ITS NRC Questions

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NRC Question	**Pages 76 through 143 of Attachment 1, volume 8, are the proposed TS 3.3.1 Bases. TS 3.3.1 Bases are not consistent with the Bases in TSTF-493, Revision 4, including applicable errata. Please correct the TS 3.3.1 Bases or provide an explanation of the changes.**
Attach File 1	
Attach File 2	
Issue Date	**1/26/2010**
Added By	**Kristy Bucholtz**
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Notification	**NRC/LICENSEE Supervision**

Licensee Response/NRC Response/NRC Question Closure

Id	**2011**
NRC Question Number	**KAB-065**
Select Application	**Licensee Response**
Response Date/Time	**2/4/2010 6:30 AM**
Closure Statement	
Response Statement	**The Kewaunee Power Station (KPS) ITS Amendment was based upon the most current revision of TSTF-493 at the time of submittal. Since the date of the submittal, a newer revision (Rev. 4) of the TSTF has been sent to the NRC for review. KPS has reviewed this revision and appropriate changes will be made. A draft markup regarding this change is attached. This change will be reflected in the supplement to this section of the ITS conversion amendment.**
Question Closure Date	
Attachment 1	**KAB-065 Markup.pdf** (1MB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Jerry Jones** **Bryan Kays** **Ray Schiele**
Added By	**Robert Hanley**
Date Added	**2/4/2010 6:34 AM**
Modified By	
Date Modified	

All changes are ① unless otherwise noted

B 3.3 INSTRUMENTATION

Protection

B 3.3.1 Reactor Trip System (RTS) Instrumentation

P

BASES

BACKGROUND

P

The RTS initiates a unit shutdown, based on the values of selected unit parameters, to protect against violating the core fuel design limits and Reactor Coolant System (RCS) pressure boundary during anticipated operational occurrences (AOOs) and to assist the Engineered Safety Features (ESF) Systems in mitigating accidents. ②

The protection and monitoring systems have been designed to assure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RTS, as well as specifying LCOs on other reactor system parameters and equipment performance.

P

include

for variables that have significant safety functions.

LSSS are

Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that

actions

protective

Analytical

Technical Specifications are required by 10 CFR 50.36 to contain LSSS defined by the regulation as "...~~settings for~~ automatic protective ~~devices...so chosen that automatic protective action~~ will correct the abnormal situation before a Safety Limit (SL) is exceeded." The Analytic Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytic Limit therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protective devices must be chosen to be more conservative than the Analytic Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur.

Analytical

protection channels

Analytical

INSERT 1

INSERT 2

② ⑦

[Nominal Trip Setpoint (NTSP)] specified in the SCP

protection channel

Analytical

[NTSP]

channel

The trip setpoint is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the Analytic Limit and thus ensuring that the SL would not be exceeded. As such, the trip setpoint accounts for uncertainties in setting the device (e.g., calibration), uncertainties in how the device might actually perform (e.g., repeatability), changes in the point of action of the device over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the trip setpoint plays an important role in ensuring that SLs are not exceeded. As such, the trip setpoint meets the definition of an LSSS (Ref. 1) and could be used to meet the requirement that they be contained in the Technical Specifications.

[NTSP] ensures

Therefore

[NTSP]

②

INSERT 1

The LSSS values are identified and maintained in the Setpoint Control Program (SCP) controlled by 10 CFR 50.59. ⑤

②

INSERT 2

--- REVIEWER'S NOTE ---

The term "Limiting Trip Setpoint (LTSP)" is generic terminology for the calculated setting (setpoint) value calculated by means of the plant-specific setpoint methodology documented in a document controlled under 10 CFR 50.59. The term [LTSP] indicates that no additional margin has been added between the Analytical Limit and the calculated trip setting.

For most Westinghouse plants the term Nominal Trip Setpoint (NTSP) is ~~the terminology for the setpoint value calculated by means of the plant-specific setpoint methodology documented in a document subject to 10 CFR 50.59. The term NTSP indicates that no additional margin has been added between the Analytical Limit and the calculated trip setting. The NTSP would replace LTSP in the Bases descriptions. The term “field setting” is terminology for the actual setpoint implemented in the plant surveillance procedures which is standard terminology for the NTSP with additional margin applied.~~ The as-found and as-left tolerances will apply to the ~~actual setpoint (~~field setting~~)~~ implemented in the Surveillance procedures to confirm channel performance. ⑦

in place of the term LTSP and NTSP will replace LTSP in the Bases descriptions. "Field setting" is the suggested terminology for the actual setpoint where margin has been added to the calculated.

The [NTSP] and field setting are located in the SCP.

All changes are ① unless otherwise noted

P

BASES

BACKGROUND (continued)

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in Technical Specifications as "...being capable of performing its safety functions(s)." For automatic protective devices, the required safety function is to ensure that a SL is not exceeded and therefore the LSSS as defined by 10 CFR 50.36 is the same as the OPERABILITY limit for these devices. However, use of the trip setpoint to define OPERABILITY in Technical Specifications and its corresponding designation as the LSSS required by 10 CFR 50.36 would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as found" value of a protective device setting during a surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protective device with a setting that has been found to be different from the trip setpoint due to some drift of the setting may still be OPERABLE since drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the trip setpoint and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as found" setting of the protective device. Therefore, the device would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to reset the ~~device to~~ the trip setpoint to account for further drift during the next surveillance interval.

Relying solely on

[NTSP]

-

protection channel

[NTSP]

protection channel

-

channel

channel within

[NTSP]

established as-left tolerance around the

②

Use of the trip setpoint to define "as found" OPERABILITY and its designation as the LSSS under the expected circumstances described above would result in actions required by both the rule and Technical Specifications that are clearly not warranted. However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the devices and is designated as the Allowable Value which, as stated above, is the same as the LSSS.

②

The Allowable Value specified in Table 3.3.1-1 serves as the LSSS such that a channel is OPERABLE if the trip setpoint is found not to exceed the Allowable Value during the CHANNEL OPERATIONAL TEST (COT). As such, the Allowable Value differs from the trip setpoint by an amount primarily equal to the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a SL

②

All changes are ① unless otherwise noted

BASES

BACKGROUND (continued)

Protection Instrumentation Rack (PPIR)

Signal Process Control and Protection System

NTSPs derived from

Analytical Limits (ALs) ②

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with setpoints established by safety analyses. These setpoints are defined in FSAR, ~~Chapter [7] (Ref. 2), Chapter [6] (Ref. 3), and~~ Chapter [15] (Ref. 4). If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable is forwarded to the SSPS for decision evaluation. Channel separation is maintained up to and through the input bays. However, not all unit parameters require four channels of sensor measurement and signal processing. Some unit parameters provide input only to the SSPS, while others provide input to the SSPS, the main control board, the unit computer, and one or more control systems.

ALs

the

U

②

14

reactor protection logic rack

reactor protection logic rack

reactor protection logic rack

Generally, if a parameter is used only for input to the protection circuits, three channels with a two-out-of-three logic are sufficient to provide the required reliability and redundancy. If one channel fails in a direction that would not result in a partial Function trip, the Function is still OPERABLE with a two-out-of-two logic. If one channel fails, such that a partial Function trip occurs, a trip will not occur and the Function is still OPERABLE with a one-out-of-two logic.

reactor protection logic rack

Generally, if a parameter is used for input to the SSPS and a control function, four channels with a two-out-of-four logic are sufficient to provide the required reliability and redundancy. The circuit must be able to withstand both an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Again, a single failure will neither cause nor prevent the protection function actuation. These requirements are described in IEEE-279-1971 (Ref. 5). The actual number of channels required for each unit parameter is specified in Reference 2.

1968

At least

P

Two logic channels are required to ensure no single random failure of a logic channel will disable the RTS. The logic channels are designed such that testing required while the reactor is at power may be accomplished without causing trip. Provisions to allow removing logic channels from service during maintenance are unnecessary because of the logic system's designed reliability.

All changes are ① unless otherwise noted

P

BASES

BACKGROUND (continued)

Nominal Trip

Allowable Values and ~~RTS~~ Setpoints

calculation

the Nominal Trip Setpoints

P

the SCP

NTSP

The as-left tolerance and as-found tolerance band methodology is provided in ~~Ref. xyz~~.

the SCP

~~7~~

as-found

STET w/changes

The trip setpoints used in the bistables are based on the analytical limits stated in Reference 2. The ~~selection~~ of ~~these~~ ~~trip setpoints~~ is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those R~~T~~S channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 6), the Allowable Values specified in ~~Table 3.3.1-1 in the accompanying LCO~~ are conservative with respect to the analytical limits. A detailed description of the methodology used to calculate the Allowable Values and ~~trip setpoints~~, including their explicit uncertainties, is provided in the "RTS/ESFAS Setpoint Methodology Study" (Ref. 7) which incorporates all of the known uncertainties applicable to each channel. The magnitudes of these uncertainties are factored into the determination of each ~~trip setpoint~~ and corresponding Allowable Value. The trip setpoint entered into the bistable is more conservative than that specified by the Allowable Value ~~(LSSS)~~ to account for measurement errors detectable by the COT. The Allowable Value serves as the Technical Specification OPERABILITY limit for the purpose of the COT. ~~One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.~~

②

NTSP

NTSP

ensures

is

the

-

NTSP

as-left tolerance

and

NTSP

The ~~trip setpoint~~ is the value at which the bistable is set and is the expected value to be achieved during calibration. The ~~trip setpoint~~ value ~~ensures~~ the LSSS and the safety analysis limits are met for surveillance interval selected when a channel is adjusted based on stated channel uncertainties. Any bistable is considered to be properly adjusted when the "as left" ~~setpoint~~ value is within the band for CHANNEL CALIBRATION uncertainty allowance (i.e., ± rack calibration ~~+~~ comparator setting uncertainties). The ~~trip setpoint~~ value is therefore considered a "nominal" value (i.e., expressed as a value without inequalities) for the purposes of COT and CHANNEL CALIBRATION.

②

Nominal

, in conjunction with the use of as-found and as-left tolerances, together

Trip ~~s~~etpoints ~~consistent~~ with the requirements of the Allowable Value ensure that SLs are not violated during AOOs (and that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed).

②

Note that the Allowable Values listed in the SCP are the least conservative value of the as-found setpoint that a channel can have during a periodic CHANNEL CALIBRATION, CHANNEL OPERATIONAL TEST, or a TRIP ACTUATING DEVICE OPERATIONAL TEST that requires trip setpoint verification.

All changes are ① unless otherwise noted

BASES

BACKGROUND (continued)

RPIR RPIR

During normal operation the output from the SSPS is a voltage signal that energizes the undervoltage coils in the RTBs and bypass breakers, if in use. When the required logic matrix combination is completed, the SSPS output voltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs and bypass breakers are tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each breaker is also equipped with a shunt trip device that is energized to trip the breaker open upon receipt of a reactor trip signal from the SSPS. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself, thus providing a diverse trip mechanism.

RPIR

2 ⑩

The decision logic matrix Functions are described in the functional diagrams included in Reference 3. In addition to the reactor trip or ESF, these diagrams also describe the various "permissive interlocks" that are associated with unit conditions. Each train has a built in testing device that can automatically test the decision logic matrix Functions and the actuation devices while the unit is at power. When any one train is taken out of service for testing, the other train is capable of providing unit monitoring and protection until the testing has been completed. The testing device is semiautomatic to minimize testing time.

panel channels ②

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

P

The RTS functions to maintain the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted.

INSERT 3 ②

P P P P

Each of the analyzed accidents and transients can be detected by one or more RTS Functions. The accident analysis described in Reference 4 takes credit for most RTS trip Functions. RTS trip Functions not specifically credited in the accident analysis are qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the unit. These RTS trip Functions may provide protection for conditions that do not require dynamic transient analysis to demonstrate Function performance. They may also serve as backups to RTS trip Functions that were credited in the accident analysis.

P

Permissive and interlock setpoints allow the blocking of trips during plant startups, and restoration of trips when the permissive conditions are not satisfied, but they are not explicitly modeled in the Safety Analyses. These permissives and interlocks ensure that the starting conditions are consistent with the safety analysis, before perventive or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values without regard to measurement accuracy.

The LCO requires all instrumentation performing an RTS Function, listed in Table 3.3.1-1 ~~in the accompanying LCO~~, to be OPERABLE. A channel is OPERABLE with a trip setpoint value outside its calibration tolerance band provided the trip setpoint "as-found" value does not exceed its ②

②

INSERT 4

within the as-found tollerance and is

The Allowable Value specified in the SCP is the least conservative value of the as-found setpoint that the channel can have when tested, such that a channel is OPERABLE if the as-found setpoint is conservative with respect to the Allowable Value during a CHANNEL CALIBRATION, or CHANNEL OPERATIONAL TEST (COT). As such, the Allowable Value differs from the [NTSP] by an amount [greater than or] equal to the expected instrument channel uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the channel ([NTSP]) will ensure that a SL is not exceeded at any given point of time as long as the channel has not drifted beyond ~~that~~ expected during the surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria). ④

tolerances

In this manner, the actual setting of the channel (NTSP) will ensure that a SL is not exceeded at any given point of time as long as the channel has not drifted beyond expected tolerances during the surveillance intervals.

~~However, there is also some point beyond which the channel may not be able to perform its function due to, for example, greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the devices and is designated as the Allowable Value.~~ If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded ~~because a potential degraded condition has been identified. During the SR performance the condition of the channel will be evaluated~~. This evaluation will consist of resetting the channel setpoint to the [NTSP] (within the allowed tolerance), and the channel's response ~~evaluated.~~ If the channel is functioning as required and is expected to pass the next surveillance, then the channel can be restored to service at the completion of the surveillance. ~~If any of the above described evaluations determine that the channel is not performing as expected the channel is degraded and its operability status cannot be verified, therefore it is inoperable because it may not perform its protective functions if needed before the next surveillance test. If the channel setpoint cannot be reset to the [NTSP], or if the actual setting of the channel is found to be non-conservative with respect to the Allowable Value, the channel is inoperable.~~ After the surveillance is completed, the channel's as-found setting will be entered into the Corrective Action Program for further evaluation. ④ ④

. The degraded condition of the channel will be further evaluated during performance of the SR.

evaluatiing

is OPERABLE and

A trip setpoint may be set more conservative that the [NTSP] as necessary in response to plant conditions. However, in this case, the operability of this instrument must be verified based on the [field setting] and not the NTSP. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions. ④ ④

All changes are ① unless otherwise noted

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3. Power Range Neutron Flux Rate

The Power Range Neutron Flux Rate trips use the same channels as discussed for Function 2 above.

a. Power Range Neutron Flux - High Positive Rate

The Power Range Neutron Flux - High Positive Rate trip Function ensures that protection is provided against rapid increases in neutron flux that are characteristic of an RCCA drive rod housing rupture and the accompanying ejection of the RCCA. This Function compliments the Power Range Neutron Flux - High and Low Setpoint trip Functions to ensure that the criteria are met for a rod ejection from the power range.

The LCO requires all four of the Power Range Neutron Flux - High Positive Rate channels to be OPERABLE.

In MODE 1 or 2, when there is a potential to add a large amount of positive reactivity from a rod ejection accident (REA), the Power Range Neutron Flux - High Positive Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux - High Positive Rate trip Function does not have to be

P

OPERABLE because other R~~T~~S trip Functions and administrative controls will provide protection against positive reactivity additions. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA. In MODE 6, no rods are withdrawn and the SDM is increased during refueling operations. The reactor vessel head is also removed or the closure bolts are detensioned preventing any pressure buildup. In addition, the NIS power range detectors cannot detect neutron levels present in this mode.

b. Power Range Neutron Flux - High Negative Rate

The Power Range Neutron Flux - High Negative Rate trip Function ensures that protection is provided for multiple rod drop accidents. At high power levels, a multiple rod drop accident could cause local flux peaking that would result in an ~~unconservative~~ local DNBR. DNBR is defined as the ratio of the

nonconservative

All changes are ① unless otherwise noted

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

- pressurizer pressure - the Trip Setpoint is varied to correct for changes in system pressure~~,~~ ; and ③

- axial power distribution - f(ΔI), the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the NIS upper and lower power range detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range detectors, the Trip Setpoint is reduced in accordance with ~~Note 1 of Table 3.3.1-1~~. ②

STET w/changes

the SCP

Dynamic compensation is included for system piping delays from the core to the temperature measurement system.

STET w/changes

the SCP

The Overtemperature ΔT trip Function is calculated for each loop as described in ~~Note 1 of Table 3.3.1-1~~. Trip occurs if Overtemperature ΔT is indicated in two loops. At some units, the pressure and temperature signals are used for other control functions. For those units, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overtemperature ΔT condition and may prevent a reactor trip. ②

The LCO requires all four channels of the Overtemperature ΔT trip Function to be OPERABLE for two and four loop units (the LCO requires all three channels on the Overtemperature ΔT trip Function to be OPERABLE for three loop units). Note that the Overtemperature ΔT Function receives input from channels shared with other R~~T~~S Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions. ⑤

P

In MODE 1 or 2, the Overtemperature ΔT trip must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

All changes are ① unless otherwise noted

P

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

7. Overpower ΔT

The Overpower ΔT trip Function ensures that protection is provided to ensure the integrity of the fuel (i.e., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions. This trip Function also limits the required range of the Overtemperature ΔT trip Function and provides a backup to the Power Range Neutron Flux - High Setpoint trip. The Overpower ΔT trip Function ensures that the allowable heat generation rate (kW/ft) of the fuel is not exceeded. It uses the ΔT of each loop as a measure of reactor power with a setpoint that is automatically varied with the following parameters:

- reactor coolant average temperature - the Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature~~,~~ and ; ③
- rate of change of reactor coolant average temperature - including dynamic compensation for the delays between the core and the temperature measurement system.

STET w/changes

the SCP

The Overpower ΔT trip Function is calculated for each loop as per ~~Note 2 of Table 3.3.1-1~~. Trip occurs if Overpower ΔT is indicated in two loops. At some units, the temperature signals are used for other control functions. At those units, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation and a single failure in the remaining channels providing the protection function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Allowable Value. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overpower ΔT condition and may prevent a reactor trip. ②

The LCO requires four channels for two and four loop units (three channels for three loop units) of the Overpower ΔT trip Function to be OPERABLE. Note that the Overpower ΔT trip Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions. ⑤ P

All changes are ① unless otherwise noted

P

BASES

ACTIONS

-----------------------------------REVIEWER'S NOTE-----------------------------------
In Table 3.3.1-1, Functions 11.a and 11.b were not included in the generic evaluations approved in either WCAP-10271, as supplemented, WCAP-15376, or WCAP-14333. In order to apply the WCAP-10271, as supplemented, and WCAP-15376 or WCAP-14333 TS relaxations to plant specific Functions not evaluated generically, licensees must submit plant specific evaluations for NRC review and approval.
--- ⑦

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.1-1.

[NTSP]

~~SCP~~

In the event a channel's Trip Setpoint is found non-conservative with respect to the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected. STET ②

or the channel is not functioning as required,

When the number of inoperable channels in a trip Function exceed those specified in one or other related Conditions associated with a trip Function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 must be immediately entered if applicable in the current MODE of operation.

-----------------------------------REVIEWER'S NOTE-----------------------------------
Certain LCO Completion Times are based on approved topical reports. In order for a licensee to use these times, the licensee must justify the Completion Times as required by the staff Safety Evaluation Report (SER) for the topical report.
--- ⑦

A.1

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Condition A applies to all RTS protection Functions. Condition A addresses the situation where one or more required channels or trains for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.1-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

All changes are ① unless otherwise noted

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.7

SR 3.3.1.7 is the performance of a COT every 184 days.

INSERT 5 ②

A COT is performed on each required channel to ensure the entire channel will perform the intended Function. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable COT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions.

~~INSERT 5~~ (~~2~~)

~~Setpoints must be within the Allowable Values specified in Table 3.3.1-1.~~ ②

~~The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology. The setpoint shall be left set consistent with the assumptions of the current unit specific setpoint methodology.~~ ②

~~The "as found" and "as left" values must also be recorded and reviewed for consistency with the assumptions of Reference 9.~~ ②

SR 3.3.1.7 is modified by a Note that provides a 4 hour~~s~~ delay in the requirement to perform this Surveillance for source range instrumentation when entering MODE 3 from MODE 2. This Note allows a normal shutdown to proceed without a delay for testing in MODE 2 and for a short time in MODE 3 until the RTBs are open and SR 3.3.1.7 is no longer required to be performed. If the unit is to be in MODE 3 with the RTBs closed for > 4 hours this Surveillance must be performed prior to 4 hours after entry into MODE 3. ⑥

The Frequency of 184 days is justified in Reference 9.

②

INSERT 5

~~COT must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the COT.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

②

INSERT 6

~~COT must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the COT.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

All changes are ①
unless otherwise noted

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.9

SR 3.3.1.9 is the performance of a TADOT and is performed every [92] days, as justified in Reference 9. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. ④

The SR is modified by a Note that excludes verification of setpoints from the TADOT. Since this SR applies to RCP undervoltage and underfrequency relays, setpoint verification requires elaborate bench calibration and is accomplished during the CHANNEL CALIBRATION.

SR 3.3.1.10

A CHANNEL CALIBRATION is performed every [18] months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. ④

INSERT 7

~~CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the unit specific setpoint methodology. The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology.~~ ② ②

The Frequency of 18 months is based on the assumption of an 18 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.

SR 3.3.1.10 is modified by a Note stating that this test shall include verification that the time constants are adjusted to the prescribed values where applicable. ⑤

②

INSERT 7

~~in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the CHANNEL CALIBRATION.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

All changes are ① unless otherwise noted

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.11

~~INSERT 8~~ INSERT 8 SR 3.3.1.11 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every [18] months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. The CHANNEL CALIBRATION for the power range neutron detectors consists of a normalization of the detectors based on a power calorimetric and flux map performed above 15% RTP. The CHANNEL CALIBRATION for the source range and intermediate range neutron detectors consists of obtaining the detector plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data. This Surveillance is not required for the NIS power range detectors for entry into MODE 2 or 1, and is not required for the NIS intermediate range detectors for entry into MODE 2, because the unit must be in at least MODE 2 to perform the test for the intermediate range detectors and MODE 1 for the power range detectors. 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 these components usually pass the Surveillance when performed on the [18] month Frequency. ④ ② ④ ④

SR 3.3.1.12

INSERT 9 SR 3.3.1.12 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every [18] months. ¶ This SR is modified by a Note stating that this test shall include verification of the RCS resistance temperature detector (RTD) bypass loop flow rate. Whenever a sensing element is replaced, the next required CHANNEL CALIBRATION of the resistance temperature detectors (RTD) sensors is accomplished by an inplace cross calibration that compares the other sensing elements with the recently installed sensing element. ④ ②

This test will verify the rate lag compensation for flow from the core to the RTDs.

The Frequency is justified by the assumption of an 18 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

②

INSERT 8

~~CHANNEL CALIBRATIONS must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the CHANNEL CALIBRATION.~~

②

INSERT 9

~~CHANNEL CALIBRATIONS must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the CHANNEL CALIBRATION.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

Licensee Response/NRC Response/NRC Question Closure

Id	**2191**
NRC Question Number	**KAB-065**
Select Application	**NRC Response**
Response Date/Time	**2/16/2010 9:50 AM**
Closure Statement	
Response Statement	**Kewaunee's markup is consistent with TSTF 493 revision 4 and errata, with one exception. Please remove the following phrase, "The specific as-found values to ensure that the channel is OPERABLE and that Safety Limits are not exceeded are specified in the SCP." from the bottom of Attachment 1, Volume 8, Page 80 of 517 to be consistent with TSTF 493 errata.**
Question Closure Date	
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**2/16/2010 8:49 AM**
Modified By	
Date Modified	

Licensee Response/NRC Response/NRC Question Closure

Id	**2341**
NRC Question Number	**KAB-065**
Select Application	**Licensee Response**
Response Date/Time	**2/26/2010 2:45 PM**
Closure Statement	
Response Statement	**KPS has reviewed the errata to TSTF-493, Rev. 4 and determined that the draft markup attached to the previous KPS response to KAB-065 did not include three changes, one of which is identified in the NRC reviewer's follow-up question. A draft markup regarding these changes is attached, and supersedes the previous draft markup. Changes from the previous markup are identified in green (see pages 2, 4, and 7 of the attachment). These changes will be reflected in the supplement to this section of the ITS conversion amendment.**
Question Closure Date	
Attachment 1	**KAB-065 Rev 1 Markup (3).pdf** (1MB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Robert Hanley** **Jerry Jones** **Bryan Kays**
Added By	**David Mielke**
Date Added	**2/26/2010 2:49 PM**
Modified By	
Date Modified	

All changes are ① unless otherwise noted

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Trip System (RTS) Instrumentation

Protection P

BASES

BACKGROUND

P

The RTS initiates a unit shutdown, based on the values of selected unit parameters, to protect against violating the core fuel design limits and Reactor Coolant System (RCS) pressure boundary during anticipated operational occurrences (AOOs) and to assist the Engineered Safety Features (ESF) Systems in mitigating accidents. ②

The protection and monitoring systems have been designed to assure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RTS, as well as specifying LCOs on other reactor system parameters and equipment performance.

P

include

for variables that have significant safety functions.

Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that

LSSS are

actions

protective

Analytical

Technical Specifications are required by 10 CFR 50.36 to contain LSSS defined by the regulation as "...~~settings for~~ automatic protective ~~devices...so chosen that automatic protective action~~ will correct the abnormal situation before a Safety Limit (SL) is exceeded." The Analytic Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytic Limit therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protective devices must be chosen to be more conservative than the Analytic Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur.

Analytical

protection channels

Analytical

INSERT 1

INSERT 2

② ⑦

Nominal Trip Setpoint (NTSP) specified in the SCP

protection channel

Analytical

NTSP

channel

The trip setpoint is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the Analytic Limit and thus ensuring that the SL would not be exceeded. As such, the trip setpoint accounts for uncertainties in setting the device (e.g., calibration), uncertainties in how the device might actually perform (e.g., repeatability), changes in the point of action of the device over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the trip setpoint plays an important role in ensuring that SLs are not exceeded. As such, the trip setpoint meets the definition of an LSSS (Ref. 1) and could be used to meet the requirement that they be contained in the Technical Specifications.

NTSP ensures

Therefore

NTSP

②

INSERT 1

The LSSS values are identified and maintained in the Setpoint Control Program (SCP) controlled by 10 CFR 50.59. ⑤

②

INSERT 2

field

-- REVIEWER'S NOTE --
The term "Limiting Trip Setpoint (LTSP)" is generic terminology for the calculated setting (setpoint) value calculated by means of the plant-specific setpoint methodology documented in a document controlled under 10 CFR 50.59. The term [LTSP] indicates that no additional margin has been added between the Analytical Limit and the calculated trip setting.

For most Westinghouse plants the term Nominal Trip Setpoint (NTSP) is ~~the terminology for the setpoint value calculated by means of the plant-specific setpoint methodology documented in a document subject to 10 CFR 50.59. The term NTSP indicates that no additional margin has been added between the Analytical Limit and the calculated trip setting. The NTSP would replace LTSP in the Bases descriptions. The term "field setting" is terminology for the actual setpoint implemented in the plant surveillance procedures which is standard terminology for the NTSP with additional margin applied.~~ The as-found and as-left tolerances will apply to the ~~actual setpoint (~~field setting~~)~~ implemented in the Surveillance procedures to confirm channel performance. ⑦

in place of the term LTSP and NTSP will replace LTSP in the Bases descriptions. "Field setting" is the suggested terminology for the actual setpoint where margin has been added to the calculated.

field setting

The [NTSP] and field setting are located in the SCP.

All changes are ① unless otherwise noted

P

BASES

BACKGROUND (continued)

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in Technical Specifications as "...being capable of performing its safety functions(s)." For automatic protective devices, the required safety function is to ensure that a SL is not exceeded and therefore the LSSS as defined by 10 CFR 50.36 is the same as the OPERABILITY limit for these devices. However, use of the trip setpoint to define OPERABILITY in Technical Specifications and its corresponding designation as the LSSS required by 10 CFR 50.36 would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as found" value of a protective device setting during a surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protective device with a setting that has been found to be different from the trip setpoint due to some drift of the setting may still be OPERABLE since drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the trip setpoint and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as found" setting of the protective device. Therefore, the device would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to reset the ~~device to~~ the trip setpoint to account for further drift during the next surveillance interval.

Relying solely on

[NTSP]

-

protection channel

[NTSP]

protection channel

-

channel

channel within

[NTSP]

established as-left tolerance around the

②

Use of the trip setpoint to define "as found" OPERABILITY and its designation as the LSSS under the expected circumstances described above would result in actions required by both the rule and Technical Specifications that are clearly not warranted. However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the devices and is designated as the Allowable Value which, as stated above, is the same as the LSSS.

②

The Allowable Value specified in Table 3.3.1-1 serves as the LSSS such that a channel is OPERABLE if the trip setpoint is found not to exceed the Allowable Value during the CHANNEL OPERATIONAL TEST (COT). As such, the Allowable Value differs from the trip setpoint by an amount primarily equal to the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a SL

②

All changes are ① unless otherwise noted

BASES

BACKGROUND (continued)

The R~~T~~P S instrumentation is segmented into four distinct but interconnected modules as illustrated in Figure ~~[ ]~~ 7.2-2, ~~F~~U SAR, Chapter ~~[7]~~ 14 (Ref. ~~2~~ 4), and as identified below: ④

1. Field transmitters or process sensors: provide a measurable electronic signal based upon the physical characteristics of the parameter being measured~~,~~ ; ③
2. ~~Signal~~ Process Protection Instrumentation Rack (PPIR) ~~Control and Protection System~~, including Reactor Analog Protection ~~System,~~ Channels and Nuclear Instrumentation ~~System (NIS), field~~ Channels ~~contacts, and protection channel sets~~: provides signal conditioning, bistable setpoint comparison, ~~process algorithm actuation,~~ ~~compatible~~ bistable electrical signal output to protection system ~~devices~~ channels, and control board/control room/miscellaneous indications~~,~~ ; ② ③
3. ~~Solid State Protection System (SSPS)~~ Reactor Protection Logic Rack, including input, logic, and output ~~bays~~ racks: initiates proper unit shutdown and/or ESF actuation in accordance with the defined logic, which is based on the bistable outputs from the ~~signal process control and protection system,~~ reactor protection logic rack; and ③
4. Reactor trip switchgear, including reactor trip breakers (RTBs) and bypass breakers: provides the means to interrupt power to the control rod drive mechanisms (CRDMs) and allows the rod cluster control assemblies (RCCAs), or "rods," to fall into the core and shut down the reactor. The bypass breakers allow testing of the RTBs at power.

Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, more than one, and often as many as four, field transmitters or sensors are used to measure unit parameters. To account for the calibration tolerances and instrument drift, which are assumed to occur between calibrations, statistical allowances are provided in the ~~trip setpoint~~ ~~[~~NTSP~~]~~ and Allowable Value~~s~~. The OPERABILITY of each transmitter or sensor is determined by either "as-found" calibration data evaluated during the CHANNEL CALIBRATION or by qualitative assessment of field transmitter or sensor as related to the channel behavior observed during performance of the CHANNEL CHECK. ~~The specific as-found values to ensure that the channel is OPERABLE and that Safety Limits are not exceeded are specified in the SCP.~~ ② ②

All changes are ①
unless otherwise noted

BASES

BACKGROUND (continued)

Protection Instrumentation Rack (PPIR)

NTSPs derived from

Analytical Limits (ALs) ②

Signal Process Control and Protection System

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with setpoints established by safety analyses. These setpoints are defined in FSAR, ~~Chapter [7] (Ref. 2), Chapter [6] (Ref. 3), and~~ Chapter [15] (Ref. 4). If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable is forwarded to the SSPS for decision evaluation. Channel separation is maintained up to and through the input bays. However, not all unit parameters require four channels of sensor measurement and signal processing. Some unit parameters provide input only to the SSPS, while others provide input to the SSPS, the main control board, the unit computer, and one or more control systems.

ALs

the

U

②

14

reactor protection logic rack

reactor protection logic rack

reactor protection logic rack

Generally, if a parameter is used only for input to the protection circuits, three channels with a two-out-of-three logic are sufficient to provide the required reliability and redundancy. If one channel fails in a direction that would not result in a partial Function trip, the Function is still OPERABLE with a two-out-of-two logic. If one channel fails, such that a partial Function trip occurs, a trip will not occur and the Function is still OPERABLE with a one-out-of-two logic.

reactor protection logic rack

Generally, if a parameter is used for input to the SSPS and a control function, four channels with a two-out-of-four logic are sufficient to provide the required reliability and redundancy. The circuit must be able to withstand both an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Again, a single failure will neither cause nor prevent the protection function actuation. These requirements are described in IEEE-279-1971 (Ref. 5). The actual number of channels required for each unit parameter is specified in Reference 2.

1968

At least

P

Two logic channels are required to ensure no single random failure of a logic channel will disable the RTS. The logic channels are designed such that testing required while the reactor is at power may be accomplished without causing trip. Provisions to allow removing logic channels from service during maintenance are unnecessary because of the logic system's designed reliability.

All changes are ① unless otherwise noted

P

BASES

BACKGROUND (continued)

Nominal Trip

Allowable Values and RTS Setpoints

the

Nominal Trip Setpoints

calculation

The trip setpoints used in the bistables are based on the analytical limits stated in Reference 2. The ~~selection~~ of ~~these~~ trip setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RTS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 6), the Allowable Values specified in Table 3.3.1-1 in the accompanying LCO are conservative with respect to the analytical limits. A detailed description of the methodology used to calculate the Allowable Values and trip setpoints, including their explicit uncertainties, is provided in the "RTS/ESFAS Setpoint Methodology Study" (Ref. 7) which incorporates all of the known uncertainties applicable to each channel. The magnitudes of these uncertainties are factored into the determination of each trip setpoint and corresponding Allowable Value. The trip setpoint entered into the bistable is more conservative than that specified by the Allowable Value (LSSS) to account for measurement errors detectable by the COT. The Allowable Value serves as the Technical Specification OPERABILITY limit for the purpose of the COT. ~~One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.~~

P

the SCP

②

[NTSP]

The as-left tolerance and as-found tolerance band methodology is provided in ~~Ref. xyz~~.

the SCP

7

as-found

STET w/changes

[NTSP]

ensures

is

-

[NTSP]

[NTSP]

The trip setpoint is the value at which the bistable is set and is the expected value to be achieved during calibration. The trip setpoint value ensures the LSSS and the safety analysis limits are met for surveillance interval selected when a channel is adjusted based on stated channel uncertainties. Any bistable is considered to be properly adjusted when the "as left" setpoint value is within the band for CHANNEL CALIBRATION uncertainty allowance (i.e., ± rack calibration + comparator setting uncertainties). The trip setpoint value is therefore considered a "nominal" value (i.e., expressed as a value without inequalities) for the purposes of COT and CHANNEL CALIBRATION.

[NTSP]

the

②

as-left tolerance

and

[Nominal

]

, in conjunction with the use of as-found and as-left tolerances, together

Trip Setpoints consistent with the requirements of the Allowable Value ensure that SLs are not violated during AOOs (and that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed).

