ \Omega / 1000 \text{ mVdc per Vdc}$

$\mathbf{y \quad = 0.1717 \text{ Vdc}}$

Table 8.9-1
1(2)PC-945A/B, 947A/B 949A/B – High Containment Pressure Bistable Calibration – Safety Injection and Condensate Isolation

Function	Input (psig)	Output (mAdc)	Output (Vdc)
OL+	5.24	17.49	0.1749
FTSP↑	5	17.33	0.1733
OL-	4.76	17.17	0.1717

8.9.2 High-High Containment Pressure – Containment Spray FTSP and Operability Limits

Determine the current signal equivalent to the OL and FTSP:

$m \quad = (y_2 - y_1) / (x_2 - x_1)$ Equation 7.1.8-2

Where:

x_1 = -6 psig
x_2 = 54 psig
y_1 = 10 mAdc
y_2 = 50 mAdc

Substituting,

m = [(50 mAdc) - (10 mAdc)] / [(54 psig) - (-6 psig)]
m = 40 mAdc/ 60 psi

Solving for the equivalent signal in mAdc corresponding to the FTSP of 25 psig

$y = m * (x - x_1) + y_1$ Equation 7.1.8-3

where:

x = 25 psig
x_1 = -6 psig
y = FTSP (mAdc)
y_1 = 10 mAdc

Substituting,

y = [(40 mAdc/ 60 psi) * (25 psig – (-6 psig))] + 10 mAdc

y = 30.67 mAdc

Converting to Vdc due to a 10 Ω resistor across the calibration point (Ref. D.12 through D.17)

y = 30.67 mAdc * 10 Ω / 1000 mVdc per Vdc

y = 0.3067 Vdc

For an OL^+ of 25.24 psig (Section 8.7.2) the equivalent equation is:

$y = m * (x - x_1) + y_1$ Equation 7.1.8-3

where:

x = 25.24 psig
x_1 = -6 psig
y = OL^+ (mAdc)
y_1 = 10 mAdc

Substituting,

y = [(40 mAdc/ 60 psi) * (25.24 psig – (-6 psig))] + 10 mAdc

y = 30.83 mAdc

Converting to Vdc due to a 10 Ω resistor across the calibration point (Ref. D.12 through D.17)

y = 30.83 mAdc * 10 Ω / 1000 mVdc per Vdc

$\mathbf{y} \quad \mathbf{= 0.3083\ Vdc}$

For an OL^- of 24.76 psig (Section 8.7.2) the equivalent equation is:

$$y = m * (x - x_1) + y_1 \qquad \text{Equation 7.1.8-3}$$

where:

x = 24.76 psig
x_1 = -6 psig
y = OL^- (mAdc)
y_1 = 10 mAdc

Substituting,

$$y = [(40 \text{ mAdc}/ 60 \text{ psi}) * (24.76 \text{ psig} - (-6 \text{ psig}))] + 10 \text{ mAdc}$$

$$\mathbf{y = 30.51\ mAdc}$$

Converting to Vdc due to a 10 Ω resistor across the calibration point (Ref. D.12 through D.17)

$$y = 30.51 \text{ mAdc} * 10\ \Omega / 1000 \text{ mVdc per Vdc}$$

$$\mathbf{y = 0.3051\ Vdc}$$

Table 8.9-2
1(2)PC-945A/B, 947A/B 949A/B – High-High Containment Pressure Bistable Calibration – Containment Spray

Function	Input (psig)	Output (mAdc)	Output (Vdc)
OL^+	25.24	30.83	0.3083
FTSP↑	25	30.67	0.3067
OL^-	24.76	30.51	0.3051

9.0 RESULTS AND CONCLUSIONS, WITH LIMITATIONS

9.1 Analytical Limits (AL)

The Analytical Limits are determined by Westinghouse (Ref. G.25) and are summarized below:

Table 9.1-1 Analytical Limits

ESFAS Function	Analytical Limit (AL)	Reference
High Containment Pressure – Safety Injection and Condensate Isolation	**6.0 psig**	**Section 6.5**
High-High Containment Pressure – Containment Spray	**30.0 psig**	**Section 6.5**

9.2 Limiting Trip Setpoints, Operability Limits (OL), and Recommended Tech Spec Changes

AR 896611 determined that the Technical Specification Allowable Values for several protection system functions in TS 3.3.1 (RPS) and TS 3.3.2 (ESFAS) were non-conservative. As a result, the I&C calibration procedures were revised to install temporary administrative limits (termed Allowable Limits in the ICPs) on the trip bistable as-found values until a license amendment is approved to revise the TS sections.