②

Note that the Allowable Values listed in the SCP are the least conservative value of the as-found setpoint that a channel can have during a periodic CHANNEL CALIBRATION, CHANNEL OPERATIONAL TEST, or a TRIP ACTUATING DEVICE OPERATIONAL TEST that requires trip setpoint verification.

All changes are ① unless otherwise noted

BASES

BACKGROUND (continued)

RPIR

RPIR

During normal operation the output from the SSPS is a voltage signal that energizes the undervoltage coils in the RTBs and bypass breakers, if in use. When the required logic matrix combination is completed, the SSPS output voltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs and bypass breakers are tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each breaker is also equipped with a shunt trip device that is energized to trip the breaker open upon receipt of a reactor trip signal from the SSPS. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself, thus providing a diverse trip mechanism.

RPIR

2

The decision logic matrix Functions are described in the functional diagrams included in Reference 3. In addition to the reactor trip or ESF, these diagrams also describe the various "permissive interlocks" that are associated with unit conditions. Each train has a built in testing device that can automatically test the decision logic matrix Functions and the actuation devices while the unit is at power. When any one train is taken out of service for testing, the other train is capable of providing unit monitoring and protection until the testing has been completed. The testing device is semiautomatic to minimize testing time.

⑩ panel channels ②

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

P

The RTS functions to maintain the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted.

INSERT 3 ②

P P P

Each of the analyzed accidents and transients can be detected by one or more RTS Functions. The accident analysis described in Reference 4 takes credit for most RTS trip Functions. RTS trip Functions not specifically credited in the accident analysis are ~~qualitatively~~ credited in the safety analysis and the NRC staff approved licensing basis for the unit. These RTS trip Functions may provide protection for conditions that do not require dynamic transient analysis to demonstrate Function performance. They may also serve as backups to RTS trip Functions that were credited in the accident analysis.

implicitly

P

Permissive and interlock setpoints allow the blocking of trips during plant startups, and restoration of trips when the permissive conditions are not satisfied, but they are not explicitly modeled in the Safety Analyses. These permissives and interlocks ensure that the starting conditions are consistent with the safety analysis, before perventive or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values without regard to measurement accuracy.

P

The LCO requires all instrumentation performing an RTS Function, listed in Table 3.3.1-1 ~~in the accompanying LCO~~, to be OPERABLE. A channel is OPERABLE with a trip setpoint value outside its calibration tolerance band provided the trip setpoint "as-found" value does not exceed its

②

②

INSERT 4

The Allowable Value specified in the SCP is the least conservative value of the as-found setpoint that the channel can have when tested, such that a channel is OPERABLE if the as-found setpoint is conservative with respect to the Allowable Value during a CHANNEL CALIBRATION, or CHANNEL OPERATIONAL TEST (COT). As such, the Allowable Value differs from the [NTSP] by an amount [greater than or] equal to the expected instrument channel uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the channel ([NTSP]) will ensure that a SL is not exceeded at any given point of time as long as the channel has not drifted beyond ~~that~~ expected during the surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria).

④

within the as-found tollerance and is

tolerances

In this manner, the actual setting of the channel (NTSP) will ensure that a SL is not exceeded at any given point of time as long as the channel has not drifted beyond expected tolerances during the surveillance intervals.

~~However, there is also some point beyond which the channel may not be able to perform its function due to, for example, greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the devices and is designated as the Allowable Value.~~ If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded ~~because a potential degraded condition has been identified. During the SR performance the condition of the channel will be evaluated~~. This evaluation will consist of resetting the channel setpoint to the [NTSP] (within the allowed tolerance), and the channel's response ~~evaluated.~~ If the channel is functioning as required and is expected to pass the next surveillance, then the channel can be restored to service at the completion of the surveillance. ~~If any of the above described evaluations determine that the channel is not performing as expected the channel is degraded and its operability status cannot be verified, therefore it is inoperable because it may not perform its protective functions if needed before the next surveillance test. If the channel setpoint cannot be reset to the [NTSP], or if the actual setting of the channel is found to be non-conservative with respect to the Allowable Value, the channel is inoperable.~~ After the surveillance is completed, the channel's as-found setting will be entered into the Corrective Action Program for further evaluation.

. The degraded condition of the channel will be further evaluated during performance of the SR.

evaluatiing ④

is OPERABLE and

④

A trip setpoint may be set more conservative that the [NTSP] as necessary in response to plant conditions. However, in this case, the operability of this instrument must be verified based on the [field setting] and not the NTSP. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

④

④

All changes are ① unless otherwise noted

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3. Power Range Neutron Flux Rate

The Power Range Neutron Flux Rate trips use the same channels as discussed for Function 2 above.

a. Power Range Neutron Flux - High Positive Rate

The Power Range Neutron Flux - High Positive Rate trip Function ensures that protection is provided against rapid increases in neutron flux that are characteristic of an RCCA drive rod housing rupture and the accompanying ejection of the RCCA. This Function compliments the Power Range Neutron Flux - High and Low Setpoint trip Functions to ensure that the criteria are met for a rod ejection from the power range.

The LCO requires all four of the Power Range Neutron Flux - High Positive Rate channels to be OPERABLE.

In MODE 1 or 2, when there is a potential to add a large amount of positive reactivity from a rod ejection accident (REA), the Power Range Neutron Flux - High Positive Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux - High Positive Rate trip Function does not have to be OPERABLE because other R~~T~~PS trip Functions and administrative controls will provide protection against positive reactivity additions. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA. In MODE 6, no rods are withdrawn and the SDM is increased during refueling operations. The reactor vessel head is also removed or the closure bolts are detensioned preventing any pressure buildup. In addition, the NIS power range detectors cannot detect neutron levels present in this mode.

b. Power Range Neutron Flux - High Negative Rate

The Power Range Neutron Flux - High Negative Rate trip Function ensures that protection is provided for multiple rod drop accidents. At high power levels, a multiple rod drop accident could cause local flux peaking that would result in an ~~unconservative~~ nonconservative local DNBR. DNBR is defined as the ratio of the

All changes are ①
unless otherwise noted

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

- pressurizer pressure - the Trip Setpoint is varied to correct for changes in system pressure, and ; ③

- axial power distribution - f(ΔI), the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the NIS upper and lower power range detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range detectors, the Trip Setpoint is reduced in accordance with ~~Note 1 of Table 3.3.1-1~~. ②

STET w/changes

the SCP

Dynamic compensation is included for system piping delays from the core to the temperature measurement system.

STET w/changes

the SCP

The Overtemperature ΔT trip Function is calculated for each loop as described in ~~Note 1 of Table 3.3.1-1~~. Trip occurs if Overtemperature ΔT is indicated in two loops. At some units, the pressure and temperature signals are used for other control functions. For those units, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overtemperature ΔT condition and may prevent a reactor trip. ②

The LCO requires all four channels of the Overtemperature ΔT trip Function to be OPERABLE for two and four loop units (the LCO requires all three channels on the Overtemperature ΔT trip Function to be OPERABLE for three loop units). Note that the Overtemperature ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions. ⑤

P

In MODE 1 or 2, the Overtemperature ΔT trip must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

All changes are ① unless otherwise noted

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

7. Overpower ΔT

The Overpower ΔT trip Function ensures that protection is provided to ensure the integrity of the fuel (i.e., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions. This trip Function also limits the required range of the Overtemperature ΔT trip Function and provides a backup to the Power Range Neutron Flux - High Setpoint trip. The Overpower ΔT trip Function ensures that the allowable heat generation rate (kW/ft) of the fuel is not exceeded. It uses the ΔT of each loop as a measure of reactor power with a setpoint that is automatically varied with the following parameters:

- reactor coolant average temperature - the Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature, and ; ③
- rate of change of reactor coolant average temperature - including dynamic compensation for the delays between the core and the temperature measurement system.

STET w/changes ②

the SCP

The Overpower ΔT trip Function is calculated for each loop as per ~~Note 2 of Table 3.3.1-1~~. Trip occurs if Overpower ΔT is indicated in two loops. At some units, the temperature signals are used for other control functions. At those units, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation and a single failure in the remaining channels providing the protection function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Allowable Value. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overpower ΔT condition and may prevent a reactor trip.

The LCO requires four channels for two and four loop units (three channels for three loop units) of the Overpower ΔT trip Function to be OPERABLE. Note that the Overpower ΔT trip Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions. ⑤ P

All changes are ①

unless otherwise noted

BASES

ACTIONS

~~-----------------------------------REVIEWER'S NOTE------------------------------------
In Table 3.3.1-1, Functions 11.a and 11.b were not included in the generic evaluations approved in either WCAP-10271, as supplemented, WCAP-15376, or WCAP-14333. In order to apply the WCAP-10271, as supplemented, and WCAP-15376 or WCAP-14333 TS relaxations to plant specific Functions not evaluated generically, licensees must submit plant specific evaluations for NRC review and approval.
---~~

⑦

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.1-1.

[NTSP]

~~SCP~~

In the event a channel's Trip Setpoint is found non-conservative with respect to the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected.

STET ②

or the channel is not functioning as required,

When the number of inoperable channels in a trip Function exceed those specified in one or other related Conditions associated with a trip Function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 must be immediately entered if applicable in the current MODE of operation.

~~-----------------------------------REVIEWER'S NOTE------------------------------------
Certain LCO Completion Times are based on approved topical reports. In order for a licensee to use these times, the licensee must justify the Completion Times as required by the staff Safety Evaluation Report (SER) for the topical report.
---~~

⑦

A.1

P

Condition A applies to all R~~T~~S protection Functions. Condition A addresses the situation where one or more required channels or trains for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.1-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

All changes are ①
unless otherwise noted

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.7

SR 3.3.1.7 is the performance of a COT every 184 days.

INSERT 5 ②

A COT is performed on each required channel to ensure the entire channel will perform the intended Function. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable COT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions.

~~INSERT 5~~ ~~2~~

~~Setpoints must be within the Allowable Values specified in Table 3.3.1-1.~~ ②

~~The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology. The setpoint shall be left set consistent with the assumptions of the current unit specific setpoint methodology.~~ ②

~~The "as found" and "as left" values must also be recorded and reviewed for consistency with the assumptions of Reference 9.~~ ②

SR 3.3.1.7 is modified by a Note that provides a 4 hours delay in the requirement to perform this Surveillance for source range instrumentation when entering MODE 3 from MODE 2. This Note allows a normal shutdown to proceed without a delay for testing in MODE 2 and for a short time in MODE 3 until the RTBs are open and SR 3.3.1.7 is no longer required to be performed. If the unit is to be in MODE 3 with the RTBs closed for > 4 hours this Surveillance must be performed prior to 4 hours after entry into MODE 3. ⑥

The Frequency of 184 days is justified in Reference 9.

②

INSERT 5

~~COT must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the COT.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

②

INSERT 6

~~COT must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the COT.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

All changes are ① unless otherwise noted

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.9

SR 3.3.1.9 is the performance of a TADOT and is performed every [92] days, as justified in Reference 9. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. ④

The SR is modified by a Note that excludes verification of setpoints from the TADOT. Since this SR applies to RCP undervoltage and underfrequency relays, setpoint verification requires elaborate bench calibration and is accomplished during the CHANNEL CALIBRATION.

SR 3.3.1.10

A CHANNEL CALIBRATION is performed every [18] months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. ④

INSERT 7

~~CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the unit specific setpoint methodology. The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology.~~ ② ②

The Frequency of 18 months is based on the assumption of an 18 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.

SR 3.3.1.10 is modified by a Note stating that this test shall include verification that the time constants are adjusted to the prescribed values where applicable. ⑤

②

INSERT 7

~~in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the CHANNEL CALIBRATION.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

All changes are ① unless otherwise noted

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.11

~~INSERT 8~~

INSERT 8

SR 3.3.1.11 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every [18] months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. The CHANNEL CALIBRATION for the power range neutron detectors consists of a normalization of the detectors based on a power calorimetric and flux map performed above 15% RTP. The CHANNEL CALIBRATION for the source range and intermediate range neutron detectors consists of obtaining the detector plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data. This Surveillance is not required for the NIS power range detectors for entry into MODE 2 or 1, and is not required for the NIS intermediate range detectors for entry into MODE 2, because the unit must be in at least MODE 2 to perform the test for the intermediate range detectors and MODE 1 for the power range detectors. 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 these components usually pass the Surveillance when performed on the [18] month Frequency. ④ ② ④ ④

SR 3.3.1.12

INSERT 9

SR 3.3.1.12 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every [18] months. ¶ This SR is modified by a Note stating that this test shall include verification of the RCS resistance temperature detector (RTD) bypass loop flow rate. Whenever a sensing element is replaced, the next required CHANNEL CALIBRATION of the resistance temperature detectors (RTD) sensors is accomplished by an inplace cross calibration that compares the other sensing elements with the recently installed sensing element. ④ ②

This test will verify the rate lag compensation for flow from the core to the RTDs.

The Frequency is justified by the assumption of an 18 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

②

INSERT 8

~~CHANNEL CALIBRATIONS must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the CHANNEL CALIBRATION.~~

②

INSERT 9

~~CHANNEL CALIBRATIONS must be performed in accordance with the assumptions of the unit specific setpoint methodology specified in the SCP to ensure instrument channel OPERABILITY between periodic testing required by the CHANNEL CALIBRATION.~~

The test is performed in accordance with the SCP. If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

Licensee Response/NRC Response/NRC Question Closure

Id	**2351**
NRC Question Number	**KAB-065**
Select Application	**NRC Question Closure**
Response Date/Time	
Closure Statement	**This question is closed and no further information is required at this time to draft the Safety Evaluation.**
Response Statement	
Question Closure Date	**3/1/2010**
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**3/1/2010 8:37 AM**
Modified By	
Date Modified	

ITS NRC Questions

Id	**1561**
NRC Question Number	**KAB-066**
Category	**Technical**
ITS Section	**3.3**
ITS Number	**3.3.7**
DOC Number	
JFD Number	
JFD Bases Number	
Page Number (s)	**472-476**
NRC Reviewer Supervisor	**Rob Elliott**
Technical Branch POC	**Add Name**
Conf Call Requested	**N**
NRC Question	**On pages 472 and 476 of Attachment 1, volume 8, inserts 5, and 6 are not consistent with TSTF-493, Revision 4, including applicable errata. Please correct the TS 3.3.7 Bases or provide an explanation of the changes.**
Attach File 1	
Attach File 2	
Issue Date	**1/26/2010**
Added By	**Kristy Bucholtz**
Date Modified	
Modified By	
Date Added	**1/26/2010 10:34 AM**
Notification	**NRC/LICENSEE Supervision**

Licensee Response/NRC Response/NRC Question Closure

Id	**2021**
NRC Question Number	**KAB-066**
Select Application	**Licensee Response**
Response Date/Time	**2/4/2010 6:35 AM**
Closure Statement	
Response Statement	**The Kewaunee Power Station (KPS) ITS Amendment was based upon the most current revision of TSTF-493 at the time of submittal. Since the date of the submittal, a newer revision (Rev. 4) of the TSTF has been sent to the NRC for review. KPS has reviewed this revision and appropriate changes will be made. A draft markup regarding this change is attached. This change will be reflected in the supplement to this section of the ITS conversion amendment.**
Question Closure Date	
Attachment 1	**KAB-066 Markup.pdf** (1MB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Jerry Jones** **Bryan Kays** **Ray Schiele**
Added By	**Robert Hanley**
Date Added	**2/4/2010 6:38 AM**
Modified By	
Date Modified	

PAR System ①

The page is included for information only.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Agreement criteria are determined by the unit staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

The Frequency is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.7.2

A COT is performed once every 92 days on each required channel to ensure the entire channel will perform the intended function. This test verifies the capability of the instrumentation to provide the CRE~~F~~S PAR ① actuation. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable COT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. ~~The setpoints shall be left consistent with the unit specific calibration procedure tolerance.~~ ⑥ INSERT 5 The Frequency is based on the known reliability of the monitoring equipment and has been shown to be acceptable through operating experience.

~~SR 3.3.7.3~~

~~SR 3.3.7.3 is the performance of an ACTUATION LOGIC TEST. The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. Through the semiautomatic tester, all possible logic combinations, with and without applicable permissives, are tested for each protection function. In addition, the master relay coil is pulse tested for continuity. This verifies that the logic modules are OPERABLE and there is an intact voltage signal path to the master relay coils. This test is performed every 31 days on a STAGGERED TEST BASIS. The Frequency is acceptable based on instrument reliability and industry operating experience.~~ ④

⑥

INSERT 5

The Setpoint Control Program (SCP) ~~establishes the necessary controls for properly maintaining the applicable CREFS System instrumentation channels~~. ①

~~PAR~~

has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology

This page is included for information only.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.7.~~9~~ 4 ④

A CHANNEL CALIBRATION is performed every ~~[~~18~~]~~ months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. ②

INSERT 6 ⑥

The Frequency is based on operating experience and is consistent with the typical industry refueling cycle.

REFERENCES 1. WCAP-15376, Rev. 0, October 2000.

⑥

INSERT 6

The ~~Setpoint Control Program (~~SCP~~) establishes the necessary controls for properly maintaining the applicable CREFS System instrumentation channels~~. ①

~~PAR~~

has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology

Licensee Response/NRC Response/NRC Question Closure

Id	**2151**
NRC Question Number	**KAB-066**
Select Application	**NRC Question Closure**
Response Date/Time	
Closure Statement	**This question is closed and no further information is required at this time to draft the Safety Evaluation.**
Response Statement	
Question Closure Date	**2/12/2010**
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**2/12/2010 2:41 PM**
Modified By	
Date Modified	

ITS NRC Questions

Id	**1571**
NRC Question Number	**KAB-067**
Category	**Technical**
ITS Section	**3.3**
ITS Number	**3.3.5**
DOC Number	
JFD Number	
JFD Bases Number	
Page Number (s)	**398**
NRC Reviewer Supervisor	**Rob Elliott**
Technical Branch POC	**Add Name**
Conf Call Requested	**N**
NRC Question	**On page 398 of Attachment 1, volume 8, insert 5 is not consistent with TSTF-493, Revision 4, including applicable errata. Please correct the TS 3.3.5 Bases or provide an explanation of the changes.**
Attach File 1	
Attach File 2	
Issue Date	**1/26/2010**
Added By	**Kristy Bucholtz**
Date Modified	
Modified By	
Date Added	**1/26/2010 10:34 AM**
Notification	**NRC/LICENSEE Supervision**

Licensee Response/NRC Response/NRC Question Closure

Id	**2091**
NRC Question Number	**KAB-067**
Select Application	**Licensee Response**
Response Date/Time	**2/9/2010 7:15 AM**
Closure Statement	
Response Statement	**The Kewaunee Power Station (KPS) ITS Amendment was based upon the most current revision of TSTF-493 at the time of submittal. Since the date of the submittal, a newer revision (Rev. 4) of the TSTF has been sent to the NRC for review. KPS has reviewed this revision and appropriate changes will be made. A draft markup regarding this change is attached. This change will be reflected in the supplement to this section of the ITS conversion amendment.**
Question Closure Date	
Attachment 1	**KAB-067 Markup.pdf** (2MB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Jerry Jones** **Bryan Kays** **Ray Schiele**
Added By	**Robert Hanley**
Date Added	**2/9/2010 7:17 AM**
Modified By	
Date Modified	

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.~~2~~ 1 ④

SR 3.3.5.~~2~~ 1 is the performance of a TADOT. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. This test is performed every ~~[~~31 days~~]~~. ③ The test checks trip devices that provide actuation signals directly, bypassing the analog process control equipment. For these tests, the relay trip setpoints are verified and adjusted as necessary. INSERT 5 ⑤ The Frequency is based on the known reliability of the relays and controls and the multichannel redundancy available, and has been shown to be acceptable through operating experience.

SR 3.3.5.~~3~~ 2 ④

SR 3.3.5.~~3~~ 2 is the performance of a CHANNEL CALIBRATION.

The setpoints, as well as the response to a loss of voltage and a degraded voltage test, shall include a single point verification that the trip occurs within the required time delay, as shown in ~~Reference 1~~ the applicable time delay setpoint calculation. ①

A CHANNEL CALIBRATION is performed every ~~[~~18~~]~~ months, or approximately at every refueling. ③ CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. INSERT ~~5~~ 6 ⑤

The Frequency of ~~[~~18~~]~~ months is based on operating experience and ③ consistency with the typical industry refueling cycle and is justified by the assumption of an ~~[~~18~~]~~ month calibration interval in the determination of ③ the magnitude of equipment drift in the setpoint analysis.

REFERENCES

1. U ~~F~~SAR, Section ~~[8.3]~~ 8.2.3. ① ③
2. U ~~F~~SAR, Chapter ~~[15]~~ 14. ① ③
3. ~~Plant specific setpoint methodology study.~~ Technical Report EE-0116, Revision ~~4~~ 6. ①

⑤ INSERT 5

The Setpoint Control Program (SCP) ~~establishes the necessary controls for properly maintaining the applicable LOP DG Start instrumentation channels~~.

O ①

has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology

⑤ INSERT 6

The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology.

Licensee Response/NRC Response/NRC Question Closure

Id	**2221**
NRC Question Number	**KAB-067**
Select Application	**NRC Question Closure**
Response Date/Time	
Closure Statement	**This question is closed and no further information is required at this time to draft the Safety Evaluation.**
Response Statement	
Question Closure Date	**2/18/2010**
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**2/18/2010 7:44 AM**
Modified By	
Date Modified	

ITS NRC Questions

Id	**1581**
NRC Question Number	**KAB-068**
Category	**Technical**
ITS Section	**3.3**
ITS Number	**3.3.6**
DOC Number	
JFD Number	
JFD Bases Number	
Page Number (s)	**437-438**
NRC Reviewer Supervisor	**Rob Elliott**
Technical Branch POC	**Add Name**
Conf Call Requested	**N**
NRC Question	**On pages 437 and 438 of Attachment 1, volume 8, the paragraph inserts are not consistent with TSTF-493, Revision 4, including applicable errata. Please correct the TS 3.3.6 Bases or provide an explanation of the changes.**
Attach File 1	
Attach File 2	
Issue Date	**1/26/2010**
Added By	**Kristy Bucholtz**
Date Modified	
Modified By	
Date Added	**1/26/2010 10:35 AM**
Notification	**NRC/LICENSEE Supervision**

Licensee Response/NRC Response/NRC Question Closure

Id	**2031**
NRC Question Number	**KAB-068**
Select Application	**Licensee Response**
Response Date/Time	**2/4/2010 6:40 AM**
Closure Statement	
Response Statement	**The Kewaunee Power Station (KPS) ITS Amendment was based upon the most current revision of TSTF-493 at the time of submittal. Since the date of the submittal, a newer revision (Rev. 4) of the TSTF has been sent to the NRC for review. KPS has reviewed this revision and appropriate changes will be made. A draft markup regarding this change is attached. This change will be reflected in the supplement to this section of the ITS conversion amendment.**
Question Closure Date	
Attachment 1	**KAB-068 Markup.pdf** (819KB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Jerry Jones** **Bryan Kays** **Ray Schiele**
Added By	**Robert Hanley**
Date Added	**2/4/2010 6:41 AM**
Modified By	
Date Modified	

Vent ①

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.6.6 3 ④

A COT is performed every 92 days on each required channel to ensure the entire channel will perform the intended Function. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable COT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. The Frequency is based on the staff recommendation for increasing the availability of 2 radiation monitors according to NUREG-1366 (Ref. 3). This test verifies the capability of the instrumentation to provide the containment purge and exhaust system isolation. The setpoint shall be left consistent with the current unit specific calibration procedure tolerance. ① ⑤ ⑤

vent

The Setpoint Control Program (SCP) ~~establishes the necessary controls for properly maintaining the applicable BDPS instrumentation channels~~.

~~Containment Purge and Vent Isolation~~

has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology

SR 3.3.6.7

SR 3.3.6.7 is the performance of a SLAVE RELAY TEST. The SLAVE RELAY TEST is the energizing of the slave relays. Contact operation is verified in one of two ways. Actuation equipment that may be operated in the design mitigation mode is either allowed to function or is placed in a condition where the relay contact operation can be verified without operation of the equipment. Actuation equipment that may not be operated in the design mitigation mode is prevented from operation by the SLAVE RELAY TEST circuit. For this latter case, contact operation is verified by a continuity check of the circuit containing the slave relay. This test is performed every [92] days. The Frequency is acceptable based on instrument reliability and industry operating experience. ④

SR 3.3.6.8

SR 3.3.6.8 is the performance of a TADOT. This test is a check of the Manual Actuation Functions and is performed every [18] months. Each Manual Actuation Function is tested up to, and including, the master relay coils. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are ④

BASES

SURVEILLANCE REQUIREMENTS (continued)

verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. In some instances, the test includes actuation of the end device (i.e., pump starts, valve cycles, etc.).

The test also includes trip devices that provide actuation signals directly to the SSPS, bypassing the analog process control equipment. The SR is modified by a Note that excludes verification of setpoints during the TADOT. The Functions tested have no setpoints associated with them. ④

The Frequency is based on the known reliability of the Function and the redundancy available, and has been shown to be acceptable through operating experience.

SR 3.3.6.9 4 ④

A CHANNEL CALIBRATION is performed every [18] months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. ③ ⑤

has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology

The SCP ~~establishes the necessary controls for properly maintaining the applicable BDPS instrumentation channels.~~

~~Containment Purge and Vent Isolation~~

The Frequency is based on operating experience and is consistent with the typical industry refueling cycle.

REFERENCES

1. 10 CFR 100.11. 10 CFR 50.67

2. WCAP-15376, Rev. 0, October 2000. ①

3. NUREG-1366, [date]. December 1992

Licensee Response/NRC Response/NRC Question Closure

Id	**2161**
NRC Question Number	**KAB-068**
Select Application	**NRC Question Closure**
Response Date/Time	
Closure Statement	**This question is closed and no further information is required at this time to draft the Safety Evaluation.**
Response Statement	
Question Closure Date	**2/12/2010**
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**2/12/2010 2:44 PM**
Modified By	
Date Modified	

ITS NRC Questions

Id	**1601**
NRC Question Number	**KAB-070**
Category	**Technical**
ITS Section	**3.3**
ITS Number	**3.3.6**
DOC Number	
JFD Number	
JFD Bases Number	
Page Number(s)	**421**
NRC Reviewer Supervisor	**Rob Elliott**
Technical Branch POC	**Add Name**
Conf Call Requested	**N**
NRC Question	1. **On page 421 of Attachment 1, volume 8, function 2.c, "Containment Radiation Iodine" requires performance of surveillance requirement (SR) 3.3.6.3 and SR 3.3.6.4. Both SRs are performed in accordance with the setpoint control program. However, containment radiation iodine (R-21) is not evaluated or listed in Kewaunee's setpoint methodology document, "Technical Report EE-0116," Revision 5. Please correct the discrepancy or provide an explanation.**
Attach File 1	
Attach File 2	
Issue Date	**1/26/2010**
Added By	**Kristy Bucholtz**
Date Modified	
Modified By	
Date Added	**1/26/2010 10:37 AM**
Notification	**NRC/LICENSEE Supervision**

Licensee Response/NRC Response/NRC Question Closure

Id	**2111**
NRC Question Number	**KAB-070**
Select Application	**Licensee Response**
Response Date/Time	**2/9/2010 8:30 AM**
Closure Statement	
Response Statement	**KPS agrees with the NRC reviewer that the R21 monitor setpoint was not specifically included in Technical Report EE-0116, Rev. 5 (the revision provided to the NRC in LAR 249 supplement letter from J. Allan Price (Dominion Energy Kewaunee, Inc.) to the NRC Document Control Desk, dated October 17, 2009). However, Technical Report EE-0116 Rev. 5, Section 4.7.4, which is applicable to the R12 monitor is also applicable to the R21 monitor. Technical Report EE-0116, Rev. 6, which was approved on 1-14-10, clarifies in Section 4.7.4 that the information is applicable to both the R12 monitor and the R21 monitor. The Kewaunee-specific sections of the EE-0116, Rev. 6 document are attached to replace the previously provided Rev. 5. Differences from the two revisions are highlighted for ease of use. Section 4.7.4 is on Page 193 of 205.**
Question Closure Date	
Attachment 1	**EE116highlightedR6(SPS and NAPS removed).pdf** (742KB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Victor Cusumano** **Jerry Jones** **Bryan Kays** **Ray Schiele**
Added By	**Robert Hanley**
Date Added	**2/9/2010 8:30 AM**
Modified By	
Date Modified	

Dominion

Technical Report Cover Sheet
EE-0116, Rev. 6
NDCM-3.11 Attachment 1

TECHNICAL REPORT No. EE-0116, REVISION 6

ALLOWABLE VALUES FOR NORTH ANNA IMPROVED TECHNICAL SPECIFICATIONS (ITS) TABLES 3.3.1-1 AND 3.3.2-1, SETTING LIMITS FOR SURRY CUSTOM TECHNICAL SPECIFICATIONS (CTS), SECTIONS 2.3 AND 3.7, AND ALLOWABLE VALUES FOR KEWAUNEE POWER STATION IMPROVED TECHNICAL SPECIFICATIONS (ITS) FUNCTIONS LISTED IN SPECIFICATION 5.5.16

NORTH ANNA POWER STATION, SURRY POWER STATION, AND KEWAUNEE POWER STATION

CORPORATE ELECTRICAL/I&C/COMPUTERS
DOMINION NUCLEAR ENGINEERING

January 2010

Prepared By: Donald McGrath Date 01-13-10

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ESFAS Instrumentation
Improved Technical Specifications
Limiting Safety System Settings
Reactor Protection System Instrumentation
Setting Limits
Setpoints

(June 2006)

Record of Revision

Rev 0 Original Issue.

Rev 1

1 Changed the calculation of the Allowable Values for North Anna's High Steam Flow in 2/3 Steam Lines ESFAS initiation on Page 23. The revised Allowable Values are based on using only 1 Rack Drift (RD) term for the function. This change yields more conservative Allowable Values.

2. Changed the calculation of the Allowable Values for Surry's High Steam Flow in 2/3 Steam Lines ESFAS initiation on Pages 29 and 30. The revised Allowable Values are based on using only 1 Rack Drift (RD) term for the function. This change yields more conservative Allowable Values.

3. Changed the Allowable Values and verbiage on Page 42 for the North Anna High Steam Flow in 2/3 Steam Lines ESFAS initiation.

4. Deleted the Allowable Values for the enable manual block of Safety Injection for North Anna Permissives P-11 and P-12 and revised the verbiage accordingly on Page 47.

5. Changed the Allowable Values and verbiage on Page 56 for the Surry High Steam Flow in 2/3 Steam Lines ESFAS initiation.

6. Deleted the Allowable Values for the enable manual block of Safety Injection for Surry Permissives P-11 and P-12 and revised the verbiage accordingly on Page 63.

Rev 2

1. Page 16 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span in Figure 3.2-5 to obtain a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

2. Page 18 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span to be consistent with Calculation EE-0415. This change yields a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

3. Page 24 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span in Figure 3.3-2 to obtain a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

4. Page 25 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span to be consistent with Calculation EE-0434. This change yields a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

5. Pages 25 and 26 – Revised calculations shown in Methods 1a through 2b based on Rack Drift Term $RD_4 = 0.0$ % span.

6. Page 31 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span in Figure 3.3-4 to obtain a more conservative Allowable Value for the OPΔT Reactor Trip Setpoint.

7. Page 32 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span to be consistent with Calculation EE-0415. This change yields a more conservative Allowable Value for the OPΔT Reactor Trip Setpoint. The Allowable Value calculation shown on Page 32 was revised based on $RD_3 = 0.0$ % span.

8. Pages 34 and 35 – Revised NAPS OTΔT Reactor Trip Allowable Value and associated verbiage in Item 4.1.8.

9. Page 47 – Added another Allowable Value for NAPS Permissive P-12 and revised associated verbiage in Item 4.2.38.

10. Page 49 – Revised SPS OTΔT Reactor Trip Allowable Value and associated verbiage in Item 4.3.6.

11. Page 49 – Revised verbiage associated with the SPS OPΔT Reactor Trip Allowable Value in Item 4.3.7.

12. Page 63 - Added another Allowable Value for SPS Permissive P-12 and revised associated verbiage in Item 4.4.42.

Rev 3 Revision 3 to this Technical Report is a major revision. The Allowable Values for North Anna's ITS and the Setting Limits for Surry's CTS are derived and based on Methods 1 or 2 as described in Part II of ISA-RP67.04.02-2000. This revision will require a complete review from cover to cover. This Technical Report will be used as the design basis for Technical Specifications Change Request 318 at Surry Power Station. In addition, this Technical Report will also be used as the design input for a future Technical Specifications Change Request for North Anna to change selected Allowable Values as noted in this report. In accordance with NDCM 3.11 the "Required Actions" and "Tracking Mechanism" will be documented in Engineering Transmittal ET-CEE-06-0020, Rev. 0 "Transmittal of CDS and PRC for Technical Report EE-0116, Rev. 3". In addition, the results of Technical Report EE-0116, Rev. 3 will be screened as part of ET-CEE-06-0020, rev. 0 and will not be repeated herein.

Rev 4

1. Page 5 - Added Cot or Non-Cot to the error terms in Table 2.1.

2. Page 9 – Changed the wording under item 3 to reflect that some Allowable Values have been rounded as per discussions with the NRC and Surry TSCR 318.

3. Page 13 – Changed the Rack Error Terms for M1MTE and M5MTE due to the revised CSA calculation EE-0063.

4. Page 33 - Changed the Power Range Neutron Flux High Setpoint Reactor Trip due to the revised CSA calculation EE-0063.

5. Page 34 - Changed Figure 4.1.2 for the Power Range Neutron Flux High Reactor Trip and changed the Power Range Neutron Flux Low Setpoint Reactor Trip due to the revised CSA calculation EE-0063.

6. Page 35 – Changed Figure 4.1.3 for the Power Range Neutron Flux Low Setpoint Reactor Trip due to the revised CSA calculation EE-0063.

7. Page 45 – Changed the Pressurizer High Pressure Reactor Trip due to the Safety Analysis Limit being changed from 2381.3 PSIG to 2391.3 PSIG based on ET-NAF-08-0061.

8. Page 47 – Changed Figure 4.1.10 for the Pressurizer High Pressure Reactor Trip due to the Safety Analysis Limit being changed from 2381.3 PSIG to 2391.3 PSIG based on ET-NAF-08-0061.

9. Page 48 – Changed the Reactor Coolant Flow Low Reactor trip due to the revised CSA calculation EE-0060.

10. Page 49 – Changed Figure 4.1.12 for Low Reactor Coolant Flow Reactor Trip due to the revision of CSA calculation EE-0060.

11. Page 53 – Changed the Permissive P-8, Power Range Neutron Flux due to the revised CSA calculation EE-0063.

12. Page 54 – Changed Figure 4.1.24 for the Power Range Reactor Trip Permissive P-8 due to the revised CSA calculation EE-0063.

13. Page 57 – Changed Figure 4.2.3 for Containment Pressure HI-1 ESFAS Initiation due to the revised Containment Partial Pressure operating Limits per Technical Report NE-1472, Revision 0.