The Limiting Trip Setpoints for primary trip functions determined in this calculation provide new Technical Specification limits that will be termed as Allowable Values in tech specs for channel operability to protect the accident analyses Analytical Limits. The LTSPs also satisfy the definition of a Limiting Safety System Setting in 10CFR50.36. Backup trips and permissives do not have a LTSP that can be used as an Allowable Value in Tech Specs because there is no analytical limit to “anchor” the LTSP.

Operability Limits have been determined for all trip functions (primary trips, backup trips, and the SI Block/Unblock function). The OLs provide new limits to be applied in the I&C calibration procedures for establishing Technical Specification operability of the trip channels during Channel Operational Testing (COT).

It is recommended that the Operability Limits for both primary and backup trips be included in the Technical Requirements Manual as limits (more restrictive than the LTSPs) for establishing channel operability during channel surveillance testing. The reason for including OLs in the TRM rather than the Technical Specifications is to allow the station flexibility to revise the field setpoint values, along with their as-left, as-found, and OL values, without requiring prior NRC approval. The LTSPs, which provide protection for the accident analyses, are the appropriate Allowable Values for the protection functions in the Specifications and would remain bounding limits for the primary trips (only).

Table 9.2-1 Operability Limits

Function	Existing AV	Calculated OL^+ and OL^-	Recommended Tech Spec OL (for AV)	Reference
High Containment pressure – Safety Injection and Condensate Isolation Actuation	≤ 6 psig	OL^+ 5.24 psig OL^- 4.76 psig	≤ 5.322 psig	**Sections 8.7.1 8.6.1**
High-High Containment Pressure – Containment Spray	≤ 30 psig	OL^+ 25.24 psig OL^- 24.76 psig	≤ 29.322 psig	**Sections 8.7.2 8.6.2**

9.3 Limiting Trip Setpoints (LTSP) and Field Trip Setpoints (FTSP)

This calculation has determined that the existing Field Trip Setpoints (FTSP) for High Containment Pressure – Safety Injection and Condensate Isolation and High-High Containment Pressure –Containment Spray are conservative with respect to the calculated LTSP and may be retained.

Table 9.3-1 Limiting Trip Setpoints/Field Trip Setpoints

ESFAS Function	Calculated LTSP	FTSP	Margin	Reference
High Containment Pressure – Safety Injection and Condensate Isolation	**5.322 psig**	**5.0 psig**	**0.322 psi**	**Section 8.6.1**
High-High Containment Pressure – Containment Spray	**29.322 psig**	**25 psig**	**4.322 psi**	**Section 8.6.2**

9.4 Tech Spec Surveillance

The Indicator and PPCS loops are associated with the parametric values for Tech Spec Surveillance compliance. The normal loop uncertainties are summarized below:

Table 9.4-1 Normal Loop Uncertainties

	Indicator Loop Uncertainties		PPCS Loop Uncertainties		Reference
75/75 Confidence	**± 1.596 % span**	**± 1.00 psi**	**± 1.143 % span**	**± 0.7 psi**	**Section 8.4.3 Section 8.4.4**

From Section 6.6, the Tech Spec limits are ≥ -2.0 psig and ≤ +2 psig. The Tech Spec limits that include loop uncertainties for the parametric values (rounded to the indicator and PPCS readability) are:

Low Range Containment Pressure Limits (Control Board Indicators, PI-945, PI-947 and PI-949):

≥ -1.0 psig and ≤ +1.0 psig **(Section 8.4.3)**

Low Range Containment Pressure Limits (PPCS display, P-945, P-947 and P-949):

≥ -1.3 psig and ≤ +1.3 psig **(Section 8.4.4)**

The calculation of the parametric values above resolve the issues raised per A/R 01055221.

9.5 EOP Inputs

The indication loop uncertainties for input to EOP are summarized below.

Table 9.5-1 EOP Indication

	Indicator Loop Uncertainties		**Reference**
95/95 Confidence (normal conditions)	**± 2.928 % span**	**± 1.757 psi**	**Section 8.4.2**
75/75 Confidence (normal conditions)	**± 1.718 % span**	**± 1.031 psi**	**Section 8.4.2**
95/95 Confidence (accident conditions)	**± 6.676 % span**	**± 4.006 psi**	**Section 8.4.2**
75/75 Confidence (accident conditions)	**± 3.917 % span**	**± 2.350 psi**	**Section 8.4.2**

9.6 Channel Check Tolerance

The Channel Check Tolerance for control board indicators is summarized below. The existing CCT value is acceptable and may be retained.

Table 9.6-1 Channel Check Tolerances

	Calculated Channel Check Tolerances		**Existing Channel Check Tolerance**	**Reference**
95/95 Confidence	**± 3.225 % span**	**± 2.0 psi**	**± 1.5 psi**	**Section 8.8**

9.7 Acceptable As-Left and As-Found Tolerances

This Calculation has determined the Acceptable As-Found and As-Left Tolerances, summarized below, for the instruments listed in Section 1.5 (Table 1-1). The calibration procedures listed in Section 10 should be revised as appropriate.

Table 9.7-1 As-Left/As-Found Tolerances

Instrument	As-Left Tolerance	As-Found Tolerance	Reference
1(2)PT-945 1(2)PT-947 1(2)PT-949	**(SAL) ± 0.20 mAdc**	**(SAF) ± 0.29 mAdc**	**8.5.1.1 8.5.2.1**
1(2)PC-945A/B 1(2)PC-947A/B 1(2)PC-949A/B	**(BAL) ± 0.001 Vdc ± 0.15 psig**	**(BAF) ± 0.0013 Vdc ±0.20 psig**	**8.5.1.2 8.5.2.2**
1(2)PM-945 1(2)PM-947 1(2)PM-949	**(I/IAL) ± 0.10 mAdc**	**(I/IAF) ± 0.23 mAdc**	**8.5.1.3 8.5.2.3**
1(2)PI-945 1(2)PI-947 1(2)PI-949	**(IAL) ± 0.70 mAdc**	**(IAF) ± 0.81 mAdc**	**8.5.1.4 8.5.2.4**
1(2)P-945 1(2)P-947 1(2)P-949	**(PPCSAL) ± 0.30 psig**	**(PPCSAF) ± 0.30 psig**	**8.5.1.5 8.5.2.5**

9.8 Scaling

Table 9.8-1 Scaling Values

Setpoints	Function	Input (psig)	Output (mAdc)	Output (Vdc)	Reference
High Containment Pressure – Safety Injection and Condensate Isolation	OL^+	5.24	17.49	0.1749	8.9.1
	As-Found	5.20	17.46	0.1746	8.5.2.2
	As-Left	5.15	17.43	0.1743	8.5.1.2
	FTSP↑	5	17.33	0.1733	6.5
	As-Left	4.85	17.23	0.1723	8.5.1.2
	As-Found	4.80	17.20	0.1720	8.5.2.2
	OL^-	4.76	17.17	0.1717	8.9.1
High-High Containment Pressure – Containment Spray	OL^+	25.24	30.83	0.3083	8.9.1
	As-Found	25.20	30.80	0.3080	8.5.2.2
	As-Left	25.15	30.77	0.3077	8.5.1.2
	FTSP↑	25	30.67	0.3067	6.5
	As-Left	24.85	30.57	0.3057	8.5.1.2
	As-Found	24.80	30.54	0.3054	8.5.2.2
	OL^-	24.76	30.51	0.3051	8.9.1

9.9 Limitations

9.9.1 M&TE Limitations

To preserve the validity of this calculation's results, this calculation requires that all future calibrations of the equipment (addressed in this calculation) be performed using the M&TE mentioned below (equivalent or better may also be used).

Table 9.9-1 M &TE

M&TE	Range	Accuracy	Reference
Current-to-Current Converters (output) and PPCS (Ref. P.1 and P.2)			
Fluke 45 (fast rate)	0-100 mAdc	± 0.025 mAdc (± 0.05 % RDG + 3 DG)	8.2.23 8.2.42
HP 34401A	0-100 mAdc	±0.030 mAdc (± 0.050 % RDG + 0.005% RNG)	8.2.23 8.2.42
Current-to-Current Converters (input) (Ref. P.1 and P.2)			
HP 34401A	0-1.0 Vdc	±0.000027 Vdc (± 0.004 % RDG + 0.0007% RNG)	8.2.23
Fluke 45	0-3.0 Vdc	±0.000236 Vdc (± 0.025 % RDG + 2 DG)	8.2.23
Fluke 8842A	0-2.0 Vdc	±0.000025 Vdc (± 0.003 % RDG + 2 DG)	8.2.23

9.9.2 Temperature Limitations

The results of this calculation are valid only if the temperature inside the Control/Computer Room instrumentation panels does not exceed 120 °F (For EOP inputs and trips). GAR 01031656 has been generated to track this limitation.