14. Page 62 – Changed the T_{AVG} Low-Low ESFAS Initiation due to the revised CSA calculation EE-0434.

15. Page 64 – Changed Figure 4.2.7 for T_{AVG} Low Low ESFAS Initiation due to the revised CSA calculation EE-0434.

16. Page 68 – Changed Figure 4.2.11 for Containment Pressure HI-3 ESFAS Initiation due to the revised Containment Partial Pressure operating Limits per Technical Report NE-1472, Revision 0.

17. Page 71 – Changed Figure 4.2.20 for Containment Pressure HI-2 ESFAS Initiation due to the revised Containment Partial Pressure operating Limits per Technical Report NE-1472, Revision 0.

18. Page 75 – Deleted the Analysis for $\geq$ 19.0 % Wide Range Level and the Analysis for $\leq$ 20.0 Wide Range Level for the Refueling Water Storage Tank Level – Low Low. With the implementation of DCP 06-013 and 06- 015 these analysis are no longer valid.

19. Page 77 – Deleted Figure 4.2.34a. This Figure is no longer applicable with the implementation of DCP 06-013 and 06-015. Changed Figure number to 4.2.34.

20. Page 78 – Changed the T_{AVG}, P-12 ESFAS Permissive due to the revised CSA calculation EE-0434.

21. Page 79 – Changed Figure 4.2.38 for ESFAS Permissive P-12 due to the revised CSA calculation EE-0434.

22. Page 103 – Incorporated Addendum 1 for the Turbine First Stage Pressure Input to Permissive P-7.

23. Page 106 – Changed the word “or” to “and” for Permissive P-10, Power Range Neutron Flux.

24. Page 107 – Changed the Containment Pressure – High, Engineered Safety Features Actuation System (EFAS) Instrumentation Setting Limits due to the revised Safety Analysis Limits in Technical Report NE-0994, Revision 15.

25. Page 108 – Changed Figure 4.4.2 for the new Safety Analysis Limit from Technical Report EE-0994, Revision 15 and updated operating limits per Technical Report NE-1460, Revision 1.

26. Page 119 – Determined the Voltage and Time corresponding to the new Allowable Value for Low Intake Canal Level.

27. Page 122 – Changed the Refueling Water Storage Tank Level Low – Low RMT Initiation, EFAS Instrumentation Setting Limits due to the revised Safety Analysis Limits in Technical Report NE-0994, Revision 14.

28. Page 124 – Changed Figure 4.4.12 due to the revised Safety Analysis Limit in technical Report NE-0994, Revision 14.

29. Page 128 – Changed References 5.1, 5.2, and 5.15 to reflect the current revision.

30. Page 129 – Changed References 5.18, 5.21, 5.23, 5.26, 5.27, 5.33 to reflect the current revision.

31. Page 130- Changed References 5.35, 5.36, 5.40, 5.41, 5.44 through 5.62 to reflect the current revision.

32. Page 132 – Changed References 5.63 through 5.65 and 5.67 through 5.69 to reflect the current revision. Deleted Reference 5.77.

33. Page 133 – Changed References 5.80 through 5.82 to reflect the current revision. Added Reference 5.88, ET-NAF-08-0061, Rev. 0 "Implementation of Revised Safety Analysis Limit for High Pressurizer Pressure Reactor Trip, North Anna Units 1 and 2".

Rev. 5 Revision 5 to this Technical Report is a major revision. Kewaunee Power Station's Setpoint Control Program has been added to the report to support Kewaunee's conversion to Improved Technical Specifications (ITS).

1. Page 3 – Added Kewaunee's Setpoint Control Program to Section 1.1, Purpose.

2. Page 3 – Added Kewaunee LCO's 3.3.1, 3.3.2, 3.3.5, 3.3.6, and 3.3.7 to Section 1.2, Scope.

3. Page 4 – Added and updated definitions in Section 2.1 to reflect Kewaunee's Setpoint Control Program and the adoption of TSTF-493, Rev. 4, Option B.

4. Page 5 – Added and updated definitions in Section 2.1 to reflect Kewaunee's Setpoint Control Program and the requirements from TSTF-493, Rev. 4 and RIS 2006-17.

5. Page 9 – Updated Section 2.2.2 to reflect current conditions for North Anna and Surry. Also, a discussion for Kewaunee was added to address the Setpoint Control Program.

6. Page 10 – Added a discussion in Sections 2.2.2 and 2.2.3 pertaining to the issuance of RIS 2006-17.

7. Page 11 – Added a discussion in Section 2.2.4 pertaining to the issuance of TSTF-493, Rev. 4.

8. Pages 12 and 13 – Added Section 2.2.6 to address Kewaunee's adoption of TSTF-493, Rev. 4, Option B.

9. Page 14 – Added Kewaunee to the discussion in Sections 3.1 and 3.2.
10. Page 15 – Updated information to reflect current conditions for North Anna and Surry and to add Kewaunee's Setpoint Control Program nomenclature.
11. Page 18 - Updated information to reflect current conditions for Surry.
12. Page 19 – Added discussion for Kewaunee's Protection and Control System.
13. Page 20 - Continued discussion of Kewaunee's Protection and Control System and updated information to reflect current conditions for North Anna.
14. Pages 21, 22, and 23 – Revised the Multiple Parameter Protection Functions discussion to evaluate Kewaunee's OTΔT instead of Surry's.
15. Page 24 - Added Kewaunee in the Notes section where applicable.
16. Pages 39 Through 45 - Added Section 3.5 to describe Kewaunee's Setpoint Methodology.
17. Page 65 – Revised wording of the Allowable Value for North Anna's Steam Flow Feed Flow Mismatch Reactor Trip.
18. Pages 74 through 76 – Revised North Anna's High Steam Flow ESFAS analysis to reflect the results of Calculation EE-0736, Rev. 5 and to reflect conditions at 20 % power.
19. Page 91 and 92 – Added the analysis for North Anna's RWST Low Level ESFAS function based on DCP 59-DCP-06-013 and DCP 59-DCP-06-015.
20. Pages 104 through 107 – Corrected error in Surry's OTΔT analysis. There is no change to the current LSSS and there is still positive margin to the Safety Analysis Limit for the three conditions analyzed.
21. Page 118 – Corrected error in the description of the operation of P-7 and P-10.
22. Page 129 and 130 – Updated Surry's High Steam Flow ESFAS analysis based on unit specific "P_{REF}" values and to reflect conditions at 20 % power.
23. Pages 143 through 169 – Added Section 4.5 to perform the setpoint analysis for Kewaunee's Reactor Protection System (LCO 3.3.1) to support the Setpoint Control Program.
24. Pages 170 through 185 – Added Section 4.6 to perform the setpoint analysis for Kewaunee's Engineered Safety Features Actuation System (LCO 3.3.2) to support the Setpoint Control Program.
25. Pages 186 through 190 – Added Section 4.7 to perform the setpoint analysis for Kewaunee's Loss of Offsite Power (LOOP) Diesel Generator (DG) Start Instrumentation (LCO 3.3.5), Containment Purge and Vent Isolation Instrumentation (LCO 3.3.6), and Control Room Post Accident Recirculation (CRPAR) Actuation Instrumentation (LCO 3.3.7) to support the Setpoint Control Program.

26. Pages 191 through 199 – Updated references for North Anna and Surry and added references for Kewaunee to support the analyses performed in Sections 4.5 through 4.7.

Rev. 6

1. General Change – Deleted Reference 5.2 from all analyzed RPS/RTS and ESFAS functions for North Anna and Surry in Sections 4.1 through 4.4.

2. Updated Section 4.3.7 to note that the Pressurizer Low Pressure Reactor Trip Allowable Value and Nominal Trip Setpoint was changed based on Reference 5.139.

3. Updated Section 4.3.18 to note that the Permissive P-7, Block Low Power Trips Allowable Value and Nominal Trip Setpoint was changed based on Reference 5.139.

4. Updated Section 4.4.4 to note that the Pressurizer Pressure Low-Low ESFAS Function Allowable Value and Nominal Trip Setpoint was changed based on Reference 5.139.

5. Revised Section 4.5.3 to change the analysis for the Power Range Neutron Flux High Positive Rate Reactor Trip to allow the currently installed Nominal Trip Setpoint and Rate Lag Derivative Time Constant to remain in place for the ITS conversion.

6. Revised Section 4.5.4 to change the analysis for the Power Range Neutron Flux High Negative Rate Reactor Trip to allow the currently installed Nominal Trip Setpoint and Rate Lag Derivative Time Constant to remain in place for the ITS conversion.

7. Revised Section 4.5.6 to base the Source Range Neutron Flux High Reactor Trip analysis on a process range of 0 to 5.301 Decades versus 0 to 6 Decades.

8. Revised Section 4.6.6 High Steam Flow Coincident with Safety Injection and Coincident with T_{AVG} Low-Low to allow the Nominal Trip Set point to be changed from $0.494 * 10^6$ lbs/hr to $0.75 * 10^6$ lbs/hr.

9. Added Section 4.7.7 to address the inclusion of the Turbine Building Service Water Header Isolation Function in ITS Table 3.3.2-1.

10. Added References 5.136 through 5.142 to support the some of the changes described above.

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide a comprehensive and controlled reference which details the design basis for the Allowable Values that appear in North Anna Power Station Improved Technical Specifications (ITS), Kewaunee Power Station Setpoint Control Program, and the LSSS/Setting Limit Values that appear in Surry Power Station Custom Technical Specifications (CTS).

1.2 Scope

- This document provides the basis for the Allowable Values to be used in North Anna Power Station Improved Technical Specifications, Table 3.3.1-1, Reactor Trip System Instrumentation (NAPS).

- This document provides the basis for the Allowable Values to be used in North Anna Power Station Improved Technical Specifications, Table 3.3.2-1, Engineered Safety Feature Actuation System Instrumentation (NAPS).

- This document provides the basis for the Limiting Safety System Settings (LSSS) to be used in Surry Power Station Custom Technical Specifications, Section 2.3, Limiting Safety System Settings, Protective Instrumentation.

- This document provides the basis for the Setting Limit Values to be used in Surry Power Station Custom Technical Specifications, Table 3.7-4, Engineered Safety Feature System Initiation Limits Instrument Setting and Table 3.7-2, Engineered Safeguards Action Instrument Operating Conditions.

- This document provides the basis for the Reactor Protection System (RPS) Instrumentation (LCO 3.3.1) Limiting Trip Setpoints, Nominal Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

- This document provides the basis for the Engineered Safety Features Actuation System (ESFAS) Instrumentation Functions (LCO 3.3.2) Limiting Trip Setpoints, Nominal Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

- This document provides the basis for the Loss of Offsite Power (LOOP) Diesel Generator (DG) Start Instrumentation (LCO 3.3.5) Limiting Trip Setpoints, Nominal Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

- This document provides the basis for the Containment Purge and Vent Isolation Instrumentation (LCO 3.3.6) and the Control Room Post Accident Recirculation (CRPAR) Actuation Instrumentation (LCO 3.3.7) As Found and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

2.0 OVERVIEW

2.1 Definitions

Accuracy - A degree of conformity of an indicated value to a recognized, accepted standard value or ideal value.

Allowable Value (AV) - is the threshold value used to determine channel operability during the performance of channel functional tests and channel calibrations. The AV is the limiting as found setting for the channel trip setpoint that accounts for all of the NON-COT error components from the CSA Calculation in accordance with Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994.

Analytical Limit (AL) - The setpoint value assumed in the Safety Analysis. In the context of this document, the Analytical Limit is the same as the Safety Analysis Limit (SAL).

As Found Tolerance (AFT) – For Surry and North Anna, the As Found Tolerance is equal to the Allowable Value or Limiting Safety System Setting (LSSS)/Setting Limit listed in Technical Specifications. For Kewaunee, the As Found Tolerance is equal to the statistical combination of the rack error components and rack drift.

As Left Tolerance (ALT) – is not applicable for Surry and North Anna. For Kewaunee the As Left Tolerance is equal to the statistical combination of the rack error components minus the rack drift.

Calibrated Range – The calibration span of the sensor/transmitter as it applies to the indicated process range of the loop/system.

Channel Statistical Allowance (CSA) - The total instrument loop uncertainty (usually expressed in percent of instrument span) where non-interactive error components are combined statistically and interactive error components are summed arithmetically in accordance with Dominion Standard STD-EEN-0304 (Ref. 5.5). The generic CSA equation and a summary of error terms are provided below in Table 2.1.

Channel Operational Test (COT) - A COT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. The COT may be performed by means of any series of sequential, overlapping, or total channel steps. In the context of this document, the Channel Operational Test is the same as a Channel Periodic Test or Channel Functional Test.

Instrument Loop - An arrangement or chain of modules or components as required to generate one or more protective/control signals and/or provide indication and recording functions. An Instrument Loop normally includes the following five elements; the process, a transmitter/sensor, process electronics, indications and/or automatic control elements.

Limiting Safety System Setting (LSSS) – The LSSS is a term used in the Surry Power Station CTS to define the threshold value used to determine channel operability during the performance of channel functional tests and channel calibrations. In the context of this document, the CTS LSSS or Setting Limit used for Surry Power Station is equivalent to the ITS Allowable Value used for North Anna Power Station and the As Found Tolerance for Kewaunee.

Limiting Trip Setpoint (LTSP) – Based on RIS 2006-17 and TSTF-493, Rev. 4, the LTSP is the limiting setting for the channel trip setpoint considering all credible instrument errors associated with the instrument channel (Refs. 5.99 and 5.100).

Margin - The resultant value when the Channel Statistical Allowance (CSA) value is subtracted from the Total Allowance Value (usually expressed in percent of span or the process/signal values corresponding to these).

Module - A generic term for a Westinghouse Nuclear Instrumentation Module, Westinghouse 7300 Series PC Card, Foxboro Module, NUS Module, or a Westinghouse/Hagan 7100 Electronic Module.

Nominal Trip Setpoint (NTSP) - The desired setpoint for the variable. Initial calibration and subsequent re-calibrations should be made at the Nominal Trip Setpoint value specified in approved plant documentation. According to RIS 2006-17 and TSTF-493, Rev. 4 (Refs. 5.99 and 5.100), the NTSP is the Limiting Trip Setpoint with margin added. The NTSP is always equal to or more conservative than the LTSP.

Operating Margin - The difference between the nominal operating value for the process parameter and the most limiting trip/alarm setpoint/control limit (usually expressed in percent of span or the process/signal values corresponding to these).

Process Range - The upper and lower limits of the operating region for a device, e.g., for a Pressurizer Pressure Transmitter, 0 to 3000 PSIG, for Steam Generator Level, 0 to 100 % Level. This is not necessarily the calibrated range of the device, e.g., for the Pressurizer Pressure Transmitter, the typical calibrated range is 1700 to 2500 PSIG.

Rack Error Components - These are the error terms associated with the process modules that are used to develop a Channel Statistical Allowance (CSA) value for a particular trip/alarm function. These rack error components are the calibration tolerances associated with the process modules for a module calibration (M1, M2 ... Mn) or (RCA & RCSA) for string calibration and an uncertainty value to account for Rack Drift (RD). These rack error components are combined statistically to determine the maximum allowable error which, ideally, should be used to determine the Allowable Value/LSSS/Setting Limit.

Safety Analysis Limit (SAL) - The setpoint value assumed in the Safety Analysis. In the context of this document, the Safety Analysis Limit is equivalent to the Analytical Limit (AL).

Span - The difference between the upper and lower range values of a process parameter or the signal values corresponding to these.

Tolerance - The allowable deviation from an ideal calculated value.

Total Allowance - The difference between the Nominal Trip Setpoint and the Safety Analysis Limit (usually expressed in percent of span or the process/signal values corresponding to these).

Total Loop Uncertainty (TLU) – In the context of this document, the TLU is equivalent to the Channel Statistical Allowance (CSA). A summary of TLU/CSA error terms is provided in Table 2.1 below.

Table 2.1: Channel Statistical Allowance (CSA) Equation and Error Term Definitions

$$\mathbf{CSA = SE \pm [EA^2 + PMA^2 + PEA^2 + (SCA+SMTE)^2 + SD^2 + SPE^2 + STE^2 + SPSE^2 + (M1+M1MTE)^2 + (M2+M2MTE)^2 + \ldots + (Mn+MnMTE)^2 + RD^2 + RTE^2 + RRA^2]^{1/2}}$$

Systematic Error (SE) (NON-COT)	Systematic Error is treated as a bias (unidirectional) and is always placed outside of the radical. Examples of Systematic Error are transmitter reference leg heatup, uncorrected Sensor Pressure Effects (SPE) and the SG Mid Deck Plate bias.
Environmental Allowance (EA) (NON-COT)	Environmental Allowance is normally associated with instrument loop sensors and equipment that is subjected to a HARSH environment during DBE and/or PDBE conditions. EA is made up of Insulation Resistance (IR) Effects, Radiation Effects (RE), Steam Pressure Temperature Effects (SPTE) and Seismic Mounting Effects (SME).
Process Measurement Accuracy (PMA) (NON-COT)	Process Measurement Accuracy is an allowance for non-instrument related effects that directly influence the accuracy of the instrument loop. Examples of PMA are fluid stratification effects on temperature measurement and the effects of fluid density changes on level measurement.
Primary Element Accuracy (PEA) (NON-COT)	Primary Element Accuracy is an allowance for the inaccuracies of the system element that quantitatively converts the measured variable energy into a form suitable for measurement.
Sensor Calibration Accuracy (SCA) (NON-COT)	Sensor Calibration Accuracy is a number or quantity that defines a limit that errors will not exceed when a sensor is used under specified operating conditions, i.e., the calibration accuracy of the sensor.
Sensor Measuring & Test Equipment (SMTE) (NON-COT)	Sensor Measuring & Test Equipment is associated with the accuracy of the Measuring and Test Equipment (M&TE) used to calibrate the loop sensor(s). Examples of SMTE are Test Gauges and Digital Multimeters (DMM).
Sensor Drift (SD) (NON-COT)	Sensor Drift is an allowance for the change in the input versus output relationship of the sensor over a period of time under specified reference operating conditions.
Sensor Pressure Effects (SPE) (NON-COT)	Sensor Pressure Effects are allowances for the steady-state pressure applied to a device. Normally, SPE applies only for differential pressure devices and is associated with the change in input-output relationship due to a change in static pressure. SPE is divided into two terms, Static Pressure Zero Effect (SPZE) and Static Pressure Span Effect (SPSE).
Sensor Temperature Effects (STE) (NON-COT)	Sensor Temperature Effect is an allowance for the effects of changes in the ambient temperature surrounding the sensor.
Sensor Power Supply Effect (SPSE) (NON-COT)	Sensor Power Supply Effect is an allowance for the effects of changes in the power supply voltage applied to the sensor.
Module Calibration Accuracy (M1 through Mn) (COT)	Module M1 to Mn is an Allowance for the accuracy of an assembly of interconnected components that constitute an identifiable device, instrument, or piece of equipment. A module can be disconnected, removed as a unit and replaced with a spare. It has definable performance characteristics that permit it to be tested as a unit.
Module Measuring & Test Equipment (MnMTE) (NON-COT)	Module Measuring & Test Equipment is associated with the accuracy of the Measuring and Test Equipment (M&TE) used to calibrate the loop module(s). Examples of MnMTE are Decade Boxes, Digital Multimeters (DMM), Test Point Resistors (TPR), Oscilloscopes and Recorders.
Rack Drift (RD) (COT)	Rack Drift is an allowance for the change in the input versus output relationship of the Rack Modules (M1 through Mn) over a period of time under specified reference operating conditions.
Rack Temperature Effect (RTE) (NON-COT)	Sensor Temperature Effect is an allowance for the effects of changes in the ambient temperature surrounding the Process Racks.
Rack Readability Allowance (RRA) (N/A)	Rack Readability Allowance is an allowance for the inability to read analog indicators because of parallax distortion.

2.2 The Significance of the Allowable Value

2.2.1 Background

Historically, for plants that have used Westinghouse Standardized Technical Specifications (STS) such as North Anna, two values have been provided for each Reactor Trip System (RTS) and Engineered Safety Features Actuation System (ESFAS) trip function; they are referred to as the "Nominal Trip Setpoint" and the "Allowable Value" (in the context of this document, the Allowable Value, Limiting Safety System Setting “LSSS” and the Setting Limit are the same). The difference in percent of span between the Nominal Trip Setpoint and the Allowable Value was calculated, in most cases, based on a summation of the errors associated with the rack components and rack drift. For linear, non-complex trip functions, this value normally worked out to be between 1.0 % and 2.0 % of span. For complex trip functions or functions that had limited margin with respect to the Safety Analysis Limit, other calculational methods were used to determine the difference between the Nominal Trip Setpoint and the Allowable Value. For plants that do not use the Westinghouse STS version of Technical Specifications such as Surry, normally only one setpoint value (assumed to be the Limiting Safety System Setting “LSSS” or the Setting Limit at Surry) is provided in the text with no guidance as to how to set the actual "Nominal" Trip Setpoint in the plant.

Based on the early versions of the Westinghouse STS, the original definition of the LSSS (i.e., the Allowable Value) was stated as follows:

"A setting chosen to prevent exceeding a Safety Analysis Limit".

This Allowable Value was intended to be used during monthly or quarterly Functional Testing as a "flag" such that if a bistable (comparator) Trip Setpoint exceeded this value, the protection channel would be declared inoperable and plant staff would be required to initiate corrective action. The intended significance of this value is that it is the point where if the value is exceeded, the implication is that the actual rack electronics and/or associated rack error components have exceeded the values assumed in the Channel Statistical Allowance (CSA) Calculation and consequently, the margin with respect to the Safety Analysis Limit has been reduced.

The Allowable Value takes on added significance when there is little or no retained/available margin with respect to the Safety Analysis Limit and conversely takes on reduced significance in proportion to the amount of retained/available margin.

2.2.2 Addressing Recent NRC Concerns Associated with Allowable Values

Dominion Corporate I&C Engineering attended a meeting with the Nuclear Regulatory Commission (NRC) and Nuclear Energy Institute (NEI) in Rockville, MD on October 8, 2003 to evaluate NRC concerns associated with the “Allowable Values” used in Technical Specifications. The “Allowable Values” of interest are those associated with Reactor Protection System (RPS) (e.g., also known as the Reactor Trip System “RTS”) and Engineered Safety Features Actuation System (ESFAS) Functions that are credited in the Plant Specific Safety Analysis. The NRC expressed a basic concern at the meeting where they have identified various plants that use a method to calculate “Allowable Values” for RTS and ESFAS functions that will reduce or eliminate margin to the Analytical Limit (AL), i.e., also known as the Safety Analysis

Limit (SAL). In the worst case scenario, the margin may be determined to be negative such that the protection function is operating outside of the analyzed region.

On August 13, 2003, NRC Staff met with members of the ISA 67.04 committee and other industry groups in Rockville, MD to discuss instrument setpoint methodology and lay out their position. The major area of discussion focused on the instrument setpoint methodology recommended in ISA Standard S67.04 used by many licensees for determining protection system instrumentation setpoints. Part II of the standard, not endorsed by the NRC Staff, includes three methods for calculating "Allowable Values" which represent the "Limiting Safety System Settings" (LSSS) as described in 10CFR50.36. As stated by the NRC, Methods 1 and 2 determine "Allowable Values" that are sufficiently conservative and are acceptable to the NRC Staff. According to the NRC, Method 3 does not appear to provide an acceptable degree of conservatism and is of concern to the NRC Staff. In addition, there is also a disagreement between the NRC Staff and NEI/ISA/Some Industry Groups as to the meaning/intent of the LSSS. These items will be addressed in this document as they apply to Surry and North Anna.

As of August 2002 North Anna adopted Improved Technical Specifications (ITS). Within the North Anna ITS and ITS Bases, Allowable Values are explicitly defined and are uniquely associated with each RTS and ESFAS function, to include Backup Trips and Permissives. The Allowable Values specified in North Anna's ITS as described in this Technical Report are based on Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994.

Surry Power Station has not adopted ITS and has decided to continue using their Custom Technical Specifications (CTS). For plants licensed before 1974, prior to the introduction of Standardized Technical Specifications (STS), the setpoints (i.e., Technical Specification Limits) included in CTS for RPS and ESFAS instrumentation were based on the plant specific setpoint study and/or based on settings provided in the Westinghouse Precautions, Limitations and Setpoints (PLS) document. The RPS and ESFAS trip setpoints specified in CTS did not include allowances for instrument uncertainties associated with channel functional testing (i.e., the COT). These allowances were left up to the licensee to deal with and justify. At the present time, this applies to Surry. In many cases, the original CTS setpoints for RPS and ESFAS instrumentation have been determined to be unacceptable based on today's standards and setpoint methodologies. To address this discrepancy, Technical Specification Change Request (TSCR) No. 318 was prepared to revise 16 Limiting Safety System Settings for the Reactor Protection System and 11 Setting Limits for the Engineered Safety Features Actuation System. The revised Limiting Safety System Settings and Setting Limits were calculated in accordance with Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994. TSCR No. 318 was approved by the USNRC via Surry Technical Specifications Amendments 261/261 dated September 23, 2008 (Serial # 080594). The revised Limiting Safety System Settings, Setting Limits, and four setpoint changes were implemented for Surry Units 1 and 2 in November of 2008.

At the present time, Kewaunee Power Station is also using Custom Technical Specifications (CTS). Kewaunee's CTS is very similar to the CTS used at Surry Power Station. Dominion has decided that Kewaunee will convert to Improved Technical Specifications (ITS) in the near future. As part of the ITS conversion, Kewaunee will remove their Reactor Protection System LSSSs, ESFAS Setting Limits (known as Allowable Values in ITS), Diesel Generator (LOOP), Containment Purge and Vent Isolation, and Control Room Post Accident Recirculation Actuation from Technical Specifications and maintain control of these and other critical limits in a Setpoint Control Program as allowed by Option B of TSTF-493, Revision 4 (Ref. 5.99). The Setpoint Control Program will be administered as defined in ITS, Section 5.5.16 “Setpoint Control Program”. Like North Anna and Surry, the Allowable Values for RPS and ESFAS Instrumentation, as administered by the Setpoint Control Program will be calculated in accordance with Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994. The Kewaunee Diesel Generator (LOOP), Containment Purge and Vent Isolation, and Control Room Post Accident Recirculation Actuation instrumentation will be handled using Methods 1 and 2 as applicable.

The following subsections will focus on the meaning/intent of the Limiting Safety System Setting (LSSS) and the Allowable Value (AV) as understood by the NRC, ISA/NEI/Various Industry Groups and Dominion.

2.2.3 The NRC Staff Position Concerning the LSSS and AV

The following LSSS information is based on information from the NRC presentation to the ISA 67.04 Committee on August 13, 2003.

10CFR50.36(C)(1)(ii)(A) defines the Limiting Safety System Setting (LSSS) as the setting that must be chosen so that the automatic protective action will correct the abnormal situation before a safety limit is exceeded.

New Improved TS Bases defines allowable value (AV) to be equivalent to LSSS and defines that a channel is operable if the trip setpoint is found not to exceed the AV during the Channel Operational Test (COT).

Prior to the issuance of NRC Regulatory Issue Summary (RIS) 2006-17, the NRC Staff believed that the Allowable Value (AV) is equivalent to the Limiting Safety System Setting (LSSS). Since the issuance of RIS 2006-17 (Ref. 5.100), the NRC’s staff position is that the Limiting Trip Setpoint (LSP) protects the Safety Limit (SL) and relationship between the Allowable Value and the LSSS has been expanded upon as discussed in Section 2.2.6.(1)

2.2.4 The ISA/NEI/Various Industry Groups Position Concerning the LSSS and AV

The following information is based on the ISA 67.04 Subcommittee handout from August 13, 2003.

<u>Position Statements</u>

- The difference between the Allowable Value (AV) and the Analytical Limit (AL) is not a direct defense of the AL.
- The Trip Setpoint (TSP) protects the AL.
- The AV confirms the TSP.

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(1) There is a difference in the terminology and abbreviations used in TSTF-493, Rev. 4 versus RIS 2006-17 with respect to the Limiting Trip Setpoint and the Safety Limit.

Summary

- Reg Guide 1.105 endorses the calculation of the TSP using statistical methods.
- The AV, based on a portion of the errors, does not invalidate the TSP.
- The TSP protects the AL.
- The AV validates an error contribution assumption via periodic surveillance testing.
- As long as the AV is not exceeded, the channel is OPERABLE.
- During Surveillance Testing, the AV serves as the LSSS.
- The errors between the AV and the AL are not part of the LSSS as defined by 10CFR50.36.

In summary, ISA/NEI/Various Industry Groups believe that the Allowable Value (AV) is equivalent to the Limiting Safety System Setting (LSSS). However, their position is that the TSP is used to protect the Analytical Limit (AL). All of the items listed above are true, with the exception of “The TSP protects the AL”. This is the statement that is under dispute.

Since August of 2003, the Industry has been developing Technical Specification Task Force Improved Standard Technical Specifications Change Traveler TSTF-493. This document addresses the agreement made between the USNRC and the industry concerning the issues listed above. Dominion’s implementation of the requirements set forth in TSTF-493, Revision 4 (Ref. 5.99) as they apply to Kewaunee Power Station will be addressed in Sections 2.2.6 and 3.5.

2.2.5 The Dominion Position Concerning the LSSS and AV for North Anna and Surry

Information Intentionally Removed
Specific to North Anna Power Station and Surry Power Station Only

Information Intentionally Removed
Specific to North Anna Power Station and Surry Power Station Only

2.2.6 The Dominion Position Concerning the LSSS and AV for Kewaunee

Dominion has decided to adopt Improved Technical Specifications (ITS) for Kewaunee. As part of the ITS conversion, Dominion has chosen to implement Option B of TSTF-493, Revision 4 (Ref. 5.99). TSTF-493, Revision 4, Option B allows for the relocation of Reactor Protection System "RPS" (also known as the Reactor Trip System "RTS") and Engineered Safety Features Actuation System – "ESFAS" (also known as Engineered Safety Features – "ESF") Allowable Values (also known as the Limiting Safety System Settings – "LSSSs" or Setting Limits) from Section 3.3 of Technical Specifications to a Licensee controlled program as defined in ITS Section 5.5.16. In addition, the Diesel Generator (LOOP), Containment Purge and Vent Isolation, and Control Room Post Accident Recirculation Actuation instrumentation will also be relocated to the Licensee controlled program as defined in ITS Section 5.5.16. To implement TSTF-493, Option B, Dominion will incorporate the relevant positions taken by the industry as detailed in TSTF-493, Revision 4 and those taken by the USNRC as detailed in NRC Regulatory Issue Summary 2006-17, Dated September 19, 2006 (Refs. 5.99 and 5.100) into the Setpoint Control Program in accordance with ITS Section 5.5.16.

New and/or revised terminology and requirements have been incorporated into TSTF-493 and NRC Regulatory Issue Summary (RIS) 2006-17 that are to be used for the determination of RPS and ESFAS Setpoints. The new terminology and requirements detailed in TSTF-493, Revision 4 and RIS 2006-17 will be incorporated into Kewaunee's Setpoint Control Program as described in ITS Section 5.5.16. In addition to the new terminology and requirements, the USNRC has taken the position that the Limiting Trip Setpoint (LTSP) protects the Safety Limit (SL) (Ref. 5.100). This revised position is a change from the historical definition of the Allowable Value as delineated in Standardized Technical Specifications

(STS), i.e., "A setting chosen to prevent exceeding a Safety Analysis Limit" (Ref. 5.3). Since the Limiting Trip Setpoint (LTSP) accounts for all credible instrument errors associated with the instrument channel, it is a more conservative setting than the associated Allowable Value as defined in Section 3.5. With respect to Kewaunee's conversion to ITS, Dominion agrees with this revised position based on explanations and guidance provided in TSTF-493, Revision 4 and RIS 2006-17.

Like North Anna and Surry, Kewaunee's Setpoint Methodology is based on Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994. Using Methods 1 or 2 will ensure that the Allowable Value (equivalent to the Minimum or Maximum Allowable Value for Surry and North Anna) will account for all credible instrument and process errors that are not tested or quantified during the performance of the Channel Operational Test (COT). This Setpoint Methodology addresses the basic NRC concern brought up back in 2003 that Method 3 (used by some Licensees to determine Allowable Values) as described in ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994 may yield Allowable Values that will not protect the Safety Limit under all postulated conditions. In addition to using Methods 1 or 2, Kewaunee's Setpoint Methodology will incorporate the revised terminology and additional requirements imposed by TSTF-493, Revision 4 and RIS 2006-17. A detailed discussion of Kewaunee's Setpoint Methodology incorporating the revised terminology and requirements from TSTF-493 and RIS 2006-17 is provided in Section 3.5.

3.0 METHODOLOGY

3.1 Introduction

Many Westinghouse Plants continue to use Westinghouse or other Engineering Firms to perform some or all of their Safety Analysis Functions. In addition, Westinghouse has also performed the RPS (RTS) and ESFAS Setpoint Study for many of their plants. Typically, the Setpoint Study for these plants included the development of Channel Statistical Allowance (CSA) Calculations for Primary and some of the Backup RTS and ESFAS Trip Functions. Derived from these Setpoint Studies and CSA Calculations are the Allowable Values that appear in various versions of Standardized Technical Specifications (STS). For the Westinghouse Plants that use Custom Technical Specifications (CTS), the setpoint values specified for RPS and ESFAS Trip Functions are not defined as Allowable Values and typically, they are the same setpoint values as those found in the original Precautions, Limitations and Setpoints (PLS) Document for that particular plant. This was the case for Surry's Custom Technical Specifications until the implementation of Technical Specifications Change Request No. 318 ultimately resulting in TS Amendments 261/261 for Units 1 and 2, respectively (Ref. 5.119).

Dominion is unique in the fact that a majority of the UFSAR Chapter 14 (Surry and Kewaunee) and Chapter 15 (North Anna) Safety Analysis is performed in house by the Corporate Nuclear Analysis & Fuels Department. In addition, Channel Statistical Allowance Calculations for Primary and Backup RPS (RTS) and ESFAS Trip Functions are performed in house by the Corporate Electrical/I&C/Computers Department. Because Dominion performs their own Safety Analysis and CSA Calculations, the methodology used to determine Improved Technical Specifications (NUREG-1431 "ITS") Allowable Values for North Anna, As Found Tolerances for Kewaunee, and LSSS/Setting Limits for Surry Custom Technical Specifications will be similar and in some cases more conservative than that used by Westinghouse in the past to determine Allowable Values for later versions of Standardized Technical Specifications. In addition, the methods used in this Technical Report to calculate the limiting values for North Anna, Kewaunee, and Surry will be consistent with the requirements of Methods 1 or 2 as described in ISA-RP67.04.02-2000 (Ref 5.43).

3.2 Functional Groups for RPS (RTS) and ESFAS Instrumentation.

Based on Dominion Technical Report NE-0994 (Ref. 5.1), the Reactor Protection System (RPS)/Reactor Trip System (RTS) and the Engineered Safety Features Actuation System (ESFAS) Instrumentation at North Anna, Kewaunee, and Surry can be divided into two major categories, i.e., Primary Trip Functions and Backup Trip Functions. Primary Trip Functions are credited in the Plant Safety Analysis and have an associated Analytical Limit (i.e., Safety Analysis Limit or Safety Limit). Backup Trip Functions are not credited in the Plant Safety Analysis but are included in the Reactor Protection System and the Engineered Safety Features Actuation System to enhance the overall effectiveness of the system.