9.9.3 Implementation Limitation

Changes recommended by this calculation, such as As-Found and As-Left Tolerances to calibration sheets, and the Technical Specification Operability Limits, are NOT to be implemented without approval of the PBNP Design Authority or the appointed designee.

9.10 Graphical Representation of the Setpoints

9.10.1 High Containment Pressure – Safety Injection and Condensate Isolation Setpoints

Figure 9.10-1
High Containment Pressure – Safety Injection and Condensate Isolation Bistable
(PC-945A, 947A, 949A)

Analytical Limit (AL)	6.0 psig
Limiting Trip Setpoint (LTSP)	5.322 psig
+Operability Limit (OL^+)	5.24 psig (0.1749 Vdc)
+As-Found	5.20 psig (0.1746 Vdc)
+As-Left	5.15 psig (0.1743 Vdc)
Field Trip Setpoint (FTSP)	5.0 psig (0.1733 Vdc)
-As-Left	4.85 psig (0.1723 Vdc)
-As-Found	4.80 psig (0.1720 Vdc)
-Operability Limit (OL^-)	4.76 psig (0.1717 Vdc)

9.10.2 High-High Containment Pressure – Containment Spray Setpoint

Figure 9.10-2
High-High Containment Pressure – Containment Spray Bistable
(PC-945B, 947B, 949B)

Analytical Limit (AL)	30.0 psig
Limiting Trip Setpoint (LTSP)	29.322 psig
+Operability Limit (OL^+)	25.24 psig (0.3083 Vdc)
+As-Found	25.20 psig (0.3080 Vdc)
+As-Left	25.15 psig (0.3077 Vdc)
Field Trip Setpoint (FTSP)	25.0 psig (0.3067 Vdc)
-As-Left	24.85 psig (0.3057 Vdc)
-As-Found	24.80 psig (0.3054 Vdc)
-Operability Limit (OL^-)	24.76 psig (0.3051 Vdc)

10.0 IMPACT ON PLANT DOCUMENTS

Note: Passport Engineering Change (EC) Number for Calculation PBNP-IC-17 is 12264.

- 1ICP 13.016L, Rev. 5, "Reactor Protection and Safeguards Analog Racks Containment Pressure 18 Month Calibration".

  New I/I Converter/Indicator As-Left Tolerances, I/I Converter/Indicator/PPCS As-Found Tolerances and specific PPCS M&TE for the P-945, P-947 and P-949 loops need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- 2ICP 13.016L, Rev. 5, "Reactor Protection and Safeguards Analog Racks Containment Pressure 18 Month Calibration".

  New I/I Converter/Indicator As-Left Tolerances, I/I Converter/Indicator/PPCS As-Found Tolerances and specific PPCS M&TE for the P-945, P-947 and P-949 loops need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- 1ICP 04.006-2, Rev. 8, "Containment Pressure Transmitter Outage Calibrations".

  New As-Found Tolerances for Transmitters 1PT-945, 1PT-947 and 1PT-949 need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- 2ICP 04.006-2, Rev. 8, "Containment Pressure Transmitter Outage Calibrations".

  New As-Found Tolerances for Transmitters 2PT-945, 2PT-947 and 2PT-949 need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- 1ICP 02.001RD, Rev. 9, "Reactor Protection and Engineered Safety Features Red Channel Analog 92 Day Surveillance Test".

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 1PC-945A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 2ICP 02.001RD, Rev. 11, "Reactor Protection and Engineered Safety Features Red Channel Analog 92 Day Surveillance Test".

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 2PC-945A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 1ICP-02.001BL, Rev. 12, "Reactor Protection and Engineered Safety Features Blue Channel Analog 92 Day Surveillance Test".

  New As-Left Tolerances, As-Found Tolerances and Operability Limits for Bistable 1PC-947A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 2ICP-02.001BL, Rev. 15, "Reactor Protection and Engineered Safety Features Blue Channel Analog 92 Day Surveillance Test".

  New As-Left Tolerances, As-Found Tolerances and Operability Limits for Bistable 2PC-947A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 1ICP-02.001WH, Rev. 11, "Reactor Protection and Engineered Safety Features White Channel Analog 92 Day Surveillance Test".

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 1PC-949A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 2ICP-02.001WH, Rev. 11, "Reactor Protection and Engineered Safety Features White Channel Analog 92 Day Surveillance Test".