Primary Trip Functions include the following:

- Primary Reactor Trip Functions
- Primary Reactor Trip Permissives
- Primary ESFAS Actuation Functions
- Primary ESFAS Permissives

Backup Trip Functions include the following:

- Backup Reactor Trip Functions
- Backup Reactor Trip Permissives
- Backup ESFAS Permissives

In addition to the above, there are three basic functional groups of Westinghouse Nuclear Instrumentation System (NIS), Foxboro H-Line, NUS Replacement Modules, Westinghouse/Hagan 7100, and Westinghouse 7300 Instrumentation that develop the majority of the RPS/RTS and ESFAS trips. These basic functional groups are divided into the three categories listed below:

1. Single parameter protection function
2. Dual parameter protection function
3. Multiple parameter protection function (i.e., more than two process parameters)

Different methods are used to calculate or validate the Allowable Values for North Anna, As Found Tolerances for Kewaunee, and LSSS/Setting Limits for Surry depending on whether the function is considered to be Primary or Backup. In addition, the functional group category will also effect how the Allowable Value, As Found Tolerance or LSSS/Setting Limit is calculated. Some examples of functional groups are given below.

Single Parameter Protection Functions

- Power Range Neutron Flux High and Low Reactor Trips
- Pressurizer High and Low Pressure Reactor Trips
- Low Reactor Coolant Flow Reactor Trip
- Containment Hi-1, Hi-2 and Hi-3 (North Anna only) Pressure ESFAS initiation
- Compensated Low Steam Line Pressure ESFAS initiation
- Steam Generator Lo-2 Level ESFAS initiation

Dual Parameter Protection Functions

- Surry High Steam Flow in 2/3 Lines ESFAS initiation
- Surry High ΔP Steam Line vs. Steam Header ESFAS initiation
- North Anna High ΔP Steam Line vs. Steam Line ESFAS initiation

Multiple Parameter Protection Functions

- Steam Flow Feed Flow Mismatch Reactor Trip
- Overpower ΔT Reactor Trip
- Overtemperature ΔT Reactor Trip

Single Parameter Protection Functions

North Anna

The Nuclear Steam Supply System (NSSS) Protection and Control System at North Anna is made up of the Westinghouse Nuclear Instrumentation System (NIS) and the Westinghouse 7300 Series Process Control System. Most of the RTS and ESFAS trips generated from these systems are single parameter protection functions. Figures 3.2-1 and 3.2-2 illustrate the configuration of the Westinghouse NIS and the 7300 Process Control System.

Westinghouse Nuclear Instrumentation System - Power Range Reactor Trips

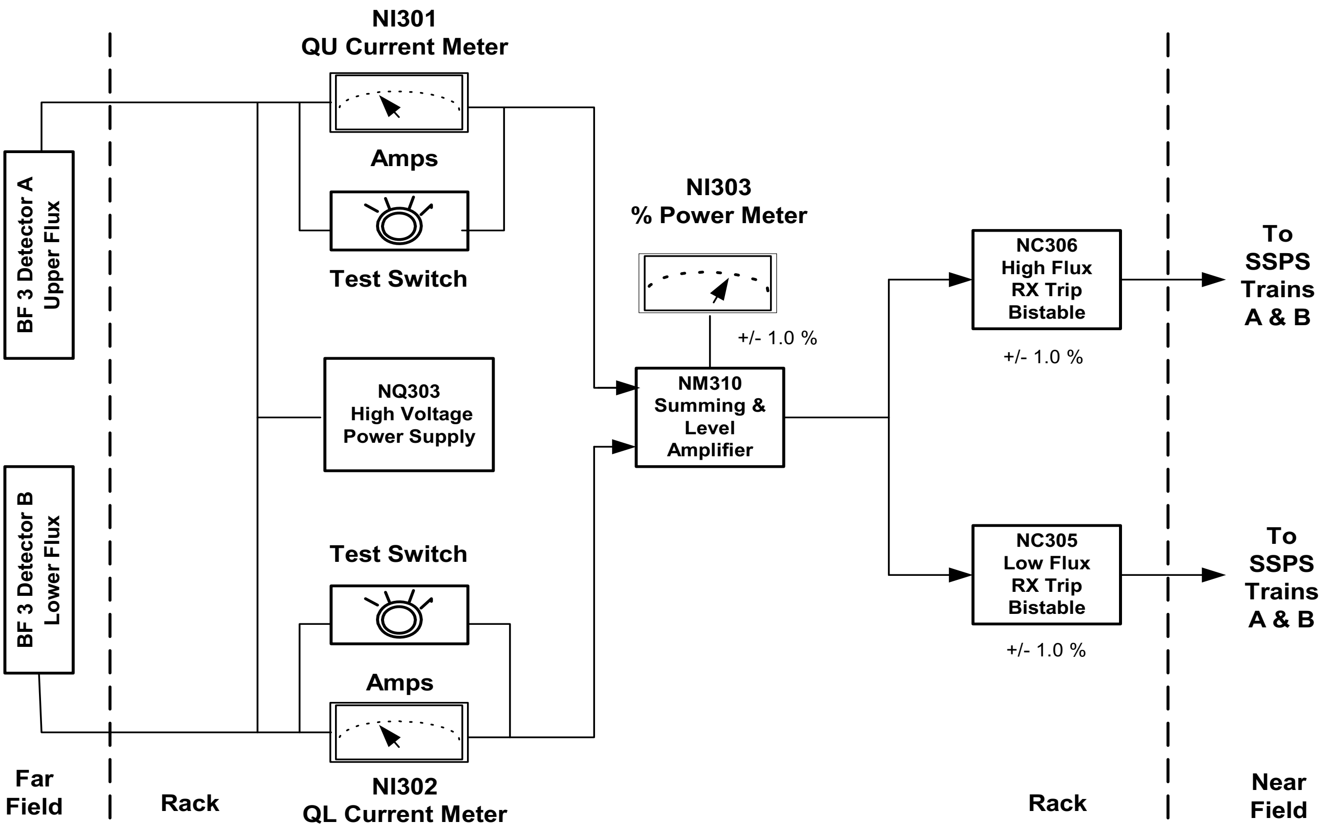


Figure 3.2-1

Refer to Figure 3.2-1 :

CSA Calculations performed for Reactor Trips generated by NIS typically include rack error terms associated with the meter indications (i.e., Amps, % Full Power, Counts per Second, etc.) and the bistables that generate the trip.

In the case of the Power Range High Flux Reactor Trip as shown on Figure 3.2-1, the rack error terms as defined in CSA Calculation EE-0063 (Ref. 5.15) are :

(M1 + M1TE) + (M5 + M5MTE) + RD + RTE

Where:
M1 = Module 1 Summing and Level Amplifier = ± 0.100 %
M1MTE = Module 1 Measuring and Test Equipment = ± 0.110 %
M5 = Module 5 Bistable Relay Driver = ± 0.833 %
M5MTE = Module 5 Measuring and Test Equipment = ± 0.943 %
RD = Rack Drift = ± 1.000 %
RTE = Rack Temperature Effects = ± 0.500 %

Westinghouse 7300 Process Control System
Low Reactor Coolant Flow Reactor Trip

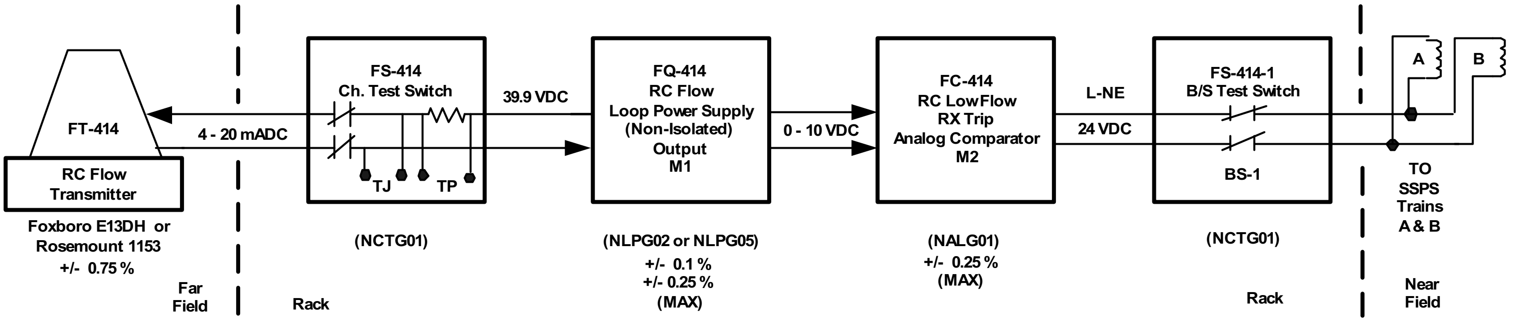


Figure 3.2-2

Refer to Figure 3.2-2 :

CSA Calculations performed for Reactor Trips generated by the Westinghouse 7300 Process Control System include rack error terms associated with the PC Cards that perform signal modification and the bistables that generate the trip.

In the case of the Low Reactor Coolant Flow Reactor Trip as shown on Figure 3.2-2, the rack error terms as defined in CSA Calculation EE-0060 (Ref. 5.21) are :

(M1 + M1MTE) + (M2 + M2MTE) + RD + RTE

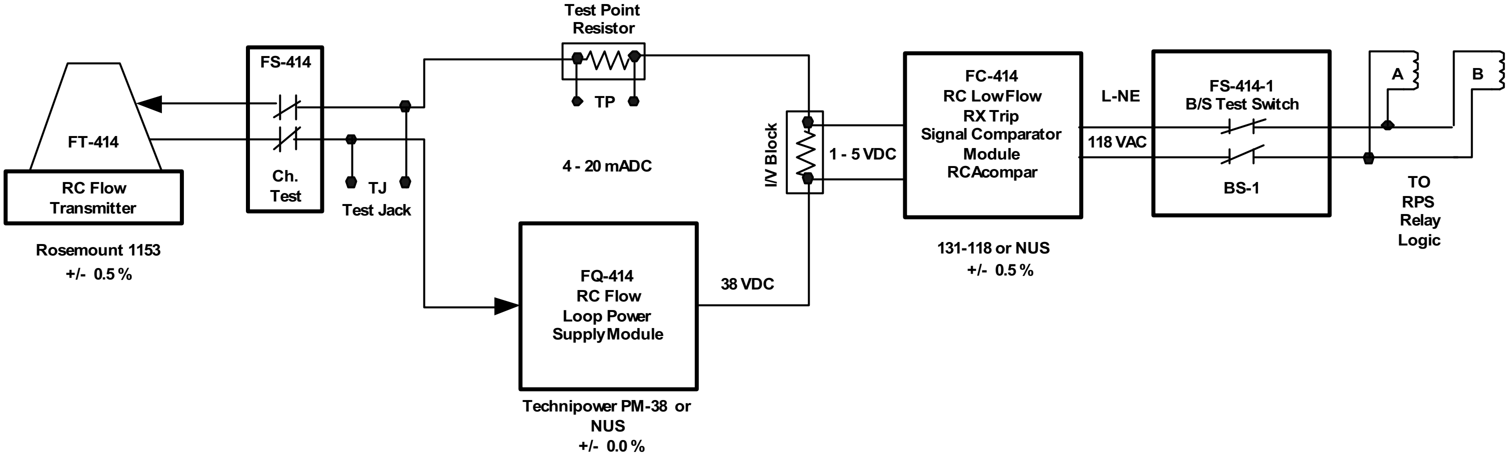
Where: M1 = Module 1 Loop Power Supply = ± 0.100 %
M1MTE = Module 1 Measuring and Test Equipment = ± 0.153 %
M2 = Module 2 Analog Comparator "Bistable" = ± 0.250 %
M2MTE = Module 2 Measuring and Test Equipment = ± 0.030 %
RD = Rack Drift = ± 1.000 %
RTE = Rack Temperature Effects = ± 0.500 %

These rack error terms along with other error terms from the CSA Calculation will be used to validate the existing Allowable Values at North Anna or to calculate revised Allowable Values, if necessary.

Surry

The NSSS Protection and Control System at Surry uses the same Westinghouse Nuclear Instrumentation System (NIS) as North Anna. However, a majority of NSSS Protection and Control is developed from the Westinghouse/Hagan 7100 Series Process Control System (using NUS Replacement Modules for some functions). Like North Anna, most of the RPS and ESFAS trips generated from these systems are single parameter protection functions. For the Westinghouse NIS, Figure 3.2-1 is also applicable for Surry. Figure 3.2-3 illustrates the configuration of the Westinghouse/Hagan 7100 Process Control System for a single input protection function.

Westinghouse 7100 Process Control System
Low Reactor Coolant Flow Reactor Trip



<u>**Figure 3.2-3**</u>

Refer to Figure 3.2-3 :

CSA Calculations performed for Reactor Trips generated by the Westinghouse/Hagan 7100 Process Control System also include rack error terms associated with the modules that perform signal modification and the bistables that generate the trip. The Westinghouse 7100 Process Control System mainly operates using current loops where the power supplies are not used as signal converters. In many cases, for a single parameter protection function, the only rack module that will have a tolerance associated with it will be the Signal Comparator (i.e., the Bistable). In the case of Surry's Low Reactor Coolant Flow Reactor Trip as shown in Figure 3.2-3, the rack error terms from CSA Calculation EE-0183 (Ref. 5.34) are :

$$(M5 + M5MTE) + RD + RTE$$

Where:
M5 = Rack Comparator Setting Accuracy = ± 0.50 %
M5MTE = Rack Measuring and Test Equipment = ± 0.15 %
RD = Rack Drift = ± 1.00 %
RTE = Rack Temperature Effects = ± 0.50 %

Note the difference between North Anna's rack error terms compared with the rack error terms listed above for Surry. The error terms for the Loop Power Supply are not included in Surry's CSA Calculation because it is not used as a signal converter.

Kewaunee

The NSSS Protection and Control System at Kewaunee uses the same Westinghouse Nuclear Instrumentation System (NIS) as does North Anna and Surry for Power Range. Most of the NSSS Protection and Control is developed from the Foxboro H-Line Process Control System (using NUS Replacement Modules for some functions). Like North Anna and Surry, most of the RPS and ESFAS trips generated from these systems are single parameter protection functions. For the Westinghouse Power Range NIS, Figure 3.2-1 is also applicable for Kewaunee. Figure 3.2-4 illustrates the configuration of the Foxboro H-Line Process Control System for a single input protection function.

Foxboro H-Line Process Control System
Low Reactor Coolant Flow Reactor Trip

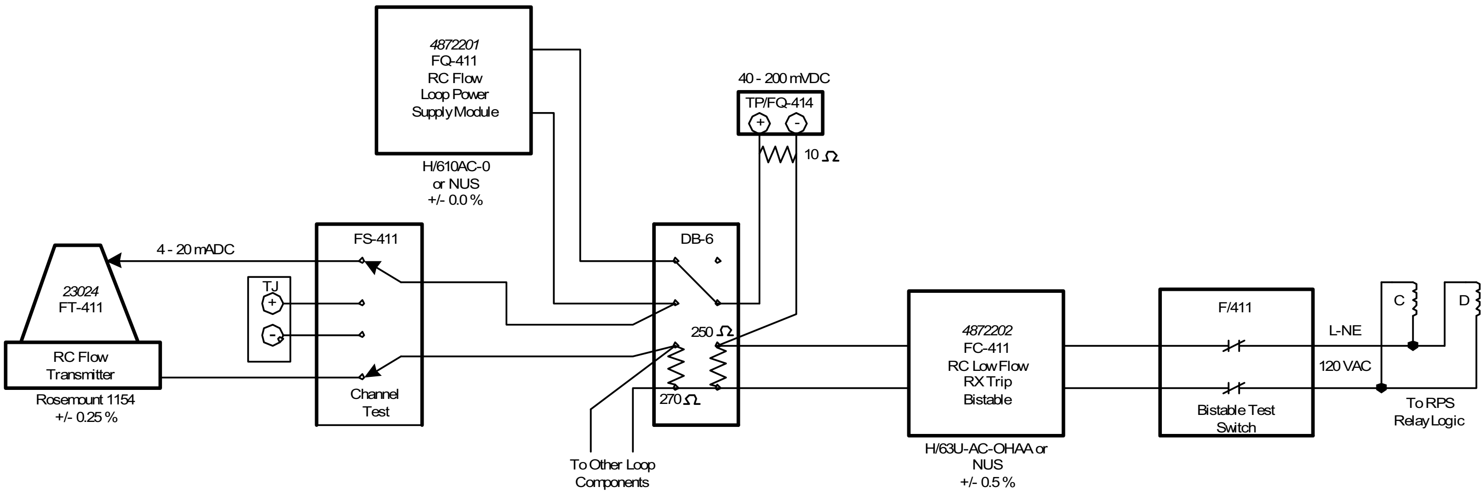


Figure 3.2-4

Refer to Figure 3.2-4 :

CSA Calculations performed for Reactor Trips generated by the Foxboro H-Line Control System also include rack error terms associated with the modules that perform signal modification and the bistables that generate the trip. The Foxboro H-Line Process Control System mainly operates using current loops where the power supplies are not used as signal converters. In many cases, for a single parameter protection function, the only rack module that will have a tolerance associated with it will be the Bistable Module.

In the case of Kewaunee's Low Reactor Coolant Flow Reactor Trip as shown in Figure 3.2-4, the rack error terms from CSA Calculation C10819 (Ref. 5.96) are :

$$(M2_{BISTABLE} + M2MTE) + RD + RTE$$

Where: $M2_{BISTABLE}$ = Rack Bistable Setting Accuracy = ± 0.50 %
M2MTE = Rack Measuring and Test Equipment = ± 0.20 %
RD = Rack Drift = ± 1.00 %
RTE = Rack Temperature Effects = ± 0.50 %

Note the difference between North Anna's rack error terms compared with the rack error terms listed above for Kewaunee. The error terms for the Loop Power Supply are not included in Kewaunee's CSA Calculation because it is not used as a signal converter.

Dual Parameter Protection Functions

Westinghouse 7300 Process Control System
High Steam Flow in 2/3 Lines ESFAS - Channel 3

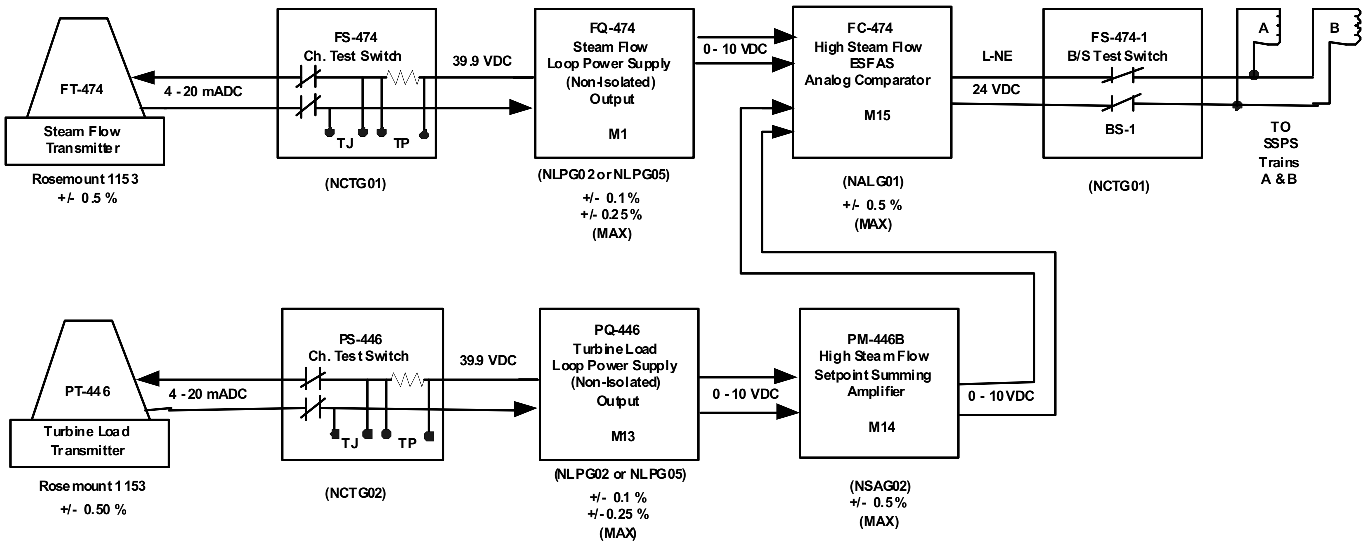


Figure 3.2-5

Figure 3.2-5 illustrates a typical dual input protection function for North Anna. Channel Statistical Allowance Calculations for dual parameter protection functions are different than single parameter functions. For example, there are more rack error terms associated with the development of the trip than a single parameter function. The rack error terms associated with North Anna's High Steam Flow in 2/3 Lines ESFAS trip based on Calculation EE-0736 (Ref. 5.23) are given below :

(M1 + M1MTE) + (M13 + M13MTE) + (M14 + M14MTE) + (M15 + M15MTE) + RD + RTE

Where:
M1 = Steam Flow Loop Power Supply Accuracy = ± 0.10 %
M1MTE = Module M1 Measuring and Test Equipment = ± 0.153 %
M13 = Turbine Load Loop Power Supply Accuracy = ± 0.10 %
M13MTE = Module M13 Measuring and Test Equipment = ± 0.153 %
M14 = High Steam Flow Setpoint Summator Accuracy = ± 0.50 %
M14MTE = Module M14 Measuring and Test Equipment = ± 0.042 %
M15 = High Steam Flow Comparator Setting Accuracy = ± 0.50 %
M15MTE = Module M15 Measuring and Test Equipment = ± 0.042 %
RD = Rack Drift = ± 1.00 %
RTE = Rack Temperature Effects = ± 0.50 %

The rack error terms described in the example above along with other error terms from the CSA Calculation will be used to validate the existing Allowable Values at North Anna or to calculate revised Allowable Values, if necessary. The configuration of dual parameter protection functions at Surry is similar to North Anna's. The major differences between the rack error components for both plants are based on the process control equipment as illustrated above for single input protection functions.

Multiple Parameter Protection Functions

Kewaunee

There are three multiple parameter protection functions at North Anna and Kewaunee, and four multiple parameter functions at Surry. Figure 3.2-6 is a block diagram that illustrates Kewaunee's Overtemperature ΔT Reactor Trip configuration (note that Overpower ΔT and Low T_{AVG} are also shown on the drawing). The configuration of North Anna's and Surry's Overtemperature ΔT Reactor Trip is similar, noting that the process control equipment is different.

As can be seen from Figure 3.2-6, Kewaunee's Overtemperature ΔT Reactor Trip function is derived from five process parameters, they are :

- T_{HOT}
- T_{COLD}
- Pressurizer Pressure
- Function of Delta Flux (FΔI) made up of Upper Flux (Q_U) and Lower Flux (Q_L)

Kewaunee Power Station Overtemperature ΔT Reactor Trip

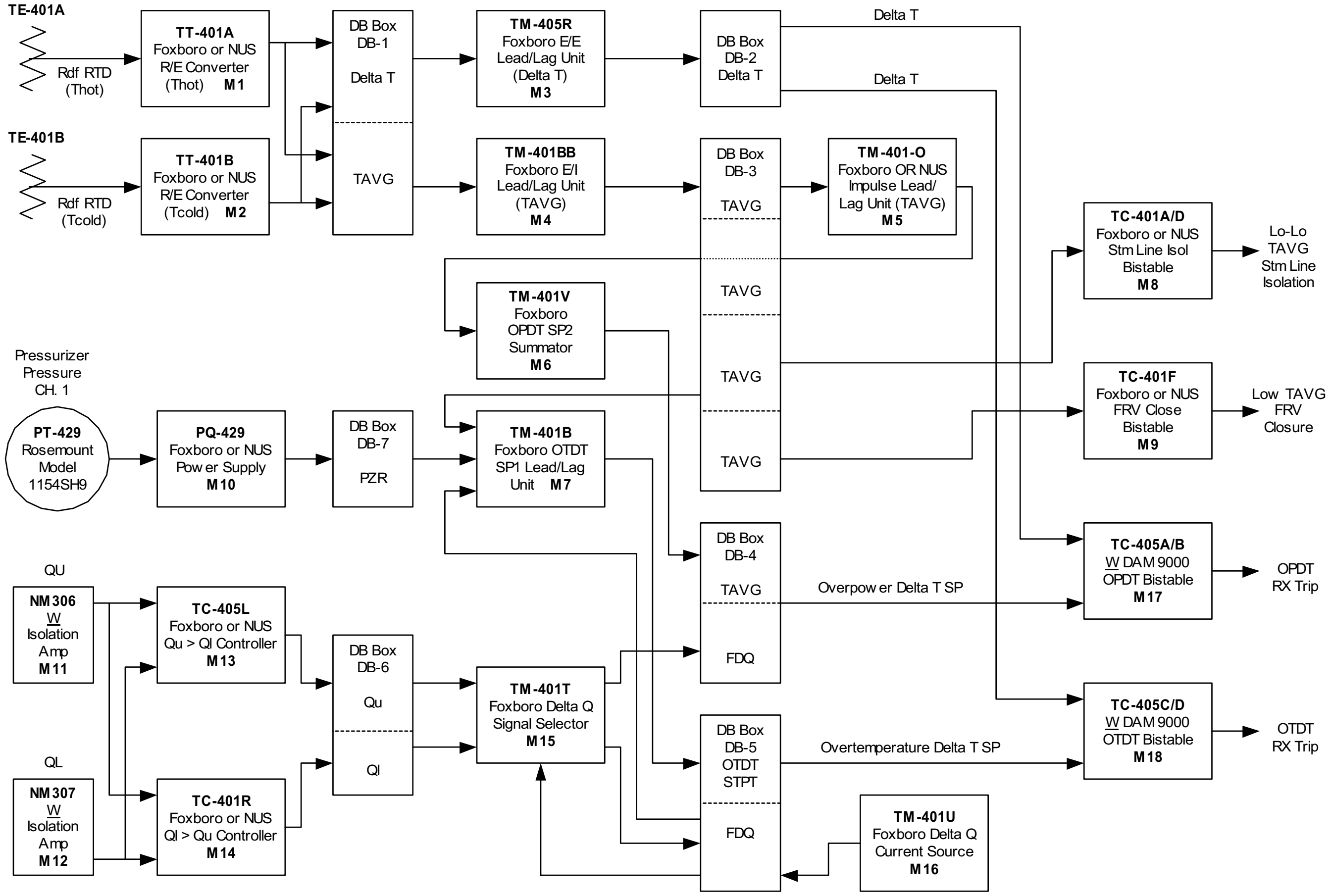


Figure 3.2-6

The Overtemperature ΔT Reactor Trip function is further broken down into channels as defined below :

- ΔT Channel, made up of T_{HOT} and T_{COLD}
- T_{AVG} Channel, made up of T_{HOT} and T_{COLD}
- Pressurizer Pressure Channel
- Function of Delta Flux (FΔI), made up of Q_U and Q_L

Because there are five inputs to Kewaunee's Overtemperature ΔT function, the rack error components will be grouped as channel inputs versus a string of modules as shown above for the Dual Parameter Function example. This type of assessment will yield a conservative and valid Allowable Value (for Kewaunee, the Allowable Value will be the As Found Tolerance) using the four step method described in Sections 3.4 and 3.5 (Section 3.5 is Kewaunee specific). CSA Calculation C11865 (Ref. 5.94) was performed using a module calibration method, which for a multiple-parameter function will result in a very conservative CSA value. However, using a module calibration method for a complex, multiple-parameter function will result in an Allowable Value, LSSS/Setting Limit, or As Found Tolerance that is non-conservative. The rack error components for each Overtemperature ΔT input channel are given below.

$$\Delta T \text{ Channel} = (RCA_1 + RMTE_1) + RD_1 + RTE_1$$

$$T_{AVG} \text{ Channel} = (RCA_2 + RMTE_2) + RD_2 + RTE_2$$

$$\text{Pressurizer Pressure Channel} = (RCA_3 + RMTE_3) + RD_3 + RTE_3$$

$$F\Delta I \text{ Channel} = (RCA_4 + RMTE_4) + RD_4 + RTE_4$$

$$OT\Delta T \text{ Setpoint} = (RCA_5 + RMTE_5)$$

$$OT\Delta T \text{ Bistable} = (RCSA + RMTE_6)$$

Where:

RCA_1 = ΔT Channel Calibration Accuracy = ± 0.707 % (M3)
$RMTE_1$ = ΔT Channel Rack Measuring and Test Equipment = ± 0.173 % (M3MTE)
RD_1 = ΔT Channel Rack Drift = ± 1.00 %
RTE_1 = ΔT Channel Rack Temperature Effect = ± 0.50 %
RCA_2 = T_{AVG} Channel Calibration Accuracy = ± 0.707 % (M4)
$RMTE_2$ = T_{AVG} Channel Rack Measuring and Test Equipment = ± 0.245 % (M4MTE)
RD_2 = T_{AVG} Channel Rack Drift = ± 1.00 %
RTE_2 = T_{AVG} Channel Rack Temperature Effect = ± 0.50 %
RCA_3 = Pressurizer Pressure Channel Calibration Accuracy = ± 0.00 %
$RMTE_3$ = Pressurizer Pressure Channel Rack Measuring and Test Equipment = ± 0.0 %
RD_3 = Pressurizer Pressure Channel Rack Drift = ± 0.00 %
RTE_3 = Pressurizer Pressure Channel Rack Temperature Effect = ± 0.00 %
RCA_4 = FΔI Channel Calibration Accuracy = ± 0.50 % (M15)
$RMTE_4$ = FΔI Channel Rack Measuring and Test Equipment = ± 0.346 % (M15MTE)
RD_4 = FΔI Channel Rack Drift = ± 1.00 %
RTE_4 = FΔI Channel Rack Temperature Effect = ± 0.50 %
RCA_5 = OTΔT Setpoint Summator Calibration Accuracy = ± 0.50 % (M7)
$RMTE_5$ = OTΔT Setpoint Summator Rack Measuring and Test Equipment = ± 0.374 % (M7MTE)
RCSA = OTΔT Reactor Trip Bistable = ± 0.50 % (M18)
$RMTE_6$ = OTΔT Reactor Trip Bistable Rack Measuring and Test Equipment = ± 0.224 % (M18MTE)

Some of the error terms listed above will be used to determine the Allowable Value (i.e., the As Found Tolerance) for Kewaunee's Overtemperature ΔT Reactor Trip. Similar error terms will be used throughout this document to evaluate the other multiple parameter protection functions at both plants.

3.3 The Instrumentation, Systems and Automation Society (ISA) Methodologies Used to Calculate Allowable Values

The following base line parameters will be used to illustrate how the Allowable Value is calculated using Methods 1, 2 and 3 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994.

Analytical Limit (AL)	= 6.00 PSIG
Total Instrument Loop Uncertainty (TLU)	= 1.39 PSIG
Calculated Instrument Uncertainties used for COT (COT)	= 1.10 PSIG
Calculated Instrument Uncertainties not used for COT (NON-COT)	= 0.85 PSIG

Notes:

1. In the context of this document, the Analytical Limit (AL), Safety Limit (SL), and the Safety Analysis Limit (SAL) have the same meaning.

2. In the context of this document, Total Instrument Loop Uncertainty (TLU) and the Channel Statistical Allowance (CSA) have the same meaning.

3. COT means Channel Operational Test.

4. COT Instrument Uncertainties are made up of the portion of the loop that is tested during the COT. For Surry, Kewaunee, and North Anna, these error components are:

   - Rack or Module Calibration Accuracy (RCA or M1, M2 ... Mn)
   - Rack Comparator Setting Accuracy or Comparator Module Calibration Accuracy (RCSA or Mn)
   - Rack Drift (RD)

5. NON-COT Instrument Uncertainties are made up of the portion of the loop that is not tested during the COT. For Surry, Kewaunee, and North Anna, these error components may include:

   - Systematic Error (SE)
   - Environmental Allowance (EA)
   - Process Measurement Accuracy (PMA)
   - Primary Element Accuracy (PEA)
   - Sensor Calibration Accuracy and Sensor Measuring and Test Equipment (SCA + SMTE)
   - Sensor Drift (SD)
   - Sensor Pressure Effect(s) (SPE)
   - Sensor Temperature Effect (STE)
   - Sensor Power Supply Effect (SPSE)
   - Rack Measuring and Test Equipment (RMTE or M1MTE, M2MTE ... MnMTE)
   - Rack Temperature Effect (RTE)

3.3.1 Method 1

Method 1 has been evaluated by the NRC Staff and was found to be an acceptable method to be used to calculate Allowable Values. Method 1 uses a TLU equal to 1.39 PSIG. The TLU was arrived at statistically using the Square Root Sum of the Squares (SRSS) method of combining channel error components. This is an accepted industry standard and is used here at Dominion Virginia Power. The channel error components used for the COT are equal to 1.10 PSIG and the error components used for the NON-COT are equal to 0.85. With a TLU equal to 1.39 PSIG and NON-COT errors equal 0.85 PSIG, then statistically, the COT error would be equal to 1.10 PSIG as shown below.

$$[(0.85)^2 + (1.10)^2]^{½} = 1.39 \quad \text{or} \quad [(1.39)^2 – (0.85)^2]^{½} = 1.10$$

If the COT error allowance were to be removed from the TLU, the statistical combination of the NON-COT error allowances would be equal to 0.85 PSIG. This means that the LSSS would have to be set such that the margin of 0.85 PSIG is maintained between the AV and the AL. To accomplish this using a COT error allowance of 1.10 PSIG, a determinant assessment must be used such that the COT allowance can only be equal to the TLU minus the NON-COT allowance, i.e., COT = 1.39 PSIG – 0.85 PSIG = 0.54 PSIG. In Method 1, the user decides that for the Channel Operational Test, the full COT allowance of 1.10 PSIG is to be retained. To maintain the full COT error allowance, the actual trip setpoint (ACT SP) is set below the calculated trip setpoint (CAL SP). Note that the difference between the CAL SP and the Allowable Value (AV) is 0.54 PSIG. The remainder of the desired COT allowance of 1.10 PSIG is obtained by lowering the ACT SP below the CAL SP by 0.56 PSIG to yield the ACT SP value of 4.05 PSIG. Method 1 ensures that the full NON-COT allowance of 0.85 PSIG is available under all conditions for the non-tested channel error components.