  □New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 2PC-949A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 1ICP 02.020RD, Rev. 11, "Post-Refueling Pre-Startup RPS and ESF Red Channel Analog Surveillance Test"

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 1PC-945A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 2ICP 02.020RD, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF Red Channel Analog Surveillance Test"

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 2PC-945A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 1ICP 02.020BL, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF Blue Channel Analog Surveillance Test"

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 1PC-947A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 2ICP 02.020BL, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF Blue Channel Analog Surveillance Test"

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 2PC-947A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 1ICP 02.020WH, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF White Channel Analog Surveillance Test"

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 1PC-949A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- 2ICP 02.020WH, Rev. 10, "Post-Refueling Pre-Startup RPS and ESF White Channel Analog Surveillance Test"

  New As-Left Tolerances, As-Found Tolerances, and Operability Limits for Bistable 2PC-949A/B need to be incorporated. Passport A/R No. 01131513 will track the generated change to this document.

- STPT 2.1, Rev. 3, "Setpoint Document – Safety Injection".

Setpoint has been verified, no changes required. New Tech Spec Allowable Value needs to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- STPT 2.3, Rev. 4, "Setpoint Document – Containment Pressure and LTOP".

  Setpoint has been verified, no changes required. New Tech Spec Allowable Value needs to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- WEP-SPT-29, Rev. 0, "Containment Parameter EOP Setpoints".

  The uncertainties per this calculation are input to WEP-SPT-29. Calculation WEP-SPT-29 was placed on Administrative Hold via CAP 062255 and will be revised under the CRR Project.

- PBF-2034, Rev. 74 – Control Room Log – Unit 1, pages 119 and 120

  Channel Check Tolerances have been verified and no changes are required. New Parametric Values for PPCS points P-945, P-947 and P-947 need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- PBF-2035, Rev. 74 – Control Room Log – Unit 2, pages 119 and 120

  Channel Check Tolerances have been verified and no changes are required. New Parametric Values for PPCS points P-945, P-947 and P-947 need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

- DBD-11, Rev. 10, "Safety Injection and Containment Spray System"

  Tech Spec Limits indicated in Item 8.135 need to be revised. Marked-up sheet is separately transmitted. (Key Words used in the search for all the DBDs are: "containment pressure", "30 psig", "25 psig", "15 psig", "psig", "steam line", "allowable value", and "analytical limit".) Passport A/R No. 01046198 will track the generated change to this document.

- DBD-24, Rev. 3, "ESF Actuation System"

  Analytical limits in Table 2-1, Containment pressure limits in Table 2-2, Channel Accuracy in Table 2-6 and Figure 2-4 need to be revised. Marked-up sheet is separately transmitted. Passport A/R No. 01046198 will track the generated change to this document.

- DBD-30, Rev. 10, "Containment Heating and Ventilation Systems"

  Instrument drift in Section 2.2.3, page 2-17 is incorrect and should be revised. Marked-up sheet is separately transmitted. Passport A/R No. 01046198 will track the generated change to this document.

- PBF-2061, Rev. 31, "Control Room Shift Turnover Checklist Unit 1"

  Revision 2 of this calculation has superseded EE 2001-0032, this form lists this engineering evaluation as the basis for action condition TS 3.6.4. The basis for this action condition is now PBNP-IC-17. Passport A/R No. 01116971 will track the generated change to this document.

- PBF-2062, Rev. 35, "Control Room Shift Turnover Checklist Unit 2"

  Revision 2 of this calculation has superseded EE 2001-0032, this form lists this engineering evaluation as the basis for action condition TS 3.6.4. The basis for this action condition is

This calculation has determined the Parametric Values for Tech Spec surveillance. The following tables illustrate the necessary modifications to the Control Room Logs (Ref. G.30 and G.31) to account for these new values. The area within the bolded box represent the necessary changes, all other fields are provided for convenience only.

Daily Logsheet

PBF-2034 Rev. 69 Control Room Log – U1

Sequence: 317, 318, 319	Station: 482, 483, 484	Equipment ID: 1PI-945, 947, 949		U-1 Containment Pressure
Minimum: -1.0	Units: PSIG	SI	REQUIRED	Location: 44/CB/CR C-01
Maximum: 1.0	MISC: MODE 1,2,3,4,5,6		'TECH SPEC'	Appl DOW: Every

Shift		Reading	Notes
1	MIDS		
2	DAYS		
3	SWINGS		
4	EXTRA 1		
5	EXTRA 2		
6	EXTRA 3		
7	EXTRA 4		

Special Instructions:
Containment pressure less than 0 psig may result in difficulty obtaining a satisfactory hatch door test.