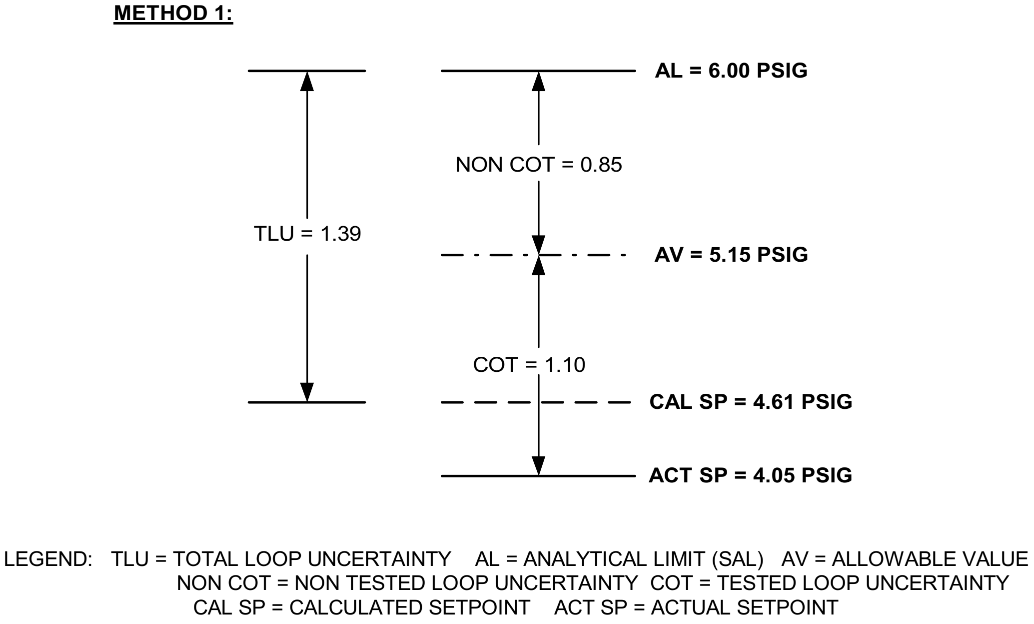


Figure 3.3-1

3.3.2 Method 2

Method 2 has been evaluated by the NRC Staff and was found to be an acceptable method to be used to calculate Allowable Values. Method 2 is essentially the same as Method 1 with the exception that the ACT SP is set equal to the CAL SP (i.e., 4.61 PSIG). This method does not allow for the full value of the COT error components as determined in the TLU (i.e., CSA Calculation). In some cases, this could cause the plant to find the AS FOUND Trip Setpoint outside of the AV more often than would be the case using Method 1. Like Method 1, Method 2 ensures that the statistical combination of the NON-COT error allowances (equal to 0.85 PSIG) is maintained between the AV and the AL under all conditions.

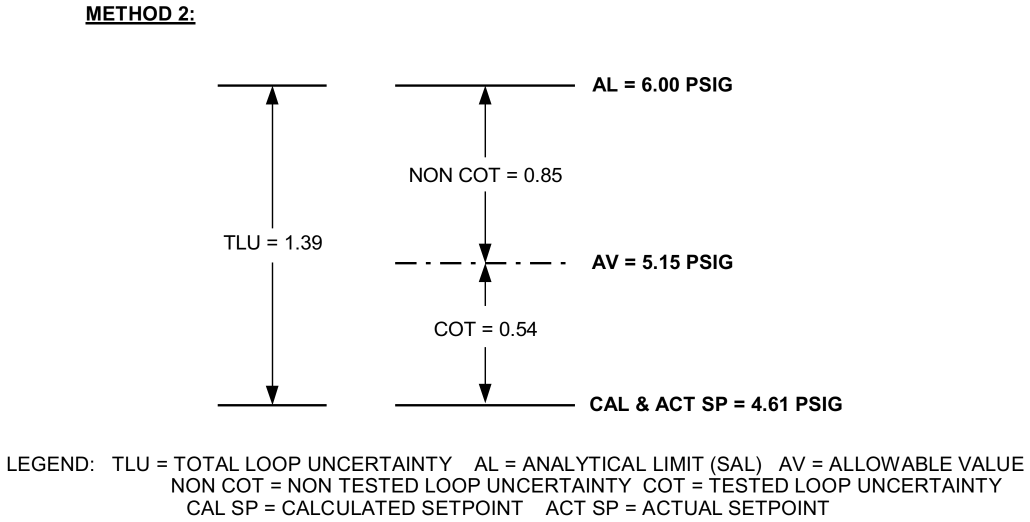
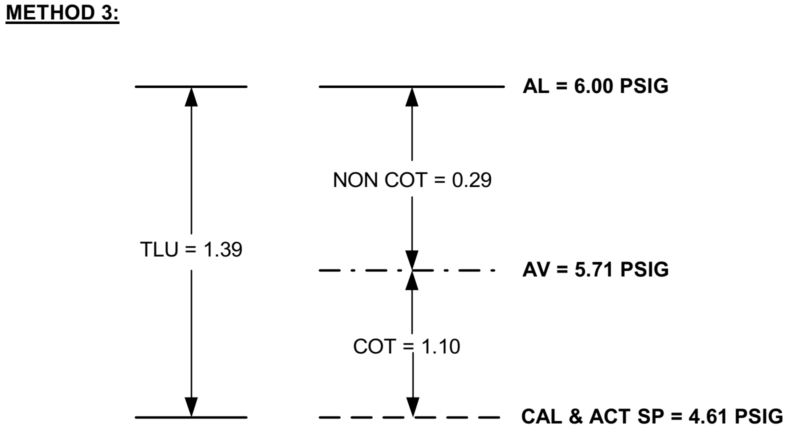


Figure 3.3-2

3.3.3 Method 3

Method 3 has been evaluated by the NRC Staff and was found to be an unacceptable method to be used to calculate Allowable Values. Method 3 has been used to calculate the Allowable Value in many Westinghouse Plants that used early versions of Standardized Technical Specifications (STS) as discussed above in Section 3.1. Using a determinant assessment, Method 3 does not ensure that the full NON-COT uncertainty allowance is maintained between the AV and the AL. To ensure that the NON-COT uncertainty allowance is maintained under all conditions, the AV must be set for ≤ 5.15 PSIG. As can be seen from the illustration below, the AV using Method 3 is set for 5.71 PSIG, i.e., CAL SP/ACT SP + COT = 5.71 PSIG. If the rack error components are allowed an offset of 1.10 PSIG before the channel is declared INOPERABLE, then the allowance for the NON-COT uncertainty is decreased to 0.29 PSIG. If the AS FOUND COT error was found to be (+) 1.05 PSIG and the AS FOUND NON-COT error was determined to be (+) 0.85 PSIG, then the channel trip function would have exceeded the Analytical Limit (i.e., SAL) and should be declared INOPERABLE. However, in accordance with Technical Specifications, the channel does not have to be declared INOPERABLE until the AS FOUND Trip Setpoint exceeds the Allowable Value. This is the concern that the NRC Staff has with Method 3. In the case of Method 3 using a determinant assessment, the AV does not protect the AL and does not identify an inoperable channel under all operating conditions.



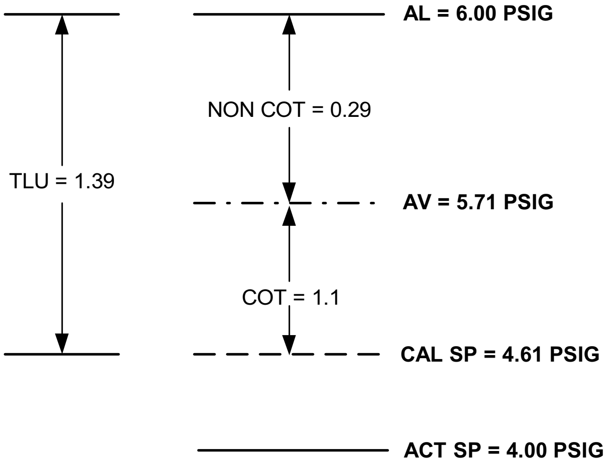
LEGEND: TLU = TOTAL LOOP UNCERTAINTY AL = ANALYTICAL LIMIT (SAL) AV = ALLOWABLE VALUE
NON COT = NON TESTED LOOP UNCERTAINTY COT = TESTED LOOP UNCERTAINTY
CAL SP = CALCULATED SETPOINT ACT SP = ACTUAL SETPOINT

Figure 3.3-3

3.3.4 Method 3 with Additional Margin

Method 3 using additional margin for the ACT SP has been evaluated by the NRC Staff and was found to be an unacceptable method to be used to calculate Allowable Values. Method 3 with additional margin is identical to Method 3 with the exception that the ACT SP is set below the CAL SP. In the case used for this illustration, the ACT SP is set for 4.00 PSIG which provides a margin of 0.61 PSIG to the CAL SP and 1.71 PSIG to the AV. This method actually yields less conservative results than Method 3 for two reasons. First, the AV is still set for 5.71 PSIG yielding a NON-COT allowance of 0.29 PSIG. As discussed above, using a determinant assessment, the NON-COT allowance of 0.29 PSIG does not fully account for the statistical combination of the non-tested loop error components. Second, the calculated COT allowance was determined to be 1.10 PSIG. Allowing an error of 1.71 PSIG between the ACT SP and the AV is beyond the assumptions used to develop the TLU (i.e., CSA Calculation). Allowing an error of 1.71 PSIG for the Trip Setpoint before the channel is declared INOPERABLE is inconsistent with the applicable TLU assumptions and will not ensure that the rack components are operating within the assumptions of the CSA Calculation and/or the manufacturer specifications. Also note that the difference between the ACT SP and the AV is larger than the calculated TLU for the entire channel.

METHOD 3 WITH ADDITIONAL MARGIN:



LEGEND: TLU = TOTAL LOOP UNCERTAINTY AL = ANALYTICAL LIMIT (SAL) AV = ALLOWABLE VALUE
NON COT = NON TESTED LOOP UNCERTAINTY COT = TESTED LOOP UNCERTAINTY
CAL SP = CALCULATED SETPOINT ACT SP = ACTUAL SETPOINT

Figure 3.3-4

3.4 Methodology for Determining North Anna "Allowable Values" and Surry "LSSS/Setting Limits"

Information Intentionally Removed
Specific to North Anna Power Station and Surry Power Station Only

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Specific to North Anna Power Station and Surry Power Station Only

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Specific to North Anna Power Station and Surry Power Station Only

3.5 Methodology for Determining Kewaunee's "Allowable Value" and "Limiting Trip Setpoint" Based on TSTF-493 and RIS 2006-17

Kewaunee's setpoint methodology is identical to that of Surry and North Anna noting that the requirements and revised terminology imposed by TSTF-493 and RIS 2006-17 (Refs. 5.99 and 5.100) will be incorporated into the methodology as appropriate. Kewaunee Power Station has chosen to implement TSTF-493, Revision 4, Option B as part of the conversion to Improved Technical Specifications. As stated above in Section 2.2.6, TSTF-493, Revision 4, Option B allows for the relocation of the Allowable Values associated with LCO's 3.3.1, 3.3.2, 3.3.5, 3.3.6, and 3.3.7 from Section 3.3 of Technical Specifications to a Licensee controlled program as defined in ITS Section 5.5.16. The Licensee controlled program is defined in ITS Section 5.5.16 as the "Setpoint Control Program".

The Setpoint Control Program establishes the requirements for ensuring that setpoints for automatic protective devices are initially within and remain within the Technical Specification requirements. The Setpoint Control Program will govern the process for implementing changes to instrumentation setpoints and will describe the setpoint methodology used to ensure that setpoints are established in accordance with the requirements of Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994, TSTF-493, Revision 4, Option B, and RIS 2006-17. The automatic protective devices related to variables that perform a significant safety function at Kewaunee Power Station as delineated by 10 CFR 50.36(c)(1)(ii)(A) are described in detail in Sections 4.5, 4.6, and 4.7.

3.5.1 Primary RPS and ESFAS Trips, Permissives, and Other LCO's Credited in the Kewaunee Safety Analysis

A four step process is used to determine the Allowable Value (AV), Limiting Trip Setpoint (LTSP), Nominal Trip Setpoint (NTSP), and the As Found Tolerance (AFT) for Trip Functions, Permissives, and other LCO's at Kewaunee Power Station that are credited in the Safety Analysis. This four step process is based on the requirements of Methods 1 or 2 as described in ISA-RP67.04.02-2000 (Ref 5.43) and the revised terminology described in TSTF-493, Revision 4, and RIS 2006-17. In the order of operation, the four steps are described below and they are illustrated in Figure 3.5-1

1. Determine the Minimum (decreasing trip) or Maximum (increasing trip) Limiting Trip Setpoint (LTSP). The Maximum Limiting Trip Setpoint is arrived at by subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) (also known as the Safety Analysis Limit). The Minimum Limiting Trip Setpoint is arrived at by adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL).

2. Determine the Minimum (decreasing trip) or Maximum (increasing trip) Allowable Value (AV). This Maximum Allowable Value is arrived at by subtracting the statistical combination (i.e., Square Root of the Sum of the Squares "SRRS") of the NON COT Loop Error Components (i.e., the loop error terms that are not tested or quantified during the Channel Operational Test "COT") from the Analytical Limit (AL). The Minimum Allowable Value is arrived at by adding the statistical combination of the NON COT Loop Error Components to the Analytical Limit (AL).

3. Determine the Nominal Trip Setpoint (NTSP). After the LTSP is determined in step 1, the current Nominal Trip Setpoint for the function can be evaluated for acceptability. It may be desirable to move the current Nominal Trip Setpoint in a more conservative direction to obtain additional margin to the Analytical Limit and/or to allow for the full COT error allowance between the Nominal Trip Setpoint and the As Found Tolerance (AFT). Conversely, the current Nominal Trip Setpoint may be overly conservative resulting in reduced operating margin. If there is sufficient margin to the Analytical Limit, then it may be desirable to move the existing Nominal Trip Setpoint in the non-conservative direction to obtain additional operating margin. In all cases, the NTSP must be set equal to or, preferably, conservative with respect to the LTSP.

4. Determine the As Found Tolerance (AFT). Note that the As Found Tolerance for Kewaunee is equivalent to the Allowable Values/Limiting Safety System Settings/Setting Limits used for North Anna and Surry. After the AV is determined in step 2, the As Found Tolerance can be determined based on the NTSP. The AFT for an increasing trip function is arrived at by adding the statistical combination (i.e., Square Root of the Sum of the Squares “SRRS”) of the COT Loop Error Components (i.e., the loop error terms that are tested or quantified during the Channel Operational Test “COT”) to the Nominal Trip Setpoint (NTSP). The AFT for a decreasing trip function is arrived at by subtracting the statistical combination of the COT Loop Error Components from the Nominal Trip Setpoint. In all cases, the As Found Tolerance must be set equal to or, preferably, conservative with respect to the Allowable Value.

Kewaunee's Four Step Process

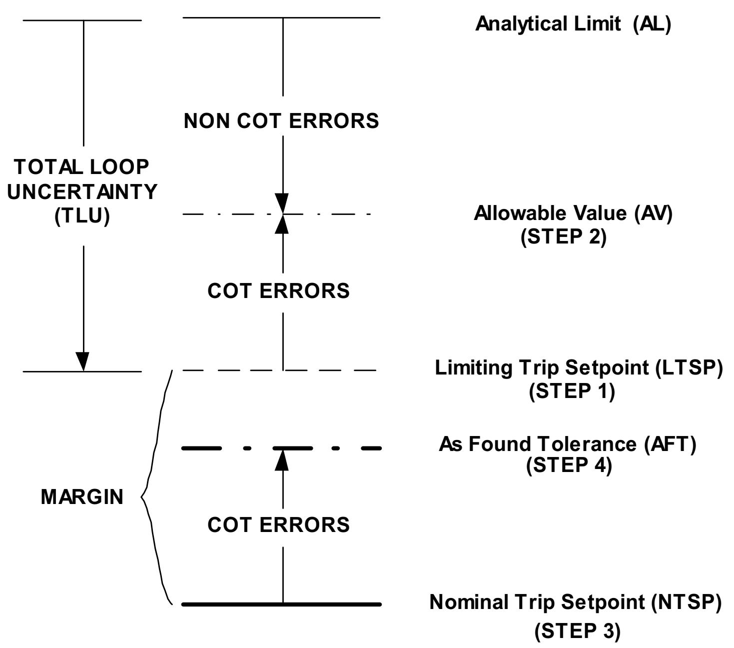

Figure 3.5-1

3.5.2 Backup RPS and ESFAS Trips, Permissives, and Other LCO's Not Credited in the Kewaunee Safety Analysis

A two step process is used to determine the As Found Tolerance for Backup RPS and ESFAS Functions at Kewaunee Power Station that are not credited in the Safety Analysis. Backup RPS/ ESFAS and other LCO's Trip Functions do not have a documented Safety Limit; therefore, Limiting Trip Setpoints and Allowable Values do not need to be calculated. In some cases for Backup Trips, a TLU (i.e., CSA Calculation) may not be available to perform the process described below. In such a case, the process is subjective and should be based on the best available information. The two step process is described below.

1. Determine the Nominal Trip Setpoint (NTSP). The current Nominal Trip Setpoint for the function should be evaluated for acceptability. It may be desirable to move the current Nominal Trip Setpoint in a more conservative direction to obtain additional margin to ensure the function will support the associated Primary Trip, if applicable. Conversely, the current Nominal Trip Setpoint may be overly conservative resulting in reduced operating margin. If there is sufficient margin with respect to the associated Primary Trip Analytical Limit (if applicable), then it may be desirable to move the existing Nominal Trip Setpoint in the non-conservative direction to obtain additional operating margin.

2. Determine the As Found Tolerance (AFT). The AFT for an increasing trip function is arrived at by adding the statistical combination (i.e., Square Root of the Sum of the Squares "SRRS") of the COT Loop Error Components (i.e., the loop error terms that are tested or quantified during the Channel Operational Test "COT") to the Nominal Trip Setpoint (NTSP). The AFT for a decreasing trip function is arrived at by subtracting the statistical combination of the COT Loop Error Components from the Nominal Trip Setpoint (NTSP).

3.5.3 Calculating Limiting Trip Setpoints, Allowable Values, and As Found Tolerances for Kewaunee Power Station

Kewaunee's Steam Generator Water Level High - High

Currently, Kewaunee's Custom Technical Specifications (Ref. 5.90) does not specify a Setting Limit for the Steam Generator High-High Water Level ESFAS Trip. This function will be included in the Setpoint Control Program in accordance with ITS Table 3.3.2.1, item 5.b. Based on the requirements of ITS Section 5.5.16, this function will be evaluated based on the four step method described in Section 3.5.1 to ensure that it is bounded by the CSA Calculation of record and by the Safety Analysis assumptions documented in Technical Report NE-0994 (Ref. 5.1). The example given below will be adjusted to include the revised terminology and requirements specified in TSTF-493, Revision 4 and RIS 2006-17 to support the conversion to ITS and the implementation of the Kewaunee Setpoint Control Program.

Given Information:

Analytical Limit = 100.0 % Narrow Range Level (Ref. 5.1)

Current CTS Setting Limit = not specified

Current Nominal Trip Setpoint = 66.5 % Narrow Range Level (Ref. 5.112)

Total Loop Uncertainty/Channel Statistical Allowance = (+) 3.967 to (+) 7.923 % Narrow Range Level (only the most positive value is used for the analysis) (Ref. 5.97)

Type of Trip = Increasing Trip, Normally Energized (Ref. 5.112)

Functional Group = Primary Trip, Single Parameter Protection Function (Refs. 5.1 and 5.112)

Step 1 - Determine the Limiting Trip Setpoint (LTSP)

The Limiting Trip Setpoint (LTSP) is equal to the Analytical Limit (AL) minus the Total Loop Uncertainty (TLU). Thus, the LTSP is equal to:

$$\text{LTSP} = 100.0\ \% - 7.923\ \%$$

$$\text{LTSP} = 92.077\ \%\ \text{Narrow Range Level}$$

Step 2 - Determine the Allowable Value (AV)

The Allowable Value (AV) is equal to the Analytical Limit (AL) minus the NON-COT loop error components taken from the Total Loop Uncertainty (TLU) calculation. The NON-COT loop error components from Kewaunee CSA Calculation C11116 (Ref. 5.97) are detailed below:

Systematic Error (SE) = ± 0.000 % of span
Process Measurement Accuracy (PMA_3) = ± 5.945 % of span
Primary Element Accuracy (PEA) = ± 0.000 % of span
Sensor Calibration Accuracy + Sensor Measuring & Test Equipment (SCA+SMTE) = ± 0.467 % of span
Sensor Drift (SD) = ± 0.280 % of span
Sensor Pressure Effects (SPE) ± 0.577 % of span
Sensor Temperature Effects (STE) = ± 1.241 % of span
Sensor Power Supply Effect (SPSE) = ± 0.060 % of span
Module 1 Measuring and Test Equipment (M1MTE) = ± 0.000 % of span
Module 3 Measuring and Test Equipment (M3MTE) = ± 0.200 % of span
Rack Temperature Effect (RTE) = ± 0.500 % of span

Combining the NON-COT loop error components using the Square Root of the Sum of the Squares (SRSS) method as described in Dominion Standard STD-EEN-0304 (Ref. 5.5), we have the following NON-COT total error:

$$\text{NON COT}_{\text{error}} = SE + PMA_3 \pm [PEA^2 + (SCA+SMTE)^2 + SD^2 + SPE^2 + STE^2 + SPSE^2 + M1MTE^2 + M3MTE^2 + RTE^2]^{1/2}$$

$$\text{NON COT}_{\text{error}} = 0.0 + 5.945 \pm [0.0^2 + (0.25+0.217)^2 + 0.280^2 + 0.577^2 + 1.241^2 + 0.060^2 + 0.0^2 + 0.20^2 + 0.5^2]^{1/2}$$

$\text{NON COT}_{\text{error}} =$ 7.514 % Narrow Range Level

The Allowable Value (AV) for an increasing trip based on the requirements of Methods 1 or 2 as described in ISA-RP67.04.02-2000 (Ref. 5.43) is determined by subtracting the total NON-COT error from the Analytical Limit as shown below.

AV = 100.0 % - 7.514 %

AV = 92.486 % Narrow Range Level

Step 3 - Determine the Nominal Trip Setpoint (NTSP)

As determined in Step 1, the Limiting Trip Setpoint is equal to 92.077 % Narrow Range Level. The current Nominal Trip Setpoint for this function at Kewaunee is 66.5 % Narrow Range Level. The Nominal Trip Setpoint is conservative with respect to the Limiting Trip Setpoint. The nominal operating band for Steam Generator Level at 100 % power is 44.0 % Level ± 5.0 % Level (Refs. 5.134 and 5.135). Subtracting the worst case normal operating level of 49.0 % from the Nominal Trip Setpoint of 66.5 % yields an operating margin of 17.5 % level. This operating margin encompasses the entire Total Loop Uncertainty and should allow for stable operation. Therefore, the current Nominal Trip Setpoint of 66.5 % Narrow Range Level will be retained.

Step 4 - Determine the As Found Tolerance (AFT)

As determined in Step 2, the Allowable Value (AV) is equal to 92.486 % Narrow Range Level. The As Found Tolerance will be based on the COT error components taken from Calculation C11116 (Ref. 5.97) as shown below.

The As Found Tolerance is equal to the Nominal Trip Setpoint plus the COT loop error components taken from the Total Loop Uncertainty (TLU) calculation. The COT loop error components from CSA Calculation C11116 are detailed below:

Module 1 – Foxboro or NUS Loop Power Supply (M1) = ± 0.00 % of span
Module 3 – Foxboro or NUS Bistable Module (M3) = ± 0.50 % of span
Rack Drift (RD) = ± 1.0 % of span

Combining the COT loop error components using the Square Root of the Sum of the Squares (SRSS) method as described in Dominion Standard STD-EEN-0304 (Ref. 5.5), we have the following COT total error:

$COT_{error} = \pm (M1^2 + M3^2 + RD^2)^{1/2}$

$COT_{error} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$

$COT_{error} = \pm$ 1.12 % Narrow Range Level

As described in Step 4 above, the As Found Tolerance (AFT) for an increasing trip is determined by adding the total COT error to the Nominal Trip Setpoint as shown below.

AFT = 66.5 % + 1.12 % = 67.62 % Narrow Range Level

This As Found Tolerance of 67.62 % Narrow Range Level will be included in the Setpoint Control Program to support Kewaunee's conversion to ITS, noting the Nominal Trip Setpoint is equal to 66.5 % Narrow Range Level. The Nominal Trip Setpoint and the As Found Tolerance are both set below the Allowable Value of 92.486 % Narrow Range Level and the Limiting Trip Setpoint of 92.077 % Narrow Range Level.

As Found Tolerance (AFT) = 66.5 % Narrow Range Level ± 1.12 % Narrow Range Level
As Left Tolerance (ALT) = 66.5 % Narrow Range Level ± 0.50 % Narrow Range Level(1)

Steps 1 through 4 as they apply for Kewaunee's Steam Generator High-High Water Level Reactor Trip are illustrated below in Figure 3.5-2.

---

(1) ALT = COT error minus Rack Drift (RD) = $\pm (0.0^2 + 0.5^2)^{1/2} = \pm$ 0.5 % of span = ± 0.5 % NR Level

KEWAUNEE'S STEAM GENERATOR HI-HI WATER LEVEL ESFAS

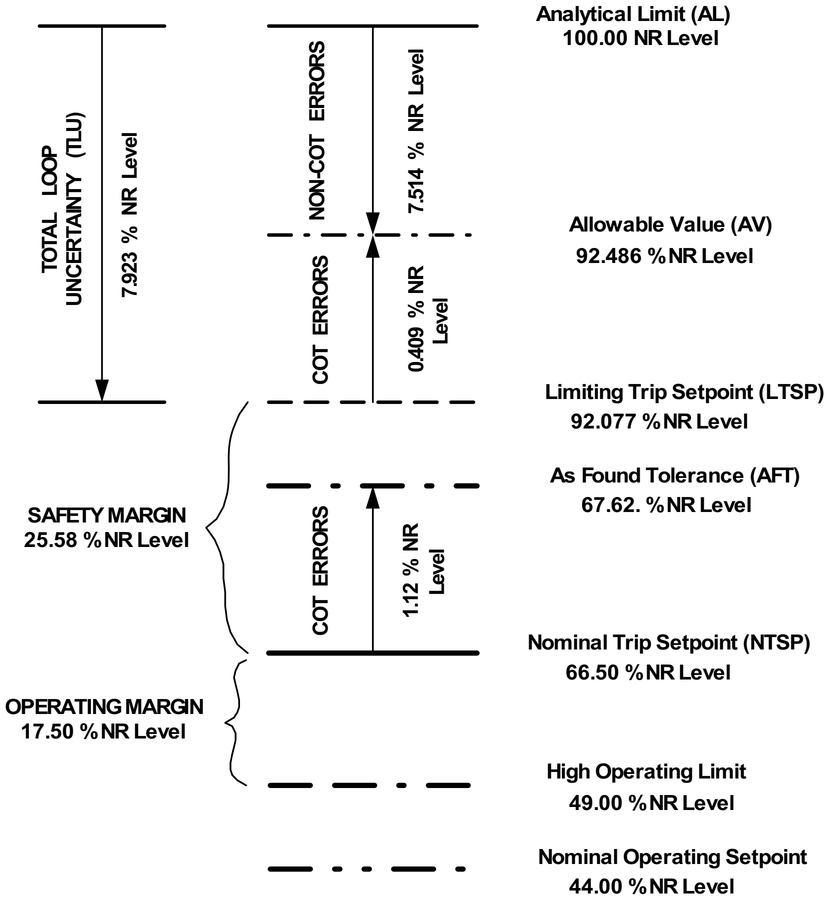

Figure 3.5-2

In addition to the above, TSTF-493, Revision 4 and RIS 2006-17 also stipulate that the As Left Tolerance be specified as part of the Setpoint Control Program. The As Left Tolerances will be specified for Kewaunee's RPS instrumentation, ESFAS instrumentation, and other instrumentation associated with LCO's 3.3.5, 3.3.6, and 3.3.7 in Sections 4.5, 4.6, and 4.7, respectively. In general, for single input parameters, the As Left Tolerance will be equal to the calibration accuracy of the module or the SRSS of calibration accuracies of the modules used to develop the trip function. For multiple input parameters, the As Left Tolerance will be developed as described in Sections 4.5, 4.6, and 4.7.

4.0 RESULTS

4.1 Allowable Values for North Anna ITS Table 3.3.1-1 (RTS Instrumentation)

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4.2 Allowable Values for North Anna ITS Table 3.3.2-1 (ESFAS Instrumentation)

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4.3 Limiting Safety System Settings (LSSS) for Surry Power Station Custom Technical Specifications, Section 2.3, Limiting Safety System Settings, Protective Instrumentation and Protective Instrumentation Settings for Reactor Trip Interlocks.

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4.4 Setting Limits for Surry Power Station Custom Technical Specifications, Table 3.7-4, Engineered Safety Features Actuation System Instrumentation Setting Limits and Table 3.7-2, Engineered Safety Features Actuation System Instrumentation Operating Conditions

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4.5 Limiting Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances for Kewaunee Reactor Protection System (RPS) Instrumentation to Support the Setpoint Control Program

Note : Only the limiting As Found Tolerance value will be addressed in analysis for each Reactor Trip Function described below.

Reactor Trips

4.5.1 Power Range Neutron Flux High Setpoint Reactor Trip

As Found Tolerance Value : 105 % RTP ± 1.5 % RTP (Refs. 5.1, 5.90, 5.91, 5.103, and 5.104)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 110.96 % Rated Thermal Power (RTP). Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 111.19 % RTP. The Nominal Trip Setpoint (NTSP) of 105.0 % RTP is conservative with respect to the Limiting Trip Setpoint and the As Found Tolerance Value of ≤ 106.5 % RTP is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value of ≤ 109 % RTP will be changed to an As Found Tolerance value ≤ 106.5 % RTP to conform to the requirements of TSTF-493, Rev. 4 and RIS 2006-17. The As Found Tolerance is based on a Nominal Trip Setpoint value of 105 % RTP. The Nominal Trip Setpoint value of 105 % RTP will allow a 1.5 % RTP margin to be used for the COT error components. The revised As Found Tolerance value of ≤ 106.5 % RTP is conservative with respect to the calculated value of ≤ 106.56 % RTP using the CSA rack error terms from Calculation C11705 (Ref 5.91).

The calculated As Found Tolerance value for this function is ≤ 106.562 % RTP. The 0.062 % RTP offset will be subtracted from the calculated value to arrive at a value that can be determined on the indicator. The statistical combination of the COT and NON COT error components from CSA Calculation C11705 (Ref. 5.91) are given below. The COT and NON COT error components are used in Figure 4.5.1 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$$\text{NON COT}_{\text{error}} = \text{SE} \pm (\text{PMA}_1^2 + \text{PMA}_3^2 + \text{M1MTE}^2 + \text{M3MTE} + \text{RTE}^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = 0.333 \pm (1.417^2 + 5.124^2 + 0.185^2 + 0.193^2 + 0.5^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = \pm 5.679 \text{ \% of span} = \pm 6.815 \text{ \% RTP}$$

$$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M3}^2 + \text{RD}^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm (0.05^2 + 0.833^2 + 1.0^2)^{1/2}$$

$\text{COT}_{\text{error}} = \pm 1.302$ % of span = ± 1.562 % RTP (for conservatism round to ± 1.5 % RTP)

As Found Tolerance (AFT) = 105 % RTP ± 1.5 % RTP
As Left Tolerance (ALT) = 105 % RTP ± 1.0 % RTP$^{(1)}$

See Figure 4.5.1 for specific details.

---

(1) As Left Tolerance = $\pm$ $(M1^2 + M3^2)^{1/2}$ = $\pm$ $(0.05^2 + 0.833^2)^{1/2}$ = $\pm$ 0.834 % of span = $\pm$ 1.001 % RTP

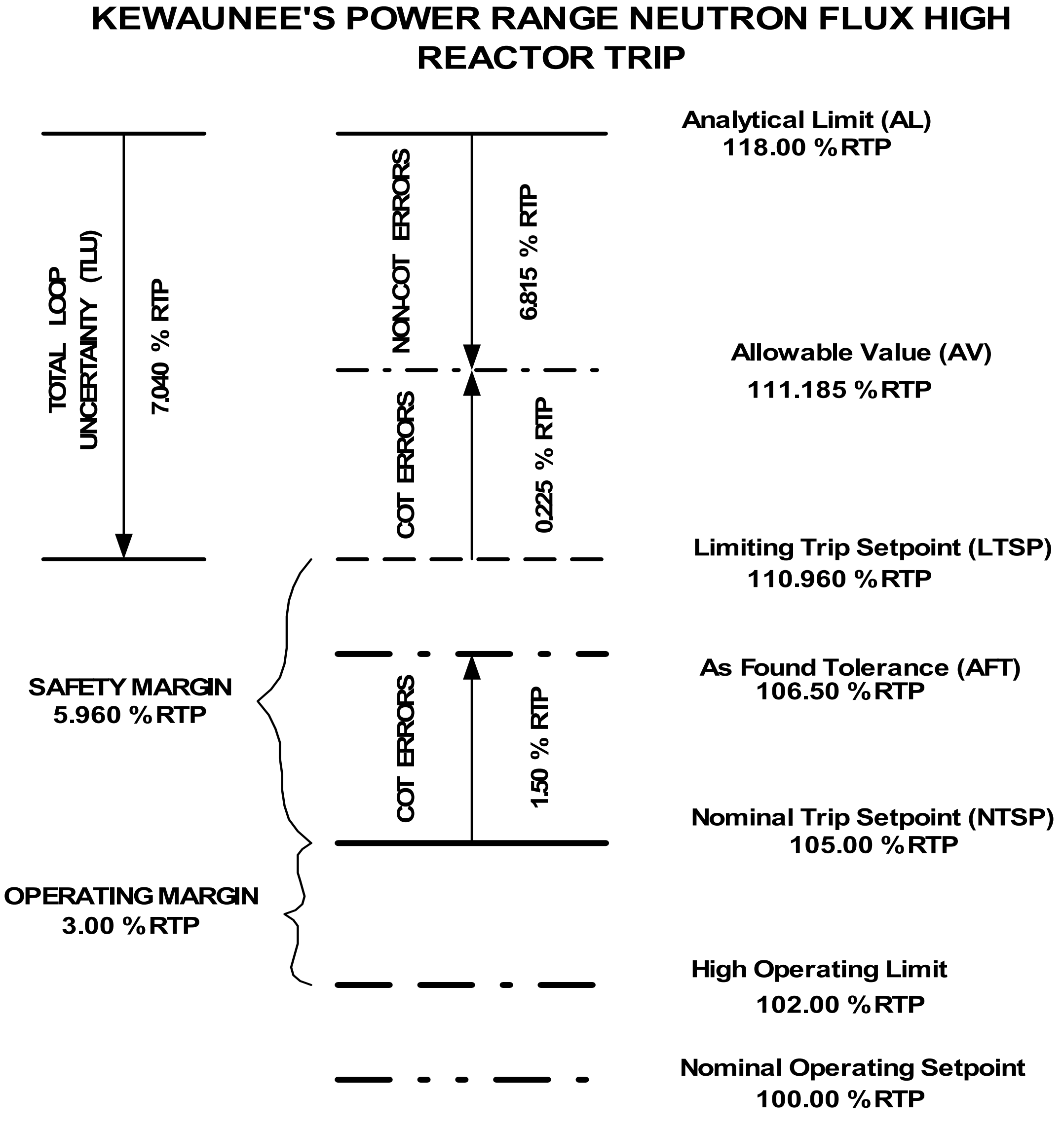

Figure 4.5.1

4.5.2 Power Range Neutron Flux Low Setpoint Reactor Trip

As Found Tolerance: 24.5 % RTP ± 1.5 % RTP (Refs. 5.1, 5.90, 5.91, 5.103, and 5.104)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 27.96 % Rated Thermal Power (RTP). Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 28.19 % RTP. The Nominal Trip Setpoint (NTSP) of 24.5 % RTP is conservative with respect to the Limiting Trip Setpoint and the As Found Tolerance Value of ≤ 26.062 % RTP (conservatively round to ≤ 26.0) is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value of ≤ 25 % RTP will be changed to an As Found Tolerance value of ≤ 26 % RTP to conform to the requirements of TSTF-493, Rev. 4 and RIS 2006-17. The As Found Tolerance is based on a Nominal Trip Setpoint value of 24.5 % RTP. The Nominal Trip Setpoint value of 24.5 % RTP will allow a 1.5 % RTP margin to be used for the COT error components.

The statistical combination of the COT and NON COT error components from CSA Calculation C11705 (Ref. 5.91) are given below. The COT and NON COT error components are used in Figure 4.5.2 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm (\text{PMA}_1{}^2 + \text{PMA}_3{}^2 + \text{M1MTE}^2 + \text{M4MTE} + \text{RTE}^2)^{1/2}$

$\text{NON COT}_{\text{error}} = 0.333 \pm (1.417^2 + 5.124^2 + 0.185^2 + 0.193^2 + 0.5^2)^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 5.679 % of span = ± 6.815 % RTP

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M4}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.05^2 + 0.833^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm$ 1.302 % of span = ± 1.562 % RTP (for conservatism round to ± 1.5 % RTP)

As Found Tolerance (AFT) = 24.5 % RTP ± 1.5 % RTP
As Left Tolerance (ALT) = 24.5% RTP ± 1.0 % RTP(1)

See Figure 4.5.2 for specific details.

---

(2) As Left Tolerance = $\pm (\text{M1}^2 + \text{M4}^2)^{1/2} = \pm (0.05^2 + 0.833^2)^{1/2} = \pm$ 0.834 % of span = ± 1.001 % RTP

KEWAUNEE'S POWER RANGE NEUTRON FLUX LOW SETPOINT REACTOR TRIP

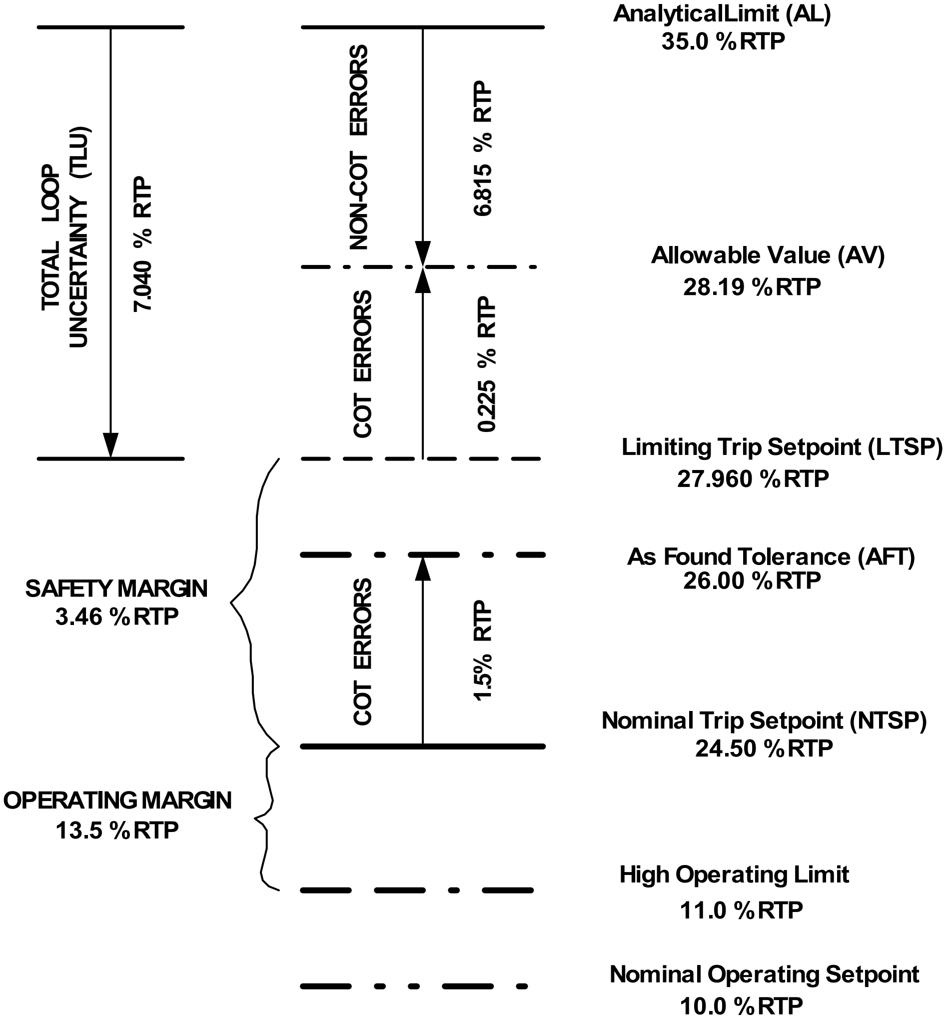

Figure 4.5.2

4.5.3 Power Range Neutron Flux High Positive Rate Reactor Trip

As Found Tolerance: **5.0 % RTP ± 1.3 % RTP with a time constant of 2.3 seconds ± 0.2 seconds (Refs. 5.1, 5.11, 5.12, 5.13, 5.73, 5.90, 5.91, 5.104, 5.136, & 5.142)**

The current Kewaunee Custom Technical Specifications (CTS) LSSS value for this function is 15.0 % / Δq / 5.0 seconds. The manner in which this specification is presented in Kewaunee's CTS is different than the typical presentation in Standardized Technical Specifications (STS) or in Improved Technical Specifications (ITS). The typical expression for this function in STS or ITS would be "≤ 15.0 % RTP with a time constant ≥ 5.0 Seconds." For consistency and clarity, the expression for this function will be written in the ITS format. The current static Nominal Trip Setpoint (NTSP) for this function is (+) 5.0 % RTP and the Rate Lag Derivative Time Constant associated with this function is currently set at a nominal value of 2 seconds versus the required CTS LSSS value of 5.0 seconds.

For Rate Lag Derivative functions, conservative settings are ≥ the desired/required time constant. The Power Range Neutron Flux Positive Rate Reactor Trip is developed based on a combination of the dynamic compensation from the Rate Lag Derivative Module (NM311) and the static trip setpoint installed in the Bistable Relay Driver (NC303). When Kewaunee's current settings for Rate Lag Derivative Module (i.e., nominal 2 second time constant) and the Bistable Relay Driver (i.e., nominal trip setpoint is + 5.0 % RTP) are combined, the Power Range Neutron Flux Positive Rate Reactor Trip function is set conservative when compared to the current CTS LSSS settings (i.e., + 15.0 % RTP with a time constant of 5 seconds) for all postulated conditions which include both a ramp and a step. The major contributing factor that results in this determination is based on the fact that the nominal trip setpoint is set at 5.0 % RTP versus 15.0 % RTP. The currently installed settings versus the current LSSS settings will be compared below for both a step and a ramp.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a step input is:

$$V_{OUT} = G * (e^{-t/t1} * (V_F - V_I) + B)$$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 0.1 second)
t1 = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_F = Voltage input to the Rate Lag Derivative Module after the step change = 8.771 VDC
V_I = Voltage input to the Rate Lag Derivative Module before the step change = 8.333 VDC
B = Rate Lag Derivative Module Bias = 0.000 VDC

There is no pedestal voltage for the NIS Rate Lag Derivative Modules. For a step change starting at V_{OUT} = 0.000 VDC with the currently installed settings, i.e., + 5.0 % RTP = (5 %/120 %) * 10.000 VDC = + 0.417 VDC and a nominal Rate Lag Derivative Time Constant of 2 seconds, the Power Range Neutron Flux Positive Rate Reactor Trip will occur with a power change of 5.256 % RTP. This includes a conservative assumption of 0.1 seconds used for the time of interest (i.e., t) to account for on-board module lag(s) and the process lags. Therefore, the common parameters are:

Bistable Relay Driver Setpoint = 5.0 % RTP = 0.417 VDC
Rate Lag Derivative Time Constant = 2 seconds

To make the Positive Rate Bistable Relay Driver trip, we must use a step change of 0.438 VDC to account for lags in the system as discussed above. This step change voltage is calculated as:

$(1 / e^{-0.1/2}) * 0.417\ \text{VDC} = 0.438\ \text{VDC}$

With the currently installed settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/2} * (8.771 – 8.333) + 0.000)$
$V_{OUT(NM311)}$ = 0.417 VDC (Bistable Relay Driver TRIP), noting that actual power is equal to (0.438 VDC / 10.000 VDC) * 120 % RTP = (+) 5.256 % RTP.

Using the same input parameters and substituting Kewaunee's current LSSS settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/5} * (8.771 – 8.333) + 0.000)$
$V_{OUT(NM311)}$ = 0.429 VDC (Bistable Relay Driver RESET), noting that actual power is equal to (+) 5.256 % RTP. However, the installed setpoint for the Bistable Relay Driver would be set at (+) 15.0 % RTP = (15 % RTP / 120 % RTP) * 10.000 VDC = 1.250 VDC.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a ramp input is:

$V_{OUT} = G * V_I + t1 * RR * G * (1 - e^{-t/t1}) + B$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 5 seconds)
t1 = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_I = Voltage input to the Rate Lag Derivative Module before the ramp starts = 8.333 VDC
RR = Ramp Rate (VDC/Second)
B = Rate Lag Derivative Module Bias = 0.000 VDC

The assumption used for this example for the Ramp Rate (RR) is a (+) 15.0 RTP power change in 5 seconds. That means the indicated power on the Full Power Meter goes from 100 % RTP to 115 % RTP in 5 seconds. So the Ramp Rate will be [(15 % RTP / 120 % RTP) * 10.000 VDC] / 5 seconds = 0.250 VDC / second = 3.0 % RTP / second. The currently installed settings versus the current Technical Specifications LSSS settings will be compared below for a ramp of (+) 3.0 % RTP / second at a time of interest (t) of 5 seconds after the ramp begins.

With the currently installed settings, the Positive Rate Trip will respond as shown below:

Nominal Trip Setpoint = (+) 5.0 % RTP = 0.417 VDC
Nominal Rate Lag Derivative Time Constant = 2 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 2 * 0.250 * 1.0000\,(1 - e^{-5/2}) + 0.000$
$V_{OUT(NM311)} = 0.459$ VDC (Bistable Relay Driver TRIP)

With the current Technical Specifications LSSS settings, the Positive Rate Trip will respond as shown below:

Nominal Trip Setpoint = (+) 15.0 % RTP = 1.250 VDC
Nominal Rate Lag Derivative Time Constant = 5 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 5 * 0.250 * 1.0000\,(1 - e^{-5/5}) + 0.000$
$V_{OUT(NM311)} = 0.790$ VDC (Bistable Relay Driver RESET)

As can be seen from the examples above, from a dynamic perspective, the current Technical Specifications LSSS setting for the Rate Lag Derivative Time Constant (i.e., time constant = 5 seconds) will yield the most conservative output from NM311 for both a ramp and a step. However, when the dynamics and the statics are combined for the overall function, noting that the installed static nominal trip setpoint is set conservative by 10.0 % RTP, the currently installed settings are conservative for all conditions. It should also be noted that Kewaunee's currently installed settings of (+) 5.0 % RTP with a Rate Lag Derivative Time Constant of 2 seconds are consistent with the nominal Standardized Technical Specifications (STS) values for this function and are identical to North Anna's settings for this function.

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. CSA Calculation 11705 (Ref. 5.91) and Instrument Surveillance Procedure SP-48-004A (Ref. 5.104) were used to perform this analysis.

Static As Found Tolerance (AFT) = 5.0 % RTP ± 1.3 % RTP(1)
Static As Left Tolerance (ALT) = 5.0% RTP ± 0.5 % RTP(2)
Dynamic As Found Tolerance = 2.3 seconds ± 0.2 seconds(3)
Dynamic As Left Tolerance = 2.3 seconds ± 0.2 seconds(3)

---

(1) $AFT = \pm (M1^2+NM311^2+NC303^2+RD^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2+1.0^2)^{1/2} = \pm 1.086$ % span = ± 1.303 % RTP
(2) $ALT = \pm (M1^2+NM311^2+NC303^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2)^{1/2} = \pm 0.424$ % span = ± 0.508 % RTP
(3) The Dynamic Tolerance is equal to ± 10 % of the desired time constant based on Reference 5.73.

Note: the calibration accuracy of NC303 is ± 0.5 % RTP = ± (0.5 % / 120 %) * 100 % span = ± 0.417 % span

4.5.4 Power Range Neutron Flux High Negative Rate Reactor Trip

As Found Tolerance: 5.0 % RTP + 1.3 % RTP with a time constant of 2.3 seconds + 0.2 seconds (Refs. 5.1, 5.11, 5.12, 5.13, 5.73, 5.90, 5.91, 5.104, 5.136, & 5.142)

The current Kewaunee Custom Technical Specifications (CTS) LSSS value for this function is 10.0 % / Δq / 5.0 seconds. The manner in which this specification is presented in Kewaunee's CTS is different than the typical presentation in Standardized Technical Specifications (STS) or in Improved Technical Specifications (ITS). The typical expression for this function in STS or ITS would be "≤ 10.0 % RTP with a time constant ≥ 5.0 Seconds." For consistency and clarity, the expression for this function will be written in the ITS format. The current static Nominal Trip Setpoint (NTSP) for this function is (-) 5.0 % RTP and the Rate Lag Derivative Time Constant associated with this function is currently set at a nominal value of 2 seconds versus the required CTS LSSS value of 5.0 seconds.

For Rate Lag Derivative functions, conservative settings are ≥ the desired/required time constant. The Power Range Neutron Flux Negative Rate Reactor Trip is developed based on a combination of the dynamic compensation from the Rate Lag Derivative Module (NM311) and the static trip setpoint installed in the Bistable Relay Driver (NC301). When Kewaunee's current settings for Rate Lag Derivative Module (i.e., nominal 2 second time constant) and the Bistable Relay Driver (i.e., nominal trip setpoint is + 5 % RTP) are combined, the Power Range Neutron Flux Negative Rate Reactor Trip function is set conservative when compared to the current CTS LSSS settings (i.e., - 10 % RTP with a time constant of 5 seconds) for all postulated conditions which include both a ramp and a step. The major contributing factor that results in this determination is based on the fact that the nominal trip setpoint is set at – 5.0 % RTP versus – 10.0 % RTP. The currently installed settings versus the current LSSS settings will be compared below for both a step and a ramp.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a step input is:

$$V_{OUT} = G * (e^{-t/t1} * (V_F - V_I) + B)$$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 0.1 second)
$t1$ = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_F = Voltage input to the Rate Lag Derivative Module after the step change = 7.895 VDC
V_I = Voltage input to the Rate Lag Derivative Module before the step change = 8.333 VDC
B = Rate Lag Derivative Module Bias = 0.000 VDC

There is no pedestal voltage for the NIS Rate Lag Derivative Modules. For a step change starting at V_{OUT} = 0.000 VDC with the currently installed settings, i.e., - 5.0 % RTP = (- 5 %/120 %) * 10.000 VDC = - 0.417 VDC and a nominal Rate Lag Derivative Time Constant of 2 seconds, the Power Range Neutron Flux Negative Rate Reactor Trip will occur with a power change of - 5.256 % RTP. This includes a conservative assumption of 0.1 seconds used for the time of interest (i.e., t) to account for on-board module lag(s) and the process lags. Therefore, the common parameters are:

Bistable Relay Driver Setpoint = - 5.0 % RTP = - 0.417 VDC
Rate Lag Derivative Time Constant = 2 seconds

To make the Negative Rate Bistable Relay Driver trip, we must use a step change of - 0.438 VDC to account for lags in the system as discussed above. This step change voltage is calculated as:

$(1 / e^{-0.1/2}) * - 0.417\text{ VDC} = - 0.438\text{ VDC}$

With the currently installed settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/2} * (7.895 – 8.333) + 0.000)$
$V_{OUT(NM311)}$ = - 0.417 VDC (Bistable Relay Driver TRIP), noting that actual power is equal to (-) 5.256 % RTP.

Using the same input parameters and substituting Kewaunee's current LSSS settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/5} * (7.895 – 8.333) + 0.000)$
$V_{OUT(NM311)}$ = - 0.429 VDC (Bistable Relay Driver RESET), noting that actual power is equal to (-) 5.256 % RTP. However, the installed setpoint for the Bistable Relay Driver would be set at (-) 10 % RTP = (-10 % RTP / 120 % RTP) * 10.000 VDC = - 0.833 VDC.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a ramp input is:

$V_{OUT} = G * V_I + t1 * RR * G * (1 - e^{-t/t1}) + B$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 10 seconds)
t1 = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_I = Voltage input to the Rate Lag Derivative Module before the ramp starts = 8.333 VDC
RR = Ramp Rate (VDC/Second)
B = Rate Lag Derivative Module Bias = 0.000 VDC

The currently installed settings versus the current Technical Specifications LSSS settings will be compared below for the minimum ramp of (-) 3.0 % RTP / second at a time of interest (t) of 5 seconds after the ramp begins. This is the minimum ramp rate and approximate ramp time required to achieve a trip for either condition. The Ramp Rate VDC/Second = (- 3.0 % RTP/120 % RTP) * 10 VDC = (-) 0.250 VDC / Second.

With the currently installed settings, the Negative Rate Trip will respond as shown below:

Nominal Trip Setpoint = (-) 5.0 % RTP = - 0.417 VDC
Nominal Rate Lag Derivative Time Constant = 2 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 2 * - 0.250 * 1.0000 (1 - e^{-5/2}) + 0.000$
$V_{OUT(NM311)}$ = - 0.459 VDC (Bistable Relay Driver TRIP)

With the current Technical Specifications LSSS settings, the Negative Rate Trip will respond as shown below:

Nominal Trip Setpoint = (-) 10.0 % RTP = - 0.833 VDC
Nominal Rate Lag Derivative Time Constant = 5 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 5 * - 0.250 * 1.0000 (1 - e^{-5/5}) + 0.000$
$V_{OUT(NM311)}$ = - 0.790 VDC (Bistable Relay Driver RESET)

As can be seen from the examples above, from a dynamic perspective, the current Technical Specifications LSSS setting for the Rate Lag Derivative Time Constant (i.e., time constant = 5 seconds) yields the most conservative output from NM311 for both a ramp and a step. However, when the dynamics and the statics are combined for the overall function, noting that the installed static nominal trip setpoint is set conservative by 5.0 % RTP, the currently installed settings are conservative for all conditions. It should also be noted that Kewaunee's currently installed settings of (-) 5.0 % RTP with a Rate Lag Derivative Time Constant of 2 seconds are consistent with the nominal Standardized Technical Specifications (STS) values for this function and are identical to North Anna's settings for this function. Finally, Kewaunee's installed settings for this function are consistent with the requirements of WCAP-10298-A which specify nominal settings for the Power Range Negative Rate Trip of (-) 5.0 % RTP with a time constant of 2 seconds (Ref. 5.138).

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. CSA Calculation 11705 (Ref. 5.91) and Instrument Surveillance Procedure SP-48-004A (Ref. 5.104) were used to perform this analysis.

Static As Found Tolerance (AFT) = 5.0 % RTP ± 1.3 % RTP(1)
Static As Left Tolerance (ALT) = 5.0% RTP ± 0.5 % RTP(2)
Dynamic As Found Tolerance = 2.3 seconds ± 0.2 seconds(3)
Dynamic As Left Tolerance = 2.3 seconds ± 0.2 seconds(3)

---

(1) $AFT = \pm (M1^2+NM311^2+NC301^2+RD^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2+1.0^2)^{1/2} = \pm 1.086$ % span = ± 1.303 % RTP
(2) $ALT = \pm (M1^2+NM311^2+NC301^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2)^{1/2} = \pm 0.424$ % span = ± 0.508 % RTP
(3) The Dynamic Tolerance is equal to ± 10 % of the desired time constant based on Reference 5.73.

Note: the calibration accuracy of NC301 is ± 0.5 % RTP = ± (0.5 % / 120 %) * 100 % span = ± 0.417 % span

4.5.5 Intermediate Range Neutron Flux High Reactor Trip

As Found Tolerance : 20.0 % RTP ± 5.0 % RTP (Refs. 5.1, 5.16, 5.29, and 5.116)

The current Custom Technical Specification (CTS) LSSS value of ≤ 40.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 20.0 % RTP. The current Custom Technical Specification (CTS) LSSS value is non-conservative based on the COT error components of the Nuclear Instrumentation System. The Intermediate Range Neutron Flux High Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); therefore no Channel Statistical Allowance (CSA) Calculation has been performed for this function. The typical COT error allowance for this function is approximately 5.0 % RTP. For example, the COT error for this function at Surry is equal to ± 5.678 % RTP, the COT error at North Anna is ± 4.403 % RTP, and the typical Standardized Technical Specifications (STS) COT allowance is 5 % RTP (Refs. 5.3, 5.16, and 5.29). The As Found Tolerance will be ≤ 25.0 % RTP. The As Found Tolerance of ≤ 25.0 % RTP is based on maintaining a Nominal Trip Setpoint Value of 20.0 % RTP.

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. Ref. 5.116 was used in the determination of the AFT and ALT below.

As Found Tolerance (AFT) = 20.0 % RTP ± 5.0 % RTP
As Left Tolerance (ALT) = 20.0% RTP ± 4.9 % RTP(1)

---

(1) $\text{ALT} = \pm (\text{CSA}^2 - \text{RD}^2)^{1/2} = \pm (5.0^2 - 1.2^2)^{1/2} = \pm 4.854$ % RTP

4.5.6 Source Range Neutron Flux High Reactor Trip

As Found Tolerance: 1.0 E5 CPS + 0.466 E5 CPS, - 0.318 E5 CPS (Refs. 5.1, 5.17, 5.30, and 5.117)

The current Custom Technical Specification (CTS) LSSS for this function states “within Source Range span”. The current Nominal Trip Setpoint for this function is 1.0 E5 Counts Per Second (CPS). The Source Range Neutron Flux High Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); therefore no Channel Statistical Allowance (CSA) Calculation has been performed for this function. The typical COT error allowance for this function is approximately ± 3.0 % of linear span. For example, the COT error for this function at Surry is equal to ± 2.973 % of linear span and the COT error at North Anna is ± 3.136 % of linear span (Refs. 5.17 and 5.30). To be conservative, the North Anna COT error allowance will be used in this analysis. The As Found Tolerance will be ≤ 1.466 E5 CPS(1). The As Found Tolerance of ≤ 1.466 E5 CPS is based on maintaining a Nominal Trip Setpoint Value of 1.0 E5 CPS.

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. References 5.17, 5.30, and 5.117 were used in the determination of the AFT and ALT below.

As Found Tolerance (AFT) = 1.0 E5 CPS + 0.466 E5 CPS, - 0.318 E5 CPS(1)
As Left Tolerance (ALT) = 1.0 E5 CPS + 0.358 E5 CPS, - 0.264 E5 CPS(2)

(1) Nominal Trip Setpoint = 1.0 * 10^5 CPS ⇒ log 1.0 * 10^5 = 5.0 (on a 0 to 5.301 Decade scale)
COT error = $\underline{+}$ 3.136 % of linear span ⇒ (3.136 %/100 %) * 5.301 Decades = $\underline{+}$ 0.166239 Decade
High Trip Setpoint = 5.0 + 0.166239 = 5.166239 ⇒ antilog 5.166239 = 1.466 * 10^5
Low Trip Setpoint = 5.0 - 0.166239 = 4.833761 ⇒ antilog 4.833761 = 0.682 * 10^5
(2) Nominal Trip Setpoint = 1.0 * 10^5 CPS ⇒ log 1.0 * 10^5 = 5.0 (on a 0 to 5.301 Decade scale)
COT error minus Rack Drift = $\underline{+}$ 2.5 % of linear span ⇒ (2.5 %/100 %) * 5.301 Decades = $\underline{+}$ 0.133 Decade
High Trip Setpoint = 5.0 + 0.133 = 5.133 ⇒ antilog 5.133 = 1.358 * 10^5
Low Trip Setpoint = 5.0 - 0.133 = 4.867 ⇒ antilog 4.867 = 0.736 * 10^5

4.5.7 Overtemperature ΔT Reactor Trip

As Found Tolerance: See below (Refs. 5.1, 5.90, 5.94, 5.105, 5.114, and 5.133)

"The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.0 % of the ΔT span" (Note that 2.0 % of the ΔT span is equal to 3.0 % ΔT Power)

The Overtemperature ΔT (OTΔT) Reactor Trip Setpoint equation in terms of process units is:

$$OT\triangle T_{SP} \leq \triangle T_0 \, [\, K_1 - K_2 * \left(\frac{1 + t_1{}^{s}}{1 + t_2{}^{s}} \right) * (T - T') + K_3 * (P - P') - f(\triangle I) \,]$$

(Equation 4.5.7)

Where :

ΔT_0 = Indicated ΔT at Rated Power, %
T = Average temperature, °F
T' = 573.0 °F
P = Pressurizer pressure, psig
P' = 2235 psig
K_1 = 1.195
K_2 = 0.015 / °F
K_3 = 0.00072 / psig
ΔI = $q_t - q_b$, where q_t and q_b are percent power in the top and bottom halves of the core respectively, and $q_t + q_b$ is total core power in percent of rated power.
f(ΔI) = function of ΔI, percent of rated core power as shown in the Kewaunee COLR.
τ_1 30.0 seconds
τ_2 4.0 seconds

The Overtemperature ΔT (OTΔT) Reactor Trip Setpoint is variable and is constantly calculated based on actual plant conditions. For this reason, the Allowable Value cannot be expressed as a constant. Further, the OTΔT Reactor Trip will only be analyzed for the following condition:

- OTΔT Reactor Trip with no FΔI

The two conditions listed below are also associated with the OTΔT Reactor Trip. These conditions are not credited in the USAR Chapter 14 Safety Analysis and will not be analyzed here.

- OTΔT Reactor Trip with (+) FΔI
- OTΔT Reactor Trip with (-) FΔI

Note: FΔI is the Delta Flux Penalty generated from the Upper and Lower Power Range Neutron Flux Detectors (i.e., Q_U and Q_L).

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields the following Limiting Trip Setpoints (LTSP) for the OTΔT Reactor Trip with no FΔI condition as described above:

- LTSP for OTΔT Reactor Trip with no FΔI = 130.0 % - 8.403 % = 121.597 % ΔT Power

Subtracting the NON COT error components from the Analytical Limit yields the following Allowable Value (AV) for the OTΔT Reactor Trip with no FΔI contribution as described above:

- AV for OTΔT Reactor Trip with no FΔI = 130.0 % - 5.883 % = 124.117 % ΔT Power

For the most limiting condition (i.e., OTΔT Reactor Trip with no FΔI) the Actual Nominal Trip Setpoint of 118.25 % ΔT Power (e.g., based on $T_{AVG} = 572.0\ ^{o}F$) is conservative with respect to the Limiting Trip Setpoint of 121.597 % ΔT Power. The As Found Tolerance Value of 121.25 % ΔT Power is conservative with respect to the Allowable Value of 124.117 % ΔT Power. This As Found Tolerance Value of $\leq$ 121.25 % ΔT Power is based on maintaining a Nominal Trip Setpoint value of 118.25 % ΔT Power. Note that this analysis is based on static conditions such that dynamic components are not considered.

The statistical combination of the COT and NON COT error components from CSA Calculation C11865 (Ref. 5.94) with the appropriate modifications described in Section 3.2 for the OTΔT Reactor Trip are given below. The COT and NON COT error components are used in Figure 4.5.7 to determine the Nominal Trip Setpoint (NTSP), Allowable Value (AV), As Found Tolerance (AFT), and As Left Tolerance (ALT) for the most limiting condition.

<u>OTΔT Reactor Trip with no FΔI</u>

$\text{NON COT}_{\text{error}} = SE_1 + SE_2 + SE_{3a} \pm [PMA_3^2 + PMA_4^2 + PMA_5^2 + PMA_6^2 + PMA_7^2 + PEA^2 + (CSA_{3\ \text{NON COT}})^2 + (CSA_{4\ \text{NON COT}})^2 + (CSA_{5\ \text{NON COT}})^2 + (CSA_{6\ \text{NON COT}})^2 + M7MTE^2 + M18MTE^2 + RTE_1^2 + RTE_2^2 + RTE_3^2]^{1/2}$

Where the following terms are taken from Calculation C11865 (Ref. 5.94):

$CSA_{3\ \text{NON COT}} = [(CSA_1\ \text{NON COT})^2 + (CSA_2\ \text{NON COT})^2 + (M3MTE)^2]^{1/2}$

$CSA_{3\ \text{NON COT}} = (0.548^2 + 0.548^2 + 0.173^2)^{1/2} = 0.794$ % of ΔT span

$CSA_{4\ NON\ COT} = [(CSA_1\ NON\ COT * 0.667)^2 + (CSA_2\ NON\ COT * 0.667)^2 + (M4MTE)^2\ ]^{\ 1/2}$

$CSA_{4\ NON\ COT} = [(0.548 * 0.667)^2 +(0.548 * 0.667)^2 + 0.245^2)^{\ 1/2} = 0.572$ % of ΔT span

$CSA_{5\ NON\ COT} = (PEA^2 + (SCA_3 + SMTE_3)^2 + SD_3{}^2 + SPE_3{}^2 + STE_3{}^2 + SPSE_3{}^2 + M10MTE^2)^{1/2}$

$CSA_{5\ NON\ COT} = (0.0^2 + (0.096 + 0.150)^2 +0.288^2 + 0.0^2 + 0.883^2 + 0.061^2 + 0.0^2)^{1/2} = 0.963$ % of ΔT span

$CSA_{6a\ NON\ COT} = (M15MTE^2 + M16MTE^2)^{1/2}$

$CSA_{6a\ NON\ COT} = (0.346^2 + 0.200^2)^{1/2} = 0.400$ % of ΔT span

Thus, the total NON COT_{error} is equal to:

$NON\ COT_{error} = 0.267 + 0.722 + 0.867 \pm [0.0^2 + 0.0^2 + 0.0^2 + 0.0^2 + 1.133^2 + 0.0^2 + 0.794^2 + 0.572^2 + 0.963^2 + 0.400^2 + 0.374^2 + 0.224^2 + 0.5^2 + 0.5^2 + 0.5^2]^{1/2}$

$NON\ COT_{error} = \pm\ 3.922$ % of span = $\pm$ 5.883 % ΔT Power

$COT_{error} = (CSA_{3\ COT}{}^2 + CSA_{4\ COT}{}^2 + CSA_{5\ COT}{}^2 + CSA_{6a\ COT}{}^2 + M7^2 + M18^2 + RD_1{}^2 + RD_2{}^2 + RD_3{}^2)^{1/2}$

Where the following terms are taken from Calculation C11865 (Ref. 5.94):

$CSA_{3\ COT} = [(CSA_1\ COT)^2\ + (CSA_2\ COT)^2\ \ + (M3)^2\ ]^{\ 1/2}$

$CSA_{3\ COT} = (0.417^2 + 0.417^2 + 0.707^2)^{\ 1/2} = 0.921$ % of ΔT span

$CSA_{4\ COT} = [(CSA_1\ COT * 0.667)^2 + (CSA_2\ COT * 0.667)^2 + M4^2]^{\ 1/2}$

$CSA_{4\ Cot} = [(0.417 * 0.667)^2 + (0.417 * 0.667)^2 + 0.707^2)^{\ 1/2} = 0.809$ % of ΔT span

$CSA_{5\ COT} = M10$

$CSA_{5\ COT} = 0.0 = 0.0$ % of ΔT span

$CSA_{6a\ COT} = [(M15MTE)^2 + (M16MTE)^2]^{1/2}$

$CSA_{6a\ COT} = (0.500^2 + 0.500^2)^{1/2} = 0.707$% of ΔT span

Thus, the COT_{error} is equal to:

$COT_{error} = (0.921^2 + 0.809^2 + 0.0^2 + 0.707^2 + 0.5^2 + 0.5^2 + 1.0^2 + 1.0^2 + 1.0^2)^{1/2}$

$COT_{error} = \pm\ 2.346$ % of ΔT span = $\pm$ 3.519 % ΔT Power (The calculated COT error will be conservatively rounded back to $\pm$ 2.0 % of ΔT span = $\pm$ 3.0 % ΔT Power for the As Found Tolerance)

Static As Found Tolerance (AFT) = Computed Setpoint ± 3.0 % ΔT Power
Static As Left Tolerance (ALT) = Computed Setpoint ± 2.4 % ΔT Power (1)

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(1) ALT = ± $(\text{COTerror}^2 - \text{RD}_1{}^2 - \text{RD}_2{}^2 - \text{RD}_3{}^2)^{1/2}$ = ± $(2.346^2 - 1.0^2 - 1.0^2 - 1.0^2)^{1/2}$
ALT = ± 1.582 % of ΔT span = ± 2.373 % ΔT Power (round to ± 2.4 % ΔT Power)

KEWAUNEE'S OVERTEMPERATURE DELTA T REACTOR TRIP

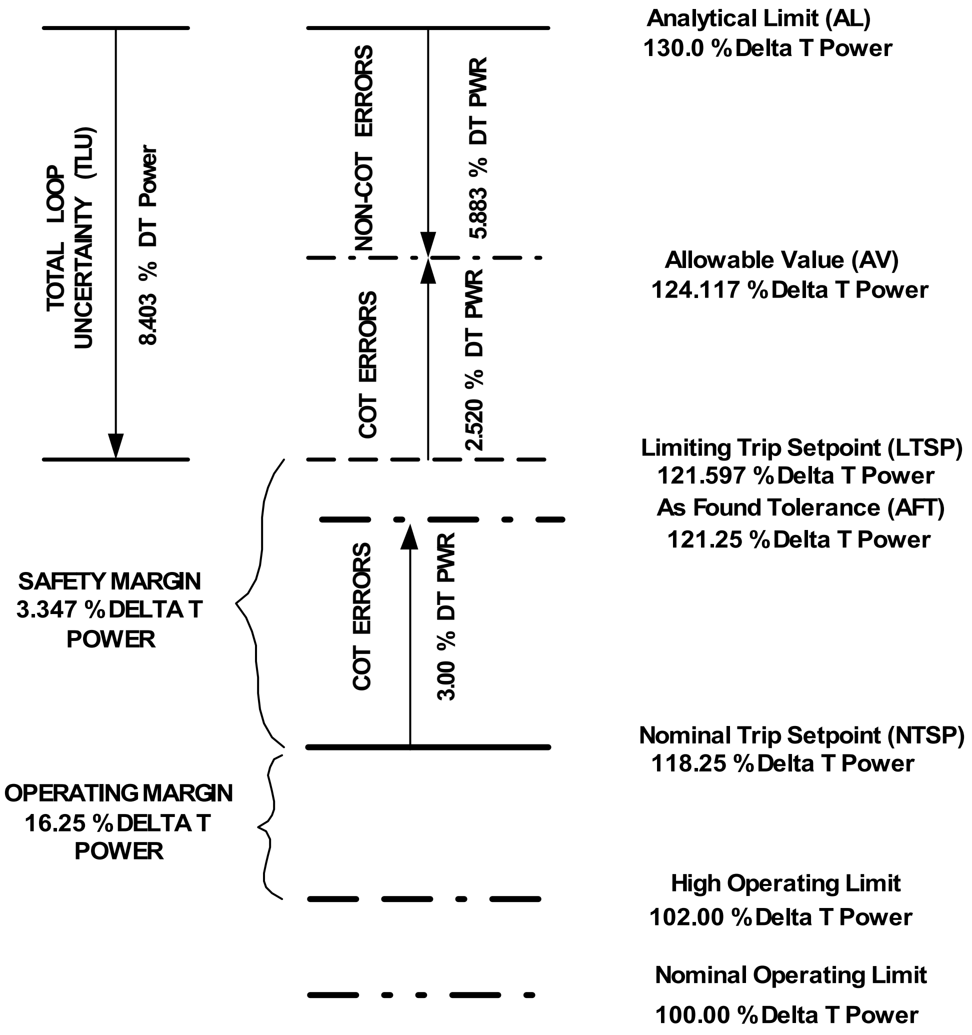

Figure 4.5.7

4.5.8 Overpower ΔT Reactor Trip

As Found Tolerance: See below (Refs. 5.1, 5.90, 5.94, and 5.105)

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 1.546 % of the ΔT span " (Note that 1.525 % of the ΔT span is equal to 2.288 % ΔT Power)

The Overpower ΔT Reactor Trip Setpoint is variable and is constantly calculated based on actual plant conditions. For this reason, the Allowable Value cannot be expressed as a constant. The Overpower ΔT Reactor Trip is a backup reactor trip function and is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). The As Found Tolerance of ± 1.525 % of ΔT span = ± 2.288 % ΔT Power(1) is based on the COT error components from CSA Calculation (Ref. 5.94). The As Left Tolerance is based on the As Found Tolerance minus Rack Drift.