If containment pressure is greater than 1 psig then ensure containment pressure as read on PPCS P-945, P-947, P-949 ~~or as read by I&C from the instrument racks~~ is less than or equal to ~~1.4 psig~~ *1.3 psig*.
LCO 3.6.4.A, modes 1-4 is not met if the following conditions are true:
-Containment pressure as read on control board instruments indicate greater than 1 psig, AND
-Containment pressure as read on PPCS P-945, P-947, P-949 ~~OR as read by I&C from the instrument racks~~ indicates greater than ~~or equal to 1.4 psig~~ *1.3 psig*, ~~OR if PPCS is NOT available AND I&C is unavailable to read the rack instruments.~~
Reference I&C callup PB0 I&C Miscellaneous Callup PB0-24, Loss of PPCS Data Taking.

Parametric values for modes 1-4, TS acceptance criteria is ~~>= -1 psig minimum and above stated maximum~~.
≥ -1 psig and ≤ 1 psig

Daily Logsheet

PBF-2035 Rev. 69 Control Room Log – U2

Sequence: 318, 319, 320	Station: 465, 467, 468	Equipment ID: 2PI-945, 947, 949	U-1 Containment Pressure
Minimum: -1	Units: PSIG	SI REQUIRED	Location: 44/CB/CR C-01
Maximum: 1	MISC: MODE 1,2,3,4,5,6	'TECH SPEC'	Appl DOW: Every

Shift		Reading	Notes
1	MIDS		
2	DAYS		
3	SWINGS		
4	EXTRA 1		
5	EXTRA 2		
6	EXTRA 3		
7	EXTRA 4		

Special Instructions:
Containment pressure less than 0 psig may result in difficulty obtaining a satisfactory hatch door test.

If containment pressure is greater than 1 psig then ensure containment pressure as read on PPCS P-945, P-947, P-949 ~~or as read by I&C from the instrument racks~~ is less than or equal to ~~1.4 psig~~ *1.3 psig*.
LCO 3.6.4.A, modes 1-4 is not met if the following conditions are true:
-Containment pressure as read on control board instruments indicate greater than 1 psig, AND
-Containment pressure as read on PPCS P-945, P-947, P-949 ~~OR as read by I&C from the instrument racks~~ indicates greater than ~~or equal to 1.4 psig~~ *1.3 psig*, ~~OR if PPCS is NOT available AND I&C is unavailable to read the rack instruments~~.
Reference I&C callup PB0 I&C Miscellaneous Callup PB0-24, Loss of PPCS Data Taking.

Parametric values for modes 1-4, TS acceptance criteria is ~~>= -1 psig minimum and above stated maximum.~~
$\geq$ -1 psig and $\leq$ 1 psig

now PBNP-IC-17. Passport A/R No. 01116987 will track the generated change to this document.

- TS-32 Unit 1, Miscellaneous Equipment Checks (Monthly). Channel Check Tolerances have been verified and no changes are required.
- TS-32 Unit 2, Miscellaneous Equipment Checks (Monthly). Channel Check Tolerances have been verified and no changes are required.
- Technical Specifications 3.3.2 (ESFAS) to be revised after NRC approval of License Amendment Request 250. Allowable Values for high and high-high containment pressure will be revised to the LTSP values shown on Figures 9.10-1 and 9.10-2. The TRM may also be revised to include the operability limits shown on these diagrams.
- OM 1.1, Conduct of Plant Operations, PBNP Specific. Parametric value for Low Range Containment Pressure has been verified and no changes are required.
- ARP 1-PPCS-018, Priority Alarm Containment Pressure Unit 1. New parametric value for Low Range Containment Pressure PPCS display P-945, P-947, and P-949 need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.
- ARP 1-PPCS-018, Priority Alarm Containment Pressure Unit 1. New parametric value for Low Range Containment Pressure PPCS display P-945, P-947, and P-949 need to be incorporated. Passport A/R No. 01046198 will track the generated change to this document.

11.0 ATTACHMENT LIST

Attachment A	Instrument Scaling (3 pages)
Attachment B	Walkdown Record Regarding Minor Divisions for Low Range Containment Pressure Indicators (PI-945, PI-947 and PI-949) (2 pages)
Attachment C	Daily Logsheets Changes (2 pages)

12.0 10 CFR 50.59/72.48 REVIEW

For this activity a 10CFR 72.48 screening is not required per FP-E-SE-03, Section 5.3.3.e. The proposed activity does not involve in any manner the dry fuel storage casks, the cask transfer or transport equipment or any ISFI facility monitoring.