Static As Found Tolerance (AFT) = Computed Setpoint ± 2.288 % ΔT Power(1)
Static As Left Tolerance (ALT) = Computed Setpoint ± 1.724 % ΔT Power (2)

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(1) The Overpower ΔT Reactor Trip COT error is taken from Calculation C11865 (Ref. 5.94).

$AFT = \pm (M_1^2 + M_2^2 + M_3^2 + M_4^2 + M_5^2 + M_6^2 + M_{17}^2 + RD_1^2 + RD_2^2)^{1/2}$
$AFT = \pm (0.417^2 + 0.417^2 + 0.707^2 + (0.707 * 0.667)^2 + 0.034^2 + 0.034^2 + 0.5^2 + 1.0^2 + (1.0 * 0.069)^2)^{1/2}$
AFT = ± 1.525 % of ΔT span = ± 2.288 % ΔT Power

(2) $ALT = \pm (COTerror^2 - RD_1^2 - RD_2^2)^{1/2} = \pm (1.525^2 - 1.0^2 - 0.069^2)^{1/2}$
ALT = ± 1.149 % of ΔT span = ± 1.724 % ΔT Power

4.5.9 Pressurizer Low Pressure Reactor Trip

As Found Tolerance: 1904 PSIG ± 10.0 PSIG (Refs. 5.1, 5.90, 5.93, and 5.105)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 1858.82 PSIG. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 1855.94 PSIG. The Actual Nominal Trip Setpoint of 1904 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specification (CTS) LSSS value of ≥ 1875 PSIG is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value of ≥ 1875 PSIG is non-conservative based on the calculated COT error components determined in Calculation C10818 (Ref. 5.93). The LSSS value of ≥ 1875 PSIG will be changed to an As Found Tolerance value of ≥ 1894 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. This As Found Tolerance is based on a Nominal Trip Setpoint value of 1904.0 PSIG. The Nominal Trip Setpoint value of 1904 PSIG will allow a 10.0 PSIG margin to be used for the COT error components. The As Found Tolerance value of ≥ 1894 PSIG is sufficiently close enough to the calculated value using the CSA rack error terms from Calculation C10818 (Ref. 5.93).

The calculated As Found Tolerance for this function is ≥ 1894.20 PSIG. The 0.20 PSIG offset is accommodated in the 45.18 PSIG Safety Margin for this trip as illustrated in Figure 4.5.9.

The statistical combination of the COT and NON COT error components from CSA Calculation C10818 (Ref. 5.93) are given below. The COT and NON COT error components are used in Figure 4.5.9 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{M3MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + (0.250 + 0.391)^2 + 0.75^2 + 0.0^2 + 2.300^2 + 0.158^2 + 0.0^2 + 0.200^2 + 0.283^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 2.580 % of span = ± 20.64 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{M3}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm$ 1.225 % of span = ± 9.80 PSIG (round to ± 10 PSIG)

As Found Tolerance (AFT) = 1904 PSIG ± 10.0 PSIG
As Left Tolerance (ALT) = 1904 PSIG ± 5.7 PSIG(1)

See Figure 4.5.9 for specific details.

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(1) $\text{ALT} = \pm (\text{COTerror}^2 - \text{RD}^2)^{1/2} = \pm (1.225^2 - 1.0^2)^{1/2} = \pm$ 0.71 % of span = ± 5.7 PSIG

KEWAUNEE'S PRESSURIZER LOW PRESSURE REACTOR TRIP

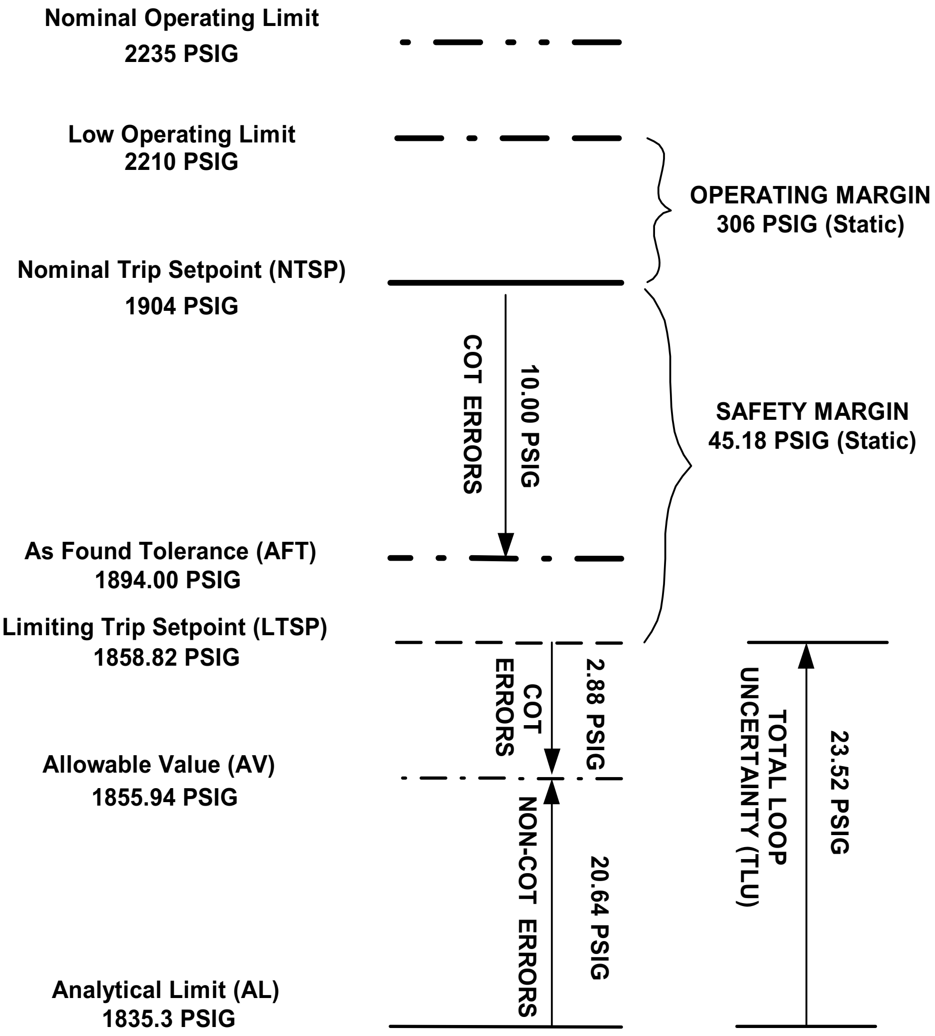

Figure 4.5.9

4.5.10 Pressurizer High Pressure Reactor Trip

As Found Tolerance: 2377 PSIG ± 9.0 PSIG (Refs. 5.1, 5.90, 5.93, and 5.105)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 2387.64 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 2389.78 PSIG. The Actual Nominal Trip Setpoint of 2377 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specification (CTS) LSSS value ≤ 2385 PSIG is conservative with respect to the Allowable Value. The CTS LSSS value ≤ 2385 PSIG will be revised to an As Found Tolerance Value of ≤ 2386 PSIG based on the COT error components calculated below. The revised As Found Tolerance Value of ≤ 2386 PSIG is also conservative with respect to the Allowable Value, however it is slightly non-conservative with respect to the calculated value using the CSA rack error components from Calculation C10818 (Ref 5.93). The calculated As Found Tolerance Value for this function is ≤ 2385.94 PSIG. The 0.06 PSIG offset from the calculated value is accommodated within the Safety Margin for this function (i.e., 10.64 PSIG). The As Found Tolerance value of ≤ 2386 PSIG is based on the Nominal Trip Setpoint value of 2377.0 PSIG.

The statistical combination of the COT and NON COT error components from CSA Calculation C10818 (Ref. 5.93) are given below. The COT and NON COT error components are used in Figure 4.5.10 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{PMA}^2 + \text{PEA}^2 + (\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2]^{1/2}$$

$$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + (0.250 + 0.391)^2 + 0.75^2 + 0.0^2 + 2.300^2 + 0.158^2 + 0.0^2 + 0.200^2 + 0.5^2]^{1/2}$$

$$\text{NON COT}_{\text{error}} = \pm 2.565 \text{ \% of span} = \pm 20.52 \text{ PSIG}$$

$$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm 1.118 \text{ \% of span} = \pm 8.944 \text{ PSIG (round to } \pm 9.0 \text{ PSIG)}$$

As Found Tolerance (AFT) = 2377 PSIG ± 9.0 PSIG
As Left Tolerance (ALT) = 2377 PSIG ± 4.0 PSIG(1)

See Figure 4.5.10 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± 4.0 PSIG

KEWAUNEE'S PRESSURIZER HIGH PRESSURE REACTOR TRIP

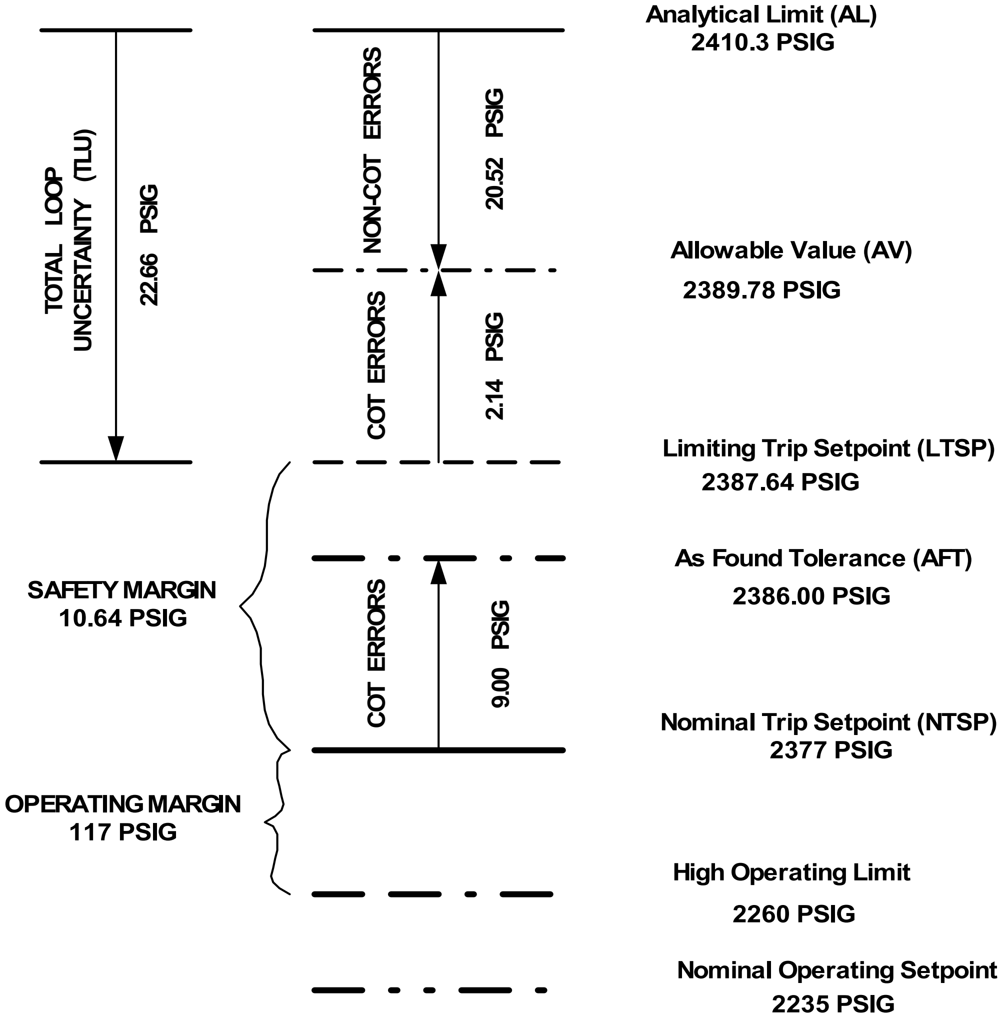

Figure 4.5.10

4.5.11 Reactor Coolant Flow Low Reactor Trip (Normalized)

Allowable Value: As Found Tolerance = 93% Flow ± 1.1% Flow
(Refs. 5.1, 5.90, 5.96, 5.106, and 5.120)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 90.52 % Flow. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 90.27 % Flow. The current Nominal Trip Setpoint of 93.0 % Flow is conservative with respect to the Limiting Trip Setpoint and the current Custom Technical Specification (CTS) LSSS value of ≥ 90.0 % Flow is non conservative with respect to the Allowable Value. The CTS LSSS value ≥ 90.0 % Flow will be changed to an As Found Tolerance value of ≥ 91.9 % Flow based on the calculated value using the CSA rack error terms from Calculation C10819 (Ref 5.96). The As Found Tolerance of ≥ 91.9 % Flow is conservative and conforms to the methodology described in TSFT-493, Rev. 4 and RIS 2006-17.

The calculated As Found Tolerance Value for this function is ≥ 91.853 % Flow. The 0.047 % Flow offset will be negated resulting in a conservative As Found Tolerance value of ≥ 91.9 % Flow for this trip as illustrated in Figure 4.5.11.

The statistical combination of the COT and NON COT error components from CSA Calculation C10819 (Ref. 5.96) are given below. The COT and NON COT error components are used in Figure 4.5.11 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}}\ (\Delta\text{P span}) = [(\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M2MTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}}\ (\Delta\text{P span}) = [(0.250 + 0.110)^2 + 0.50^2 + 0.0^2 + 0.713^2 + 0.110^2 + 0.200^2]^{1/2}$

$\text{NON COT}_{\text{error}}\ (\Delta\text{P span}) = \pm\ 0.970\ \%\ \text{of}\ \Delta\text{P span} = \pm\ 0.574\ \%\ \text{of Flow span @ 93 \% Flow}^{(1)}$

$\text{NON COT}_{\text{error}}\ (\text{Flow span}) = \text{SE} \pm (\text{PMA}^2 + \text{PEA}^2 + \text{RTE}^2)^{1/2}$

$\text{NON COT}_{\text{error}}\ (\text{Flow span}) = 0.372 \pm (2.455^2 + 0.455^2 + 0.5^2)^{1/2}$

$\text{NON COT}_{\text{error}}\ (\text{Flow span}) = 2.918\ \%\ \text{of Flow span}$

$\text{TOTAL NON COT}_{\text{error}}\ (\text{Flow span}) = (2.918^2 + 0.574^2)^{1/2} = 2.974\ \%\ \text{of Flow span} = 3.271\ \%\ \text{Flow @}$ 93.0 % Flow (e.g., the Nominal Trip Setpoint).

$\text{COT}_{\text{error}}\ (\Delta\text{P span}) = \pm\ \text{M2}$

$\text{COT}_{\text{error}}\ (\Delta\text{P span}) = \pm\ 0.50\ \%\ \text{of}\ \Delta\text{P span}$

$\text{COT}_{\text{error}}\ (\Delta\text{P span}) = \pm\ 0.50\ \%\ \text{of}\ \Delta\text{P span} = \pm\ 0.296\ \%\ \text{of Flow span @ 93 \% Flow} = \pm\ 0.326\ \%\ \text{Flow}^{(1)}$

$\text{COT}_{\text{error}}\ (\text{Flow span}) = \text{RD} = \pm\ 1.0\ \%\ \text{of Flow span} = \pm\ 1.10\ \%\ \text{Flow}$

TOTAL COT_{error} (Flow span) = $(0.296^2 + 1.0^2)^{1/2}$ = 1.043 % of Flow span = 1.147 % Flow @ 93.0 % Flow (e.g., the Nominal Trip Setpoint) (1)

As Found Tolerance (AFT) = 93% Flow ± 1.1% Flow(1)
As Left Tolerance (ALT) = 93% Flow ± 0.55% Flow(2)

See Figure 4.5.11 for specific details.

KEWAUNEE'S REACTOR COOLANT LOW FLOW REACTOR TRIP

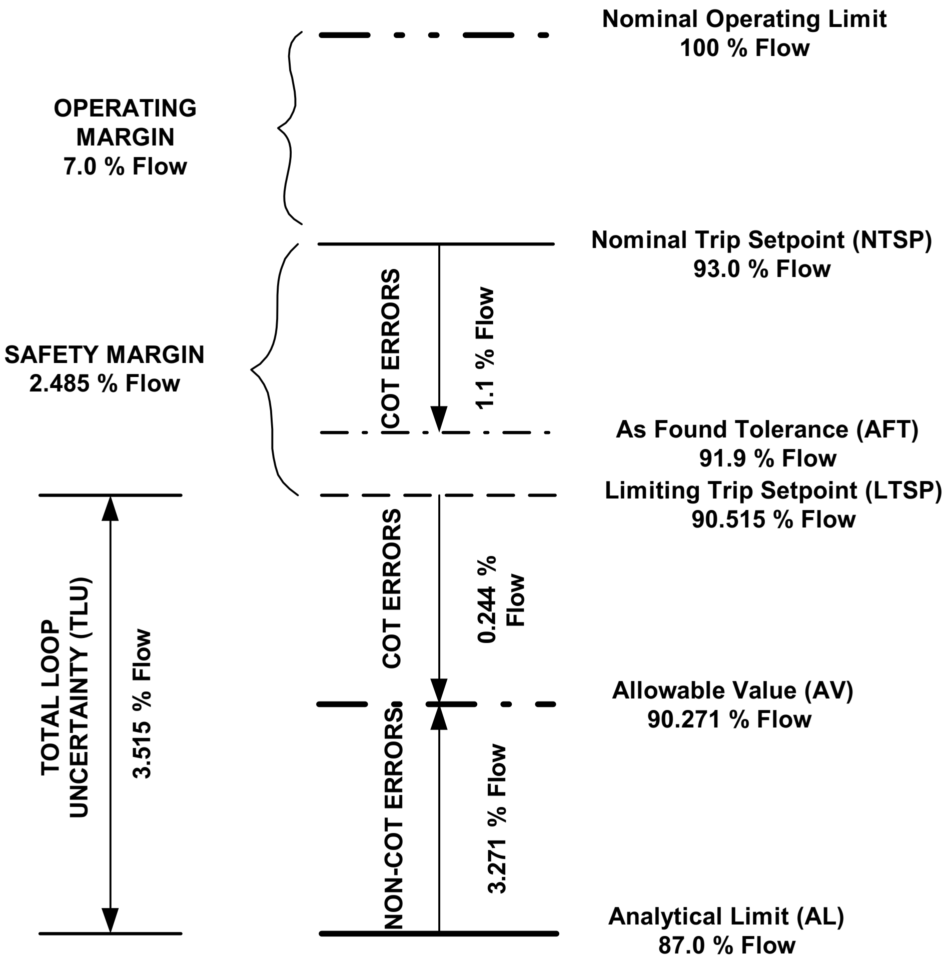

Figure 4.5.11

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(1) The equation to convert % ΔP error to % Flow error is: % flow span = (ΔP uncertainty) * 0.5 * (flow max / flow x) (Ref. 5.120)

(2) The calculated As Left Tolerance is ± 0.296 % of Flow Span. This tolerance is too restrictive and will be set at ± 0.5 % of Flow Span (i.e., like all other Bistable tolerances). The + 0.204 % of Flow Span offset is accommodated in the Safety Margin of 2.485 % Flow = 2.259 % of Flow Span.

4.5.12 Reactor Coolant Pump Undervoltage

As Found Tolerance: 76.667 ± 0.885 % of normal voltage = 92 ± 1.06 VAC
(Refs. 5.1, 5.90, 5.127, and 5.128)

The current Custom Technical Specification (CTS) LSSS for this function is ≥ 75 % of normal voltage. The current Nominal Trip Setpoint for this function is 91 to 93 VAC where 92 VAC is the centerline voltage = 76.667 % of voltage span (Ref. 5.127). This analysis assumes that 120 VAC from the potential transformer is equal to 100 % of bus voltage/normal voltage which is equal to 4160 VAC. The Reactor Coolant Pump Undervoltage Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. The calibration accuracy for this trip function is 92 ± 1.0 VAC = 76.667 ± 0.833 % of normal voltage (Ref. 5.127). The COT error from Calculation C11891 is ± 1.06 VAC = ± 0.885 % of normal voltage. Therefore, the As Found Tolerance for the Reactor Coolant Pump Undervoltage Trip is 76.667 ± 0.885 % of normal voltage = 92 ± 1.06 VAC based on device calibration accuracy and drift from Reference 5.128. The As Left Tolerance for the Reactor Coolant Pump Undervoltage Trip is 76.667 ± 0.833 % of normal voltage = 92 ± 1.0 VAC based on the device calibration accuracy from Reference 5.127. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value 92 VAC = 76.667 % of normal voltage.

As Found Tolerance (AFT) = 76.667 ± 0.885 % of normal voltage = 92 ± 1.06 VAC(1)
As Left Tolerance (ALT) = 76.667 ± 0.833 % of normal voltage = 92 ± 1.0 VAC(2)

---

(1) AFT = $\pm (SCA^2 + SD^2)^{1/2} = \pm (0.833^2 + 0.300^2)^{1/2} = \pm 0.885$ % of normal voltage = ± 1.06 VAC
(2) ALT = ± SCA = ± 0.833 % of normal voltage = ± 1.0 VAC

4.5.13 Reactor Coolant Pump Underfrequency

As Found Tolerance: 57 ± 0.3 Hz (Refs. 5.1, 5.90, 5.126, and 5.127)

The current Custom Technical Specification (CTS) LSSS for this function is ≥ 55.0 Hz. The current Nominal Trip Setpoint for this function is 57 ± 0.1 Hz (Ref. 5.127). The Reactor Coolant Pump Underfrequency Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C11890 (Ref. 5.126), the COT error allowance for this function is ± 0.3 Hz. The calibration accuracy for this trip function is ± 0.1 Hz (Ref. 5.127). The As Found Tolerance of 57 ± 0.3 Hz is based on the COT error from Calculation C11890 and the As Left Tolerance of 57 ± 0.1 Hz is conservatively based on device calibration accuracy from Reference 5.127. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 57 Hz.

As Found Tolerance (AFT) = 57 ± 0.3 Hz(1) (3)
As Left Tolerance (ALT) = 57 ± 0.1 Hz(2)

---

(1) AFT = $\pm (SCA^2 + SD^2)^{1/2} = \pm (6.66^2 + 0.667^2)^{1/2} = \pm 6.69$ % of frequency span or (6.69% /100%) x 4.5 Hz(3) = ± 0.3 Hz
(2) ALT = Current Calibration Accuracy from Reference 5.127 = ± 0.1 Hz
(3) The frequency span of 4.5 Hz is taken from Calculation C11890 (Ref. 5.126).

4.5.14 Pressurizer High Level Reactor Trip

As Found Tolerance: 85.0 % Level ± 1.12 % Level (Refs. 5.1, 5.90, 5.92, and 5.109)

The current Custom Technical Specification (CTS) LSSS for this function is ≤ 90.0 % Level. The current Nominal Trip Setpoint for this function is 85.0 % Level (Ref. 5.109). The Pressurizer High Level Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C10982 (Ref. 5.92), the COT error allowance for this function is ± 1.118 % of span = ± 1.118 % Level. The calibration accuracy for this trip function is ± 0.5 % of span = ± 0.5 % Level (Ref. 5.109). The As Found Tolerance based on the COT error from Calculation C10982 is 85 ± 1.118 % Level (round to 85 ± 1.12 % Level). The As Left Tolerance is 85 ± 0.5 % Level is based on device calibration accuracy from Reference 5.109. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 85 % Level.

As Found Tolerance (AFT) = 85.0 % Level ± 1.12 % Level(1)
As Left Tolerance (ALT) = 85.0 % Level ± 0.5 % Level(2)

---

(1) AFT = $\pm (M2^2 + RD^2)^{½} = \pm (0.5^2 + 1.0^2)^{½} = \pm 1.118$ % span = ± 1.118 % Level
(2) ALT = ± M2 = ± 0.5 % span = ± 0.5 % Level

4.5.15 Steam Generator Water Level Low Low Reactor Trip

As Found Tolerance: 17.0 % Level ± 1.12 % Level (Refs. 5.1, 5.90, 5.97, 5.112, and 5.134)

Note: The Analytical Limit for this function is 0.0 % NR Level (Ref. 5.1). The Channel Statistical Allowance (CSA) for this function has a large negative Process Measurement Accuracy (PMA) bias term which results in a negative CSA value. For conservatism, the absolute value of the larger CSA value from Reference 5.97 will be used in this analysis.

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 4.496 % NR Level. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 4.087 % NR Level. The Actual Nominal Trip Setpoint of 17.0 % NR Level (Ref. 5.112) is conservative with respect to the Limiting Trip Setpoint and the current Custom Technical Specification (CTS) LSSS value of ≥ 5.0 % NR Level is conservative with respect to the Allowable Value. The CTS LSSS value of ≥ 5.0 % NR Level is non-conservative based on the calculated COT error components determined in Calculation C11116 (Ref. 5.97). The CTS LSSS value of ≥ 5.0 % NR Level will be changed to an As Found Tolerance value of ≥ 15.88 % NR Level to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. The As Found Tolerance Value of ≥ 15.88 % NR Level is based on maintaining a Nominal Trip Setpoint value of 17.0 % NR Level.

The statistical combination of the COT and NON COT error components from CSA Calculation C11116 (Ref. 5.97) are given below. The COT and NON COT error components are used in Figure 4.5.15 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{PMA}_2 \pm (\text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE} + \text{M1MTE}^2 + \text{M3MTE}^2 + \text{RTE}^2)^{1/2}$

$\text{NON COT}_{\text{error}} = 2.518 \pm [0.0^2 + (0.250+0.217)^2 + 0.280^2 + 0.577^2 + 1.241^2 + 0.060^2 + 0^2 + 0.200^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}}$ = + 4.087 % of span = + 4.087 % NR Level (worst case).

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M3}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{½}$

$\text{COT}_{\text{error}}$ = ± 1.118 % of span = ± 1.118 % NR Level (round to ± 1.12 % NR Level)

As Found Tolerance (AFT) = 17.0 % Level ± 1.12 % Level(1)
As Left Tolerance (ALT) = 17.0 % Level ± 0.5 % Level(2)

See Figure 4.5.15 for specific details.

---

(1) $\text{AFT} = \pm (\text{M3}^2 + \text{RD}^2)^{½} = \pm (0.5^2 + 1.0^2)^{½}$ = ± 1.118 % span = ± 1.118 % Level (round to ± 1.12 % NR Level)

(2) ALT = ± M3 = ± 0.5 % span = ± 0.5 % Level

KEWAUNEE'S STEAM GENERATOR LO-LO LEVEL REACTOR TRIP

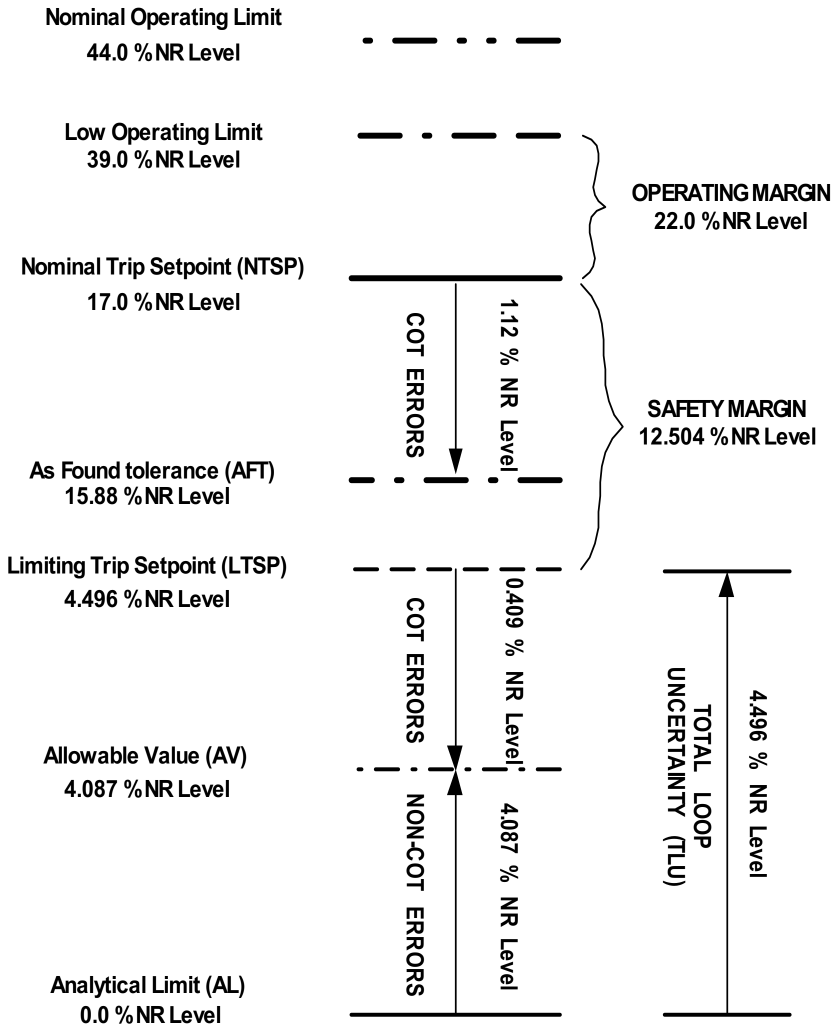

Figure 4.5.15

4.5.16 Steam Generator Water Level Low Coincident Reactor Trip

As Found Tolerance: 25.5 % Level ± 1.12 % NR Level (Refs. 5.1, 5.90, 5.97, and 5.112)

The Steam Generator Water Level Low Coincident Reactor Trip is not addressed in the current version of Kewaunee's Custom Technical Specifications (CTS). This function will now be included in the Setpoint Control Program based on the requirements of ITS Table 3.3.1-1, item 15. The current Nominal Trip Setpoint for this function is 25.5 % NR Level (Ref. 5.112). The Steam Generator Water Level Low Coincident Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C11116 (Ref. 5.97), the COT error allowance for this function is ± 1.118 % of span = ± 1.118 % NR Level. The calibration accuracy for this trip function is ± 0.5 % of span = ± 0.5 % Level (Ref. 5.112). The As Found Tolerance based on the COT error from Calculation C11116 is 25.5 ± 1.118 % NR Level (round to 25.5 ± 1.12 % NR Level). The As Left Tolerance is 25.5 ± 0.5 % NR Level is based on the device calibration accuracy from Reference 5.112. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 25.5 % NR Level.

As Found Tolerance (AFT) = 25.5 % Level ± 1.12 % NR Level(1)
As Left Tolerance (ALT) = 25.5 % Level ± 0.5 % NR Level(2)

---

(1) AFT = $\pm (M2^2 + RD^2)^{½} = \pm (0.5^2 + 1.0^2)^{½} = \pm 1.118$ % span = ± 1.118 % NR Level
(2) ALT = ± M2 = ± 0.5 % span = ± 0.5 % NR Level

4.5.17 Steam Flow Feed Flow Mismatch Coincident Reactor Trip

As Found Tolerance: 0.87 * 10^6 PPH ± 0.063 * 10^6 PPH (Refs. 5.1, 5.90, 5.98, 5.108, and 5.130)

The Steam Flow Feed Flow Mismatch Coincident Reactor Trip is not addressed in the current version of Kewaunee's Custom Technical Specifications (CTS). This function will now be included in the Setpoint Control Program based on the requirements of ITS Table 3.3.1-1, item 15. The current Nominal Trip Setpoint for this function is 0.87 * 10^6 Pound Per Hour (PPH) (Ref. 5.108). Based on Reference 5.108, the maximum Steam and Feedwater flowrate is 4.47 * 10^6 PPH and the nominal flowrate at 100 % power (i.e., $Flow_{nom}$) is ≈ 3.82 * 10^6 PPH (Ref. 5.98). This means that the current Nominal Trip Setpoint is set at 22.77 % of $Flow_{nom}$. The Steam Flow Feed Flow Mismatch Coincident Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1) and a Channel Statistical Allowance (CSA) Calculation has not been performed for this function. The COT error allowance for this function will be based on the applicable module calibration accuracies given in Reference 5.108 and the standard ± 1.0 % of span Rack Drift (RD) value from Reference 5.5. Based on References 5.108 and 5.130, there are four modules with calibration accuracies that develop this trip function. The COT error allowance based on References 5.5 and 5.108 is ± 1.414 % of Flow Span = ± 0.063 * 10^6 PPH (1). The As Found Tolerance based on References 5.5, 5.108, and 5.130 is 0.87 * 10^6 PPH ± 0.063 * 10^6 PPH. The As Left Tolerance based on calibration accuracy of the four devices from Reference 5.108 is 0.87 * 10^6 PPH ± 0.045 * 10^6 PPH. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 0.87 * 10^6 PPH.

As Found Tolerance (AFT) = $0.87 * 10^6$ PPH $\pm$ $0.063 * 10^6$ PPH $^{(1)}$
As Left Tolerance (ALT) = $0.87 * 10^6$ PPH $\pm$ $0.045 * 10^6$ PPH $^{(2)}$

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(1) AFT = $\pm\,(\text{FM-466A}^2 + \text{FC-466B/C}^2 + \text{FM-464A}^2 + \text{FM-464B}^2 + \text{RD}^2)^{1/2}$
AFT = $\pm\,(0.5^2 + 0.5^2 + 0.5^2 + 0.5^2 + 1.0^2)^{1/2} = \pm\,1.414$ % of Flow Span = $\pm\,0.063 * 10^6$ PPH

(2) ALT = $\pm\,(\text{FM-466A}^2 + \text{FC-466B/C}^2 + \text{FM-464A}^2 + \text{FM-464B}^2)^{1/2}$
ALT = $\pm\,(0.5^2 + 0.5^2 + 0.5^2 + 0.5^2)^{1/2} = \pm\,1.00$ % of Flow Span = $\pm\,0.0447 * 10^6$ PPH (round to $\pm\,0.045 * 10^6$ PPH)

4.5.18 Safety Injection (SI) Input from Engineered Safety Features Actuation System (ESFAS)

See Section 4.6.