A 10 CFR 50.59 screening was prepared under screening number SCR 2006-0104. The screening is summarized as follows:
The calculation is not changing or challenging the design function(s) of the Pressurizer. The uncertainties are used to evaluate setpoints to ensure adequate safety margin exists to protect the Analytical Limit. The calculation does not affect the method of performing or controlling the design function(s) of the Pressurizer Pressure.
The proposed activity of performing calculation PBNP-IC-17 does not adversely affect the design function of an SSC credited in the safety analysis. The calculation is used to ensure SSC's are capable of performing their design function and does not change how the SSC operates.

Instrument Scaling

This calculation has determined Acceptable As-Found Tolerances for all instruments identified in Section 1.5. The following tables illustrate the necessary modifications to calibration procedures P.2 through P.14 to account for these new tolerance values. The area within the bolded box represent the necessary changes, all other fields are provided for convenience only.

1(2)ICP 04.006-2 (Ref. P.3 and P.4)

1(2)PT-945, 947, 949 U1(2)C Low Range Pressure							
Input	**Output**			**As- Found Limits**		**As- Left Limits**	
psig	**Ideal mAdc**	**As-Found mAdc**	**As-Left mAdc**	**Low mAdc**	**High mAdc**	**Low mAdc**	**High mAdc**
0.0	14.00			13.71	14.29	13.80	14.20
9.0	20.00			19.71	20.29	19.80	20.20
24.0	30.00			29.71	30.29	29.80	30.20
39.0	40.00			39.71	40.29	39.80	40.20
54.0	50.00			49.71	50.29	49.80	50.20
39.0	40.00			39.71	40.29	39.80	40.20
24.0	30.00			29.71	30.29	29.80	30.20
9.0	20.00			19.71	20.29	19.80	20.20
0.0	14.00			13.71	14.29	13.80	14.20

1(2)ICP 13.016L (Ref. P.1 and P.2)

1(2)PM-945, 947, 949 Containment Pressure I/I Conv							
Containment Press Input Vdc	**Output**			**As- Found Limits**		**As- Left Limits**	
	Ideal mAdc	**As-Found mAdc**	**As-Left mAdc**	**Low mAdc**	**High mAdc**	**Low mAdc**	**High mAdc**
0.1000	10.00			9.77	10.23	9.90	10.10
0.2000	20.00			19.77	20.23	19.90	20.10
0.3000	30.00			29.77	30.23	29.90	30.10
0.4000	40.00			39.77	40.23	39.90	40.10
0.5000	50.00			49.77	50.23	49.90	50.10

Note: The As-Left Tolerance is changed to 0.250% span per Assumption 5.1.8 to tighten the indicator loop TLE to less than 1 psig.

1(2)ICP 13.016L (Ref. P.1 and P.2)

PI-945, 947, 949 Containment Pressure Indicator							
Output psig	Input			As- Found Limits		As- Left Limits	
	Ideal mAdc	As-Found mAdc	As-Left mAdc	Low mAdc	High mAdc	Low mAdc	High mAdc
-6.00	10.00			9.19	10.81	9.30	10.70
9.00	20.00			19.19	20.81	19.30	20.70
24.00	30.00			29.19	30.81	29.30	30.70
39.00	40.00			39.19	40.81	39.30	40.70
54.00	50.00			49.19	50.81	49.30	50.70
39.00	40.00			39.19	40.81	39.30	40.70
24.00	30.00			29.19	30.81	29.30	30.70
9.00	20.00			19.19	20.81	19.30	20.70
-6.00	10.00			9.19	10.81	9.30	10.70

Note: The As-Left Tolerance is changed to 1.750% span per Assumption 5.1.8 to tighten the indicator loop TLE to less than 1 psig.

1(2)ICP 13.016L (Ref. P.1 and P.2)

1(2)P-945, 947, 949 PPCS Point ID CNMT LR PRESS RED, BLU, WHT							
Input mAdc	Output			As- Found Limits		As- Left Limits	
	Ideal psig	As-Found psig	As-Left psig	Low psig	High psig	Low psig	High psig
10.00	-6.00			-6.30	-5.70	-6.30	-5.70
20.00	9.00			8.70	9.30	8.70	9.30
30.00	24.00			23.70	24.30	23.70	24.30
40.00	39.00			39.70	39.30	39.70	39.30
50.00	54.00			53.70	54.30	53.70	54.30

1(2)ICP 02.001RD, BL, WH (Ref. P.13 through P.18) and 1(2)ICP 02.020RD, BL, WH (Ref. P.21 through P.26)

1(2)PC-945A/B, 947A/B, 949A/B Containment Pressure										
Containment Pressure	Process Setpoint psig	Output (Containment Pressure)			As-Left Limits		As-Found Limits		Operability Limits	
		Setpoint Vdc	As-Found Vdc	As-Left Vdc	Low Vdc	High Vdc	Low Vdc	High Vdc	Low Vdc	High Vdc
Safety Injection	5.0	0.1733↑			0.1723	0.1743	0.1720	0.1746	0.1717	0.1749
Containment Spray Logic	25.0	0.3067↑			0.3057	0.3077	0.3054	0.3080	0.3051	0.3083
• Operability Limits • 1(2)-PC-945A, 947A, 949A ≤ 0.1749 Vdc (≤ 5.24 psig) (Ref: Calculation PBNP-IC-17)										
• Operability Limits • 1(2)-PC-945B, 947B, 949B ≤ 0.3083 Vdc (≤ 25.24 psig) (Ref: Calculation PBNP-IC-17)										

Per Section 9.9, to preserve the validity of this calculation's results, this calculation requires that all future calibrations of the equipment (addressed in this calculation) be performed using the M&TE indicated below (or better). This table needs to be implemented in the indicated calibration procedures to provide the calibrator with a list of acceptable M&TE equipment.

M&TE	Range	Accuracy
Current-to-Current Converters (output) and PPCS (Ref. P.1 and P.2)		
Fluke 45 (fast rate)	0-100 mAdc	± 0.025 mAdc (± 0.05 % RDG + 3 DG)
HP 34401A	0-100 mAdc	±0.030 mAdc (± 0.050 % RDG + 0.005% Range)
Current-to-Current Converters (input) (Ref. P.1 and P.2)		
HP 34401A	0-1.0 Vdc	±0.000027 Vdc (± 0.004 % RDG + 0.0007% Range)
Fluke 45	0-3.0 Vdc	±0.000236 Vdc (± 0.025 % RDG + 2 DG)
Fluke 8842A	0-2.0 Vdc	±0.000025 Vdc (± 0.003 % RDG + 2 DG)

PART 1 - WALKDOWN REQUEST FORM

Calculation No. WEP-SPT-20-02-B; WEP-SPT-29-01-A, WEP-SPT-35-01-A; 2005-0028

Walkdown Location (Bldg/Elev/Room/Column Lines)
Simulator Office

Scope
Determine the minor divisions for the following control room indicators:

Steam Generator pressure
Containment narrow range pressure
Low head SI flow
Containment air temperature (66' elevation)
Containment sump B temperature

References:

Data Tolerance Requirements

S&L Lead Robert L. Marsh Signature Robert Marsh/WAB Date 6-28-05

PART 2 - WALKDOWN DATA COLLECTION FORM

Results

Photographs of the control room indicators listed in Part I were reviewed. The identification numbers span, major divisions, and minor divisions for each indicator are as follows:

Steam Generator Pressure

The indicators checked are 1PI-468, 1PI-469, 1PI-479, 1PI-482A, 1PI-483A, 2PI-468, 2PI-469, 2PI-478, 2PI-479, 2PI-482A, and 2PI-483A. The span is 0 to 1400 psig. The major divisions correspond to 200 psig. The minor divisions correspond to 20 psig.

Containment Narrow Range Pressure

The indicators checked are 1PI-945, 1PI-947, PI-949, 2PI-945, 2PI-947 and 2PI-949. The span is – 6 psig to 54 psig. The major divisions correspond to 10 psig. The minor divisions correspond to 1 psig.

Low Head SI Flow

The indicators checked are 1FI-626A and 2FI-928, 2FI-626A and 2FI-928.

The span for indicators 1FI-626A and 2FI-626A is 0 to 4000 gpm. The major divisions correspond to 1000 gpm. The minor divisions correspond to 100 gpm.

The span for indicators 1FI-928 and 2FI-928 is 0 to 2500 gpm. The major divisions correspond to 500 gpm. The minor divisions correspond to 50 gpm.

Containment Air Temperature (66' Elevation)

The indicators checked are 1TI-3292, 1TI-3293, 2TI-3292, and 2TI-3293. The span is 50°F to 350°F. The major divisions correspond to 50°F. The minor divisions correspond to 5°F.

Containment Sump B Temperature

The indicators checked are 1TI-3294, 1TI-3295, 2TI-3294, and 2TI-3295. The span is 50°F to 350°F. The major divisions correspond to 50°F. The minor divisions correspond to 5°F.

Robert L. Marsh	Robert Marsh / ABS	6-28-05
Data Taker Name	Signature	Date
NICK VILLONE	N. Vil	6/28/05
Independent Verifier Name	Signature	Date