Reactor Trip Permissives

Note : Only the limiting As Found Tolerance value will be addressed in analysis for each Reactor Trip Permissive described below.

4.5.19 Permissive P-6, Intermediate Range Neutron Flux

As Found Tolerance: Permissive P-6 unblock should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power (Refs. 5.1, 5.90, and 5.116)

The current Custom Technical Specification (CTS) LSSS for this function is > 10^{-5}% Rated Power. The current Nominal Trip Setpoint for this function is set equal to the CTS LSSS value, i.e., 1 * 10^{-5}% Rated Power. Permissive P-6 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1) and a Channel Statistical Allowance (CSA) calculation has not been performed for this function. The COT error allowance for this function will be based on a portion of the calibration accuracy for the Intermediate Range Front Panel Meter at the nominal unblock trip setpoint value of 1 * 10^{-5}% Rated Power, i.e., 7.9 * 10^{-6}% Rated Power to 1.27 * 10^{-5}% Rated Power as specified in Reference 5.116. Only the high end of the tolerance value will be used to develop the As Found Tolerance for this function such that the current CTS LSSS value of 10^{-5}% Rated Power will be the low end of the tolerance. The As Found Trip for Permissive P-6 should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power. Since this As Found Tolerance does not include a Rack Drift value, the As Left Tolerance will be equal to the As Found Tolerance.

As Found Tolerance (AFT) = Permissive P-6 unblock should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power
As Left Tolerance (ALT) = Permissive P-6 unblock should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power

4.5.20 Permissive P-7, Block Low Power Reactor Trips and Enable High Power Trips

P-10 As Found Tolerance (AFT) = 11.0 % RTP ± 1.2 % RTP
P-13 As Found Tolerance (AFT) = 8.8 % Turbine Load ± 1.25 % Turbine Load
(Refs. 5.1, 5.90, 5.91, 5.104, and 5.132)

The current Custom Technical Specification (CTS) LSSS for Permissive P-7 is ≤ 12.2 % of Rated Power for both inputs, i.e., P-10 and P-13. Permissive P-7 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however, a Channel Statistical Allowance (CSA) Calculation has been performed for Permissive P-10. Permissive P-7 is made up of input signals from Turbine First Stage Pressure (P-13) and NIS Power Range (P-10). Signals to the P-7 and P-10 permissives are supplied from the same bistables in the NIS Power Range drawers. P-7 and P-10 will both enable and block functions from the "trip" and "reset" points of these bistables. The calibration procedure (Ref. 5.104) for the NIS Power Range P-10 unblock input into Permissive P-7 sets the Nominal Trip Setpoint at 11.0 % RTP (increasing). The current Nominal Trip Setpoint for the Turbine First Stage Pressure input to P-7, i.e., P-13 is 8.8 % of Turbine Load (e.g., based on a nominal Turbine First Stage Pressure value of 583.5 PSIG @ 100 % Power). The COT error associated with P-10 taken from Calculation C11705 (Ref. 5.91) is ± 1.085 % of span = ± 1.3 % RTP (round back to ± 1.2 % RTP)(1). The COT error associated with P-13 is ± 1.12 % of span = ± 1.25 % Turbine Load based on the P-13 Bistable calibration accuracy from Reference 5.132 and the standard Rack Drift (RD) error value from Reference 5.5(3). The As Found Tolerance for the P-10 input to P-7 is 11.0 ± 1.2 % RTP(1). The As Left Tolerance for the P-10 input to P-7 is 11.0 ± 0.5 % RTP(2). The As Found Tolerance for the P-13 input to P-7 is 8.8 ± 1.25 % Turbine Load(3). The As Left Tolerance for the P-13 input to P-7 is 8.8 ± 0.56 % Turbine Load(4).

P-10 As Found Tolerance (AFT) = 11.0 % RTP ± 1.2 % RTP(1)
P-10 As Left Tolerance (ALT) = 11.0 % RTP ± 0.5 % RTP(2)
P-13 As Found Tolerance (AFT) = 8.8 % Turbine Load ± 1.25 % Turbine Load(3)
P-13 As Left Tolerance (ALT) = 8.8 % Turbine Load ± 0.56 % Turbine Load(4)

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(1) AFT = $\pm (M1^2 + M5^2 + RD^2)^{½} = \pm (0.05^2 + 0.417^2 + 1.0^2)^{½} = \pm 1.085$ % of span = ± 1.3 % RTP. This COT error will be rounded back to ± 1.2 % RTP to conform to the current CTS LSSS of ≤ 12.2 % RTP (i.e., 11 % + 1.2 % is ≤ 12.2 %)

(2) ALT = $\pm (M1^2 + M5^2)^{½} = \pm (0.05^2 + 0.417^2)^{½} = \pm 0.42$ % of span = ± 0.5 % RTP.

(3) AFT = $\pm (PC\text{-}466A^2 + RD^2)^{½} = \pm (0.5^2 + 1.0^2)^{½} = \pm 1.12$ % of span. The range of the Turbine First Stage Pressure Transmitters is 0 to 650 PSIG and the nominal 100 % Power pressure is 583.5 PSIG. (1.12 %/100 %)*650 PSIG = 7.28 PSIG. Then, (7.28 PSIG/583.5 PSIG) * 100 % Turbine Load = 1.25 % Turbine Load.

(4) ALT = ± 0.5 % of span = (0.5 %/100 %)*650 PSIG = 3.25 PSIG. Then, (3.25 PSIG/583.5 PSIG) * 100 % Turbine Load = 0.56 % Turbine Load.

4.5.21 Permissive P-8, Power Range Neutron Flux

As Found Tolerance (AFT) = 9.5 % RTP ± 1.3 % RTP (Refs. 5.1, 5.90, 5.91, and 5.104)

The current Custom Technical Specification (CTS) LSSS for Permissive P-8 is < 10.0 % of Rated Power. The Nominal Trip Setpoint for the unblock portion of Permissive P-8 is 9.5 % RTP (Ref. 5.104). Permissive P-8 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1) and a Channel Statistical Allowance (CSA) Calculation has not been performed for this function. However, CSA Calculation C11705 (Ref. 5.91) has identified the COT error components associated with Permissive P-10 which uses identical circuitry to that of Permissive P-8 to generate their respective functions. The COT error associated with Permissive P-10, taken from Calculation C11705 (Ref. 5.91), is ± 1.085 % of span = ± 1.3 % RTP(1). This COT error is also applicable for Permissive P-8 and will be used to develop the As Found Tolerance. Based on a Nominal Trip Setpoint of 9.5 % RTP and a COT error of ± 1.3 % RTP, the As Found Tolerance for Permissive P-8 is 9.5 ± 1.3 % RTP. Note that the high end of the As Found Tolerance (i.e., 9.5 % RTP + 1.3 % RTP = 10.8 % RTP) is non-conservative with respect to the current CTS LSSS of < 10 % RTP, however this As Found tolerance is acceptable because there is no specific Analytical Limit associated with this permissive. The As Left Tolerance will be equal to the COT error minus Rack Drift (RD)(2). The As Found and As Left Tolerance are based on maintaining a Nominal Trip Setpoint of 9.5 % RTP.

As Found Tolerance (AFT) = 9.5 % RTP ± 1.3 % RTP(1)
As Left Tolerance (ALT) = 9.5 % RTP ± 0.5 % RTP(2)

---

(1) AFT = $\pm (M1^2 + M5^2 + RD^2)^{½} = \pm (0.05^2 + 0.417^2 + 1.0^2)^{½} = \pm 1.085$ % of span = ± 1.3 % RTP.

(2) ALT = $\pm (M1^2 + M5^2)^{½} = \pm (0.05^2 + 0.417^2)^{½} = \pm 0.42$ % of span = ± 0.5 % RTP.

Note: The error terms used above are from Calculation C11705 (Ref. 5.91) and they are used for Permissive P-10.

4.5.22 Permissive P-10, Power Range Neutron Flux Unblock Low Power Reactor Trips and Block High Power Trips

As Found Tolerance (AFT) = 9.0 % RTP ± 1.3 % RTP (Refs. 5.1, 5.90, 5.91, and 5.104)

The current Custom Technical Specification (CTS) LSSS for Permissive P-10 (i.e., unblock the low power trips) is ≥ 7.8 % of Rated Power. The calibration procedure (Ref. 5.104) for the NIS Power Range P-10 unblock of the low power trips sets the Nominal Trip Setpoint at 9.0 % RTP (decreasing). Permissive P-10 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however, a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Reference 5.91, the COT error associated with P-10 is ± 1.085 % of span = ± 1.3 % RTP(1). This COT error will be used to develop the As Found Tolerance for this function. Based on a Nominal Trip Setpoint of 9.0 % RTP and a COT error of ± 1.3 % RTP, the As Found Tolerance for Permissive P-10 is 9.0 ± 1.3 % RTP. Note that the low end of the As Found Tolerance (i.e., 9.0 % RTP - 1.3 % RTP = 7.7 % RTP) is non-conservative with respect to the current CTS LSSS of ≥ 7.8 % RTP, however this As Found tolerance is acceptable because there is no specific Analytical Limit associated with this permissive. The As Left Tolerance will be equal to the COT error minus Rack Drift (RD)(2). The As Found and As Left Tolerance are based on maintaining a Nominal Trip Setpoint of 9.0 % RTP.

As Found Tolerance (AFT) = 9.0 % RTP ± 1.3 % RTP(1)
As Left Tolerance (ALT) = 9.0 % RTP ± 0.5 % RTP(2)

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(1) AFT = ± $(M1^2 + M5^2 + RD^2)^{1/2}$ = ± $(0.05^2 + 0.417^2 + 1.0^2)^{1/2}$ = ± 1.085 % of span = ± 1.3 % RTP.
(2) ALT = ± $(M1^2 + M5^2)^{1/2}$ = ± $(0.05^2 + 0.417^2)^{1/2}$ = ± 0.42 % of span = ± 0.5 % RTP.

4.6 Limiting Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances for Kewaunee Engineered Safety Features Actuation System (ESFAS) Instrumentation to support the Setpoint Control Program

Note: Only the limiting As Found Tolerance value will be addressed in analysis for each ESFAS Trip Function described below.

4.6.1 Safety Injection, Manual Initiation

As Found Tolerance: There is no specific ESFAS Trip Setpoint associated with this function.

4.6.2 High Containment Pressure – Safety Injection

As Found Tolerance: **As Found Tolerance = 3.6 PSIG ± 0.335 PSIG (Refs. 5.1, 5.90, 5.95, 5.110, and 5.111)**

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 4.237 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 4.328 PSIG. The current CTS Setting Limit for this function is ≤ 4.0 PSIG. The CTS Setting Limit for this function of ≤ 4.0 PSIG is conservative with respect to the Allowable Value, however it is non-conservative with respect to the calculated As Found Tolerance value of 3.6 PSIG ± 0.335 PSIG (i.e., 3.935 PSIG) . The Actual Nominal Trip Setpoint of 3.6 PSIG is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of ≤ 4.0 PSIG will be changed to an As Found Tolerance value of 3.6 PSIG ± 0.335 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17.

The statistical combination of the COT and NON COT error components from CSA Calculation C11006 (Ref. 5.95) are given below. The COT and NON COT error components are used in Figure 4.6.2 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = [\text{PMA}^2 + \text{PEA}^2 + (\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = [0.0^2 + 0.0^2 + (0.5+0.388)^2 + 0.375^2 + 0.0^2 + 1.950^2 + 0.0^2 + 0.0^2 + 0.200^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 2.241 % of span = ± 0.672 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{½}$

$\text{COT}_{\text{error}} = \pm$ 1.118 % of span = ± 0.335 PSIG

As Found Tolerance (AFT) = 3.6 PSIG ± 0.335 PSIG
As Left Tolerance (ALT) = 3.6 PSIG ± 0.15 PSIG$^{(1)}$

See Figure 4.6.2 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± (0.5 % / 100 %) * 30 PSIG = ± 0.15 PSIG

KEWAUNEE'S HIGH CONTAINMENT PRESSURE (SAFETY INJECTION)

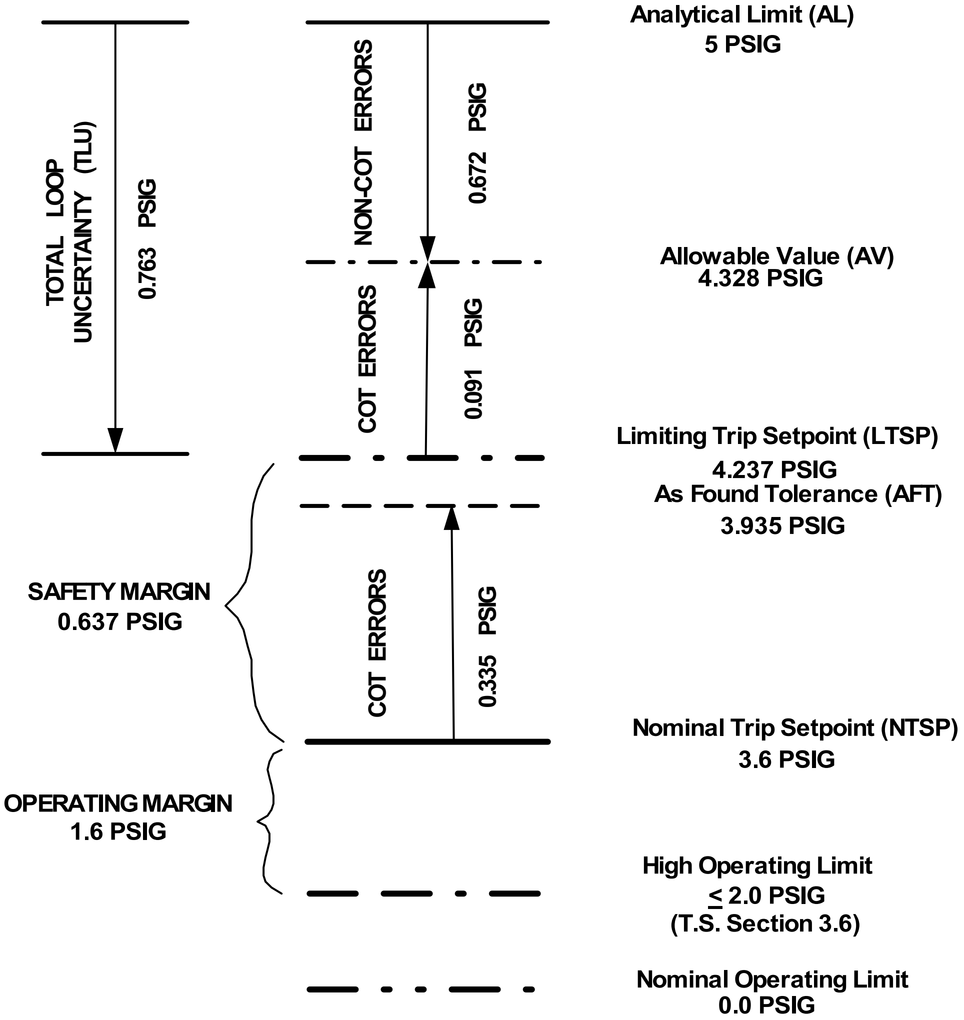

Figure 4.6.2

4.6.3 High - High Containment Pressure (Containment Spray)

As Found Tolerance: **As Found Tolerance = 21.0 PSIG ± 0.671 PSIG (Refs. 5.1, 5.90, 5.95, 5.110, and 5.111)**

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 21.622 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 21.827 PSIG. The current CTS Setting Limit for this function is ≤ 23.0 PSIG. The CTS Setting Limit for this function of ≤ 23.0 PSIG is set equal to the Analytical Limit and is non-conservative with respect to the Allowable Value. In addition, the current CTS Setting Limit is also non-conservative with respect to the calculated As Found Tolerance value of 21.0 PSIG ± 0.671 PSIG (i.e., 21.671 PSIG). The Actual Nominal Trip Setpoint of 21.0 PSIG is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of ≤ 23.0 PSIG will be changed to an As Found Tolerance value of 21.0 PSIG ± 0.671 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17.

The statistical combination of the COT and NON COT error components from CSA Calculation C11006 (Ref. 5.95) are given below. The COT and NON COT error components are used in Figure 4.6.3 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$$\text{NON COT}_{\text{error}} = (\text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = [0.0^2 + 0.0^2 + (0.5+0.261)^2 + 0.375^2 + 0.0^2 + 1.677^2 + 0.0^2 + 0.0^2 + 0.2^2 + 0.5^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = \pm\ 1.955\ \%\ \text{of span} = \pm\ 1.173\ \text{PSIG}$$

$$\text{COT}_{\text{error}} = \pm\ (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{½}$$

$$\text{COT}_{\text{error}} = \pm\ (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm\ 1.118\ \%\ \text{of span} = \pm\ 0.671\ \text{PSIG}$$

As Found Tolerance (AFT) = 21.0 PSIG ± 0.671 PSIG
As Left Tolerance (ALT) = 21.0 PSIG ± 0.300 PSIG(1)

See Figure 4.6.3 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± (0.5 % / 100 %) * 60 PSIG = ± 0.30 PSIG

KEWAUNEE'S HIGH HIGH CONTAINMENT PRESSURE CONTAINMENT SPRAY INITIATION

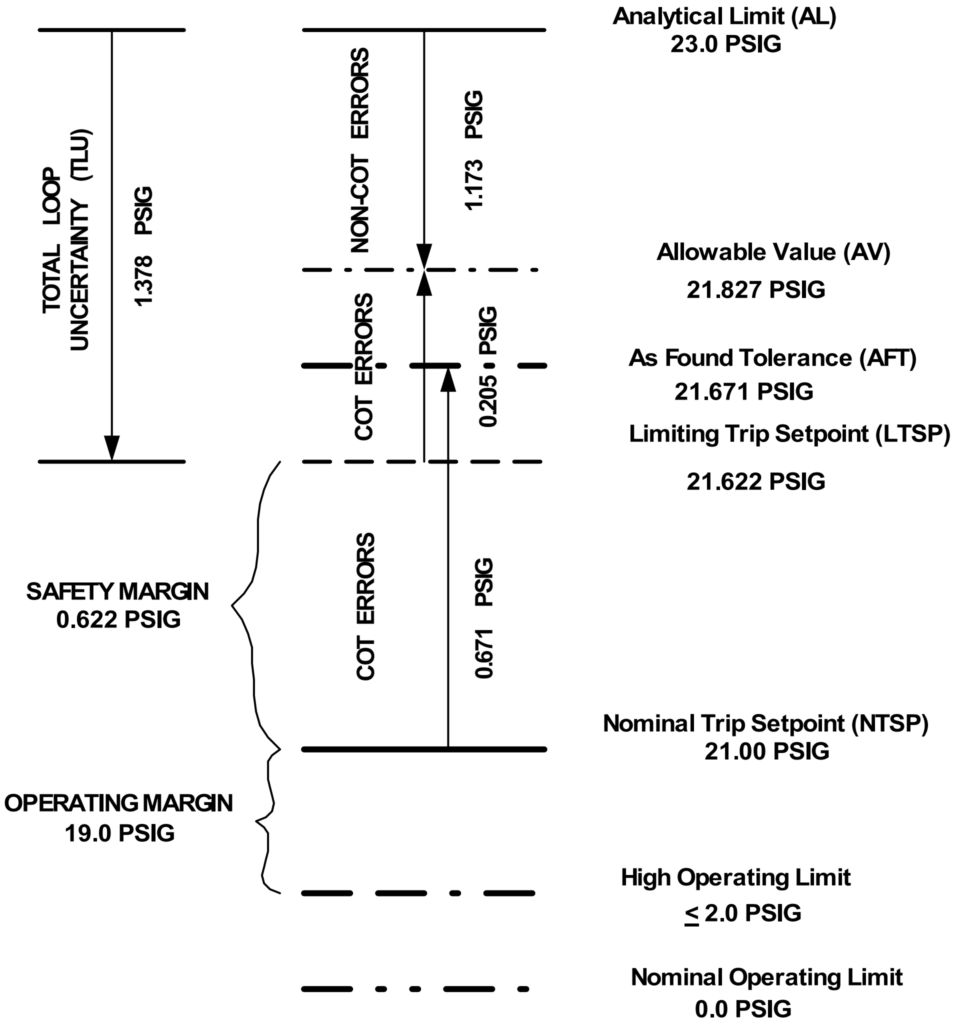

Figure 4.6.3

4.6.4 High - High Containment Pressure (Steam Line Isolation)

As Found Tolerance: **As Found Tolerance = 15.0 PSIG ± 0.671 PSIG (Refs. 5.1, 5.90, 5.95, 5.110, and 5.111)**

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 15.622 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 15.827 PSIG. The current CTS Setting Limit for this function is ≤ 17.0 PSIG. The CTS Setting Limit for this function of ≤ 17.0 PSIG is set equal to the Analytical Limit and is non-conservative with respect to the Allowable Value. In addition, the current CTS Setting Limit is also non-conservative with respect to the calculated As Found Tolerance value of 15.0 PSIG ± 0.671 PSIG (i.e., 15.671 PSIG). The Actual Nominal Trip Setpoint of 15.0 PSIG is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of ≤ 17.0 PSIG will be changed to an As Found Tolerance value of 15.0 PSIG ± 0.671 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17.

The statistical combination of the COT and NON COT error components from CSA Calculation C11006 (Ref. 5.95) are given below. The COT and NON COT error components are used in Figure 4.6.4 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$$\text{NON COT}_{\text{error}} = (\text{PMA}^2 + \text{PEA}^2 + (\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = [0.0^2 + 0.0^2 + (0.5+0.261)^2 + 0.375^2 + 0.0^2 + 1.677^2 + 0.0^2 + 0.0^2 + 0.2^2 + 0.5^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = \pm\ 1.955\ \%\ \text{of span} = \pm\ 1.173\ \text{PSIG}$$

$$\text{COT}_{\text{error}} = \pm\ (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm\ (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm\ 1.118\ \%\ \text{of span} = \pm\ 0.671\ \text{PSIG}$$

As Found Tolerance (AFT) = 15.0 PSIG ± 0.671 PSIG
As Left Tolerance (AFT) = 15.0 PSIG ± 0.300 PSIG(1)

See Figure 4.6.4 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± (0.5 % / 100 %) * 60 PSIG = ± 0.30 PSIG

KEWAUNEE'S CONTAINMENT PRESSURE HI-HI STEAM LINE ISOLATION INITIATION

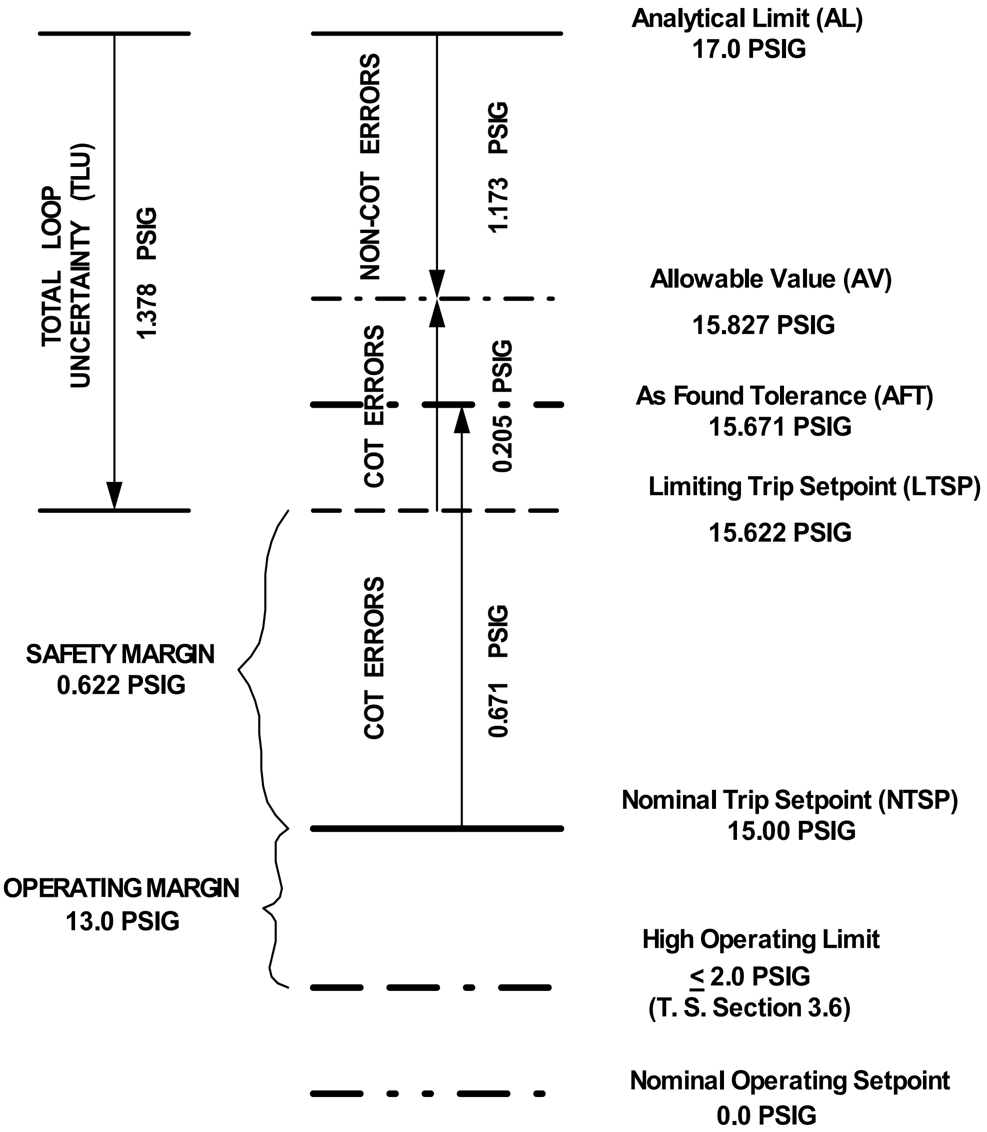

Figure 4.6.4

4.6.5 Pressurizer Low Pressure (Safety Injection)

As Found Tolerance: 1830 PSIG ± 10 PSIG (Refs. 5.1, 5.90, 5.93, and 5.105)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 1755.62 PSIG. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 1754.94 PSIG. The Actual Nominal Trip Setpoint of 1830 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specification (CTS) Setting Limit value of ≥ 1815 PSIG is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value ≥ 1815 PSIG is non-conservative based on the calculated COT error components determined in Calculation C10818 (Ref. 5.93). The Setting Limit value of ≥ 1815 PSIG will be changed to an As Found Tolerance value of 1830 PSIG ± 10.0 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. The revised As Found Tolerance value of ≥ 1820 PSIG will allow a 10.00 PSIG margin to be used for the COT error components. The revised As Found Tolerance value of ≥ 1820 PSIG is conservative with respect to the calculated Allowable Value but is non-conservative with respect to the calculated As Found Tolerance value using the CSA rack error terms from Calculation C10818 (Ref. 5.93).

The calculated As Found Tolerance value for this function is ≥ 1821.06 PSIG based on using the COT error components. The 1.06 PSIG offset is accommodated in the 74.38 PSIG Safety Margin for this trip as illustrated in Figure 4.6.5.

The statistical combination of the COT and NON COT error components from CSA Calculation C10818 (Ref. 5.93) are given below. The COT and NON COT error components are used in Figure 4.6.5 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} + \text{IR} \pm [\text{PMA}^2 + \text{PEA}^2 + \text{RE}_{\text{DBE}}^2 + \text{SPTE}^2 + (\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M4MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 + 0.174 \pm [0.0^2 + 0.0^2 + 1.688^2 + 8.0^2 + (0.250 + 0.391)^2 + 0.75^2 + 0.0^2 + 2.300^2 + 0.158^2 + 0.0^2 + 0.2^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = -\,8.395\ \%$ or $+\,8.743\ \%$ of span $= +\,69.944$ PSIG (worst case)

$\text{COT}_{\text{error}} = \pm\,(\text{M1}^2 + \text{M4}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm\,(0.0 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm\,1.118\ \%$ of span $= \pm\,8.944$ PSIG (round to ± 10 PSIG)

As Found Tolerance (AFT) = 1830 PSIG ± 10 PSIG
As Left Tolerance (ALT) = 1830 PSIG ± 4.0 PSIG(1)

See Figure 4.6.5 for specific details.

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(1) ALT = ± M4 = ± 0.5 % of span = ± 4.0 PSIG

KEWAUNEE'S PRESSURIZER LOW PRESSURE ESFAS INITIATION

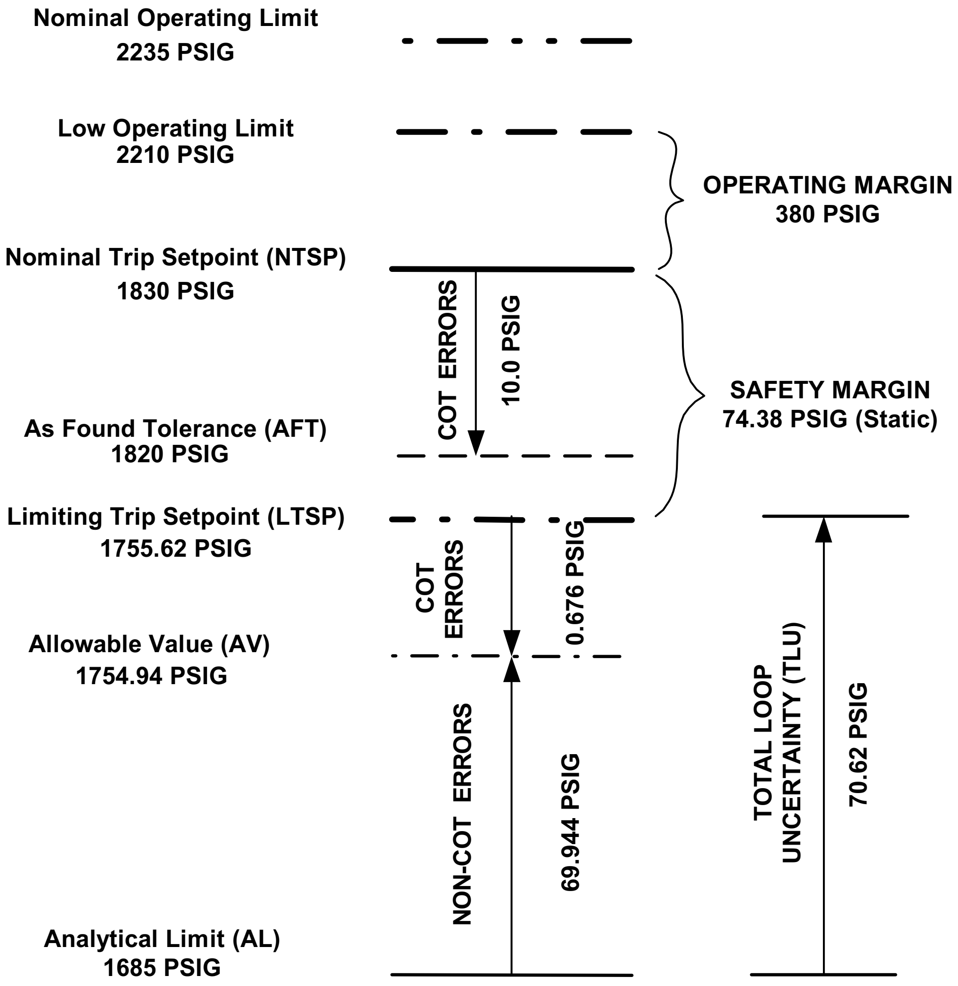

Figure 4.6.5

4.6.6 High Steam Flow Coincident with Safety Injection and Coincident with Tavg – Low Low

As Found Tolerance: **$0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr (Refs. 5.1, 5.90, 5.98, 5.108, and 5.120)**

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of $0.944 * 10^6$ lbs/hr. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of $0.981 * 10^6$ lbs/hr. The current CTS Setting Limit for this function is $0.745 * 10^6$ lbs/hr. The CTS Setting Limit for this function of $0.745 * 10^6$ lbs/hr is set conservative with respect to the Allowable Value. The current Nominal Trip Setpoint of $0.494 * 10^6$ lbs/hr is conservative with respect to the Limiting Trip Setpoint, however it is set overly conservative and at an unstable flowrate during startup. The current Nominal Trip Setpoint will be changed to $0.75 * 10^6$ lbs/hr equivalent to 19.63 % of $\text{Flow}_{\text{nom}}^{(4)}$. This revised Nominal Trip Setpoint will now be set at a more stable flowrate which should allow the trip to lock in without excessive relay chatter (i.e., passing through trip and reset multiple times) during the power escalation. The CTS Setting Limit of $0.745 * 10^6$ lbs/hr will be changed to an As Found Tolerance Value of $0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. This As Found Tolerance Value of $0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr is based on maintaining a Nominal Trip Setpoint value of $0.75 * 10^6$ lbs/hr.

The statistical combination of the COT and NON COT error components from CSA Calculation C10854 (Ref. 5.98) are given below. Calculation C10854 is based on a Nominal Trip Setpoint of $0.494 * 10^6$ lbs/hr versus the revised Nominal Trip Set point of $0.75 * 10^6$ lbs/hr which allows the current Channel Statistical Allowance (CSA) value to be used in this analysis since it is conservative. The COT and NON COT error components are used in Figure 4.6.6 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$$\text{NON COT}_{\text{error}} = SE \pm [EA^2 + PMA^2 + PEA^2 + (SCA+SMTE)^2 + SD^2 + SPE^2 + STE^2 + SPSE^2 + M1MTE^2 + M2MTE^2 + RTE^2]^{1/2}$$

$$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.066^2 + 3.333^2 + (0.250+0.187)^2 + 0.386^2 + 0.503^2 + 1.557^2 + 0.158^2 + 0.0^2 + 0.2^2 + 0.5^2]^{1/2}$$

$$\text{NON COT}_{\text{error}} = \pm 3.801\% \text{ of } \Delta P \text{ span} = \pm 17.197 \% \text{ of Flow Span} = \pm 0.769 * 10^6 \text{ lbs/hr}^{(1)}$$

$$\text{COT}_{\text{error}} = \pm (M1^2 + M2^2 + RD^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm 1.118\% \text{ of } \Delta P \text{ span} = \pm 3.332 \% \text{ of Flow Span} = \pm 0.149 * 10^6 \text{ lbs/hr}^{(2)}$$

As Found Tolerance (AFT) = $0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr$^{(2)}$
As Left Tolerance (ALT) = $0.75 * 10^6$ lbs/hr ± $0.067 * 10^6$ lbs/hr$^{(3)}$

See Figure 4.6.6 for specific details.

KEWAUNEE'S HI STEAM FLOW COINCIDENT WITH SI AND LO-2 T_{AVG}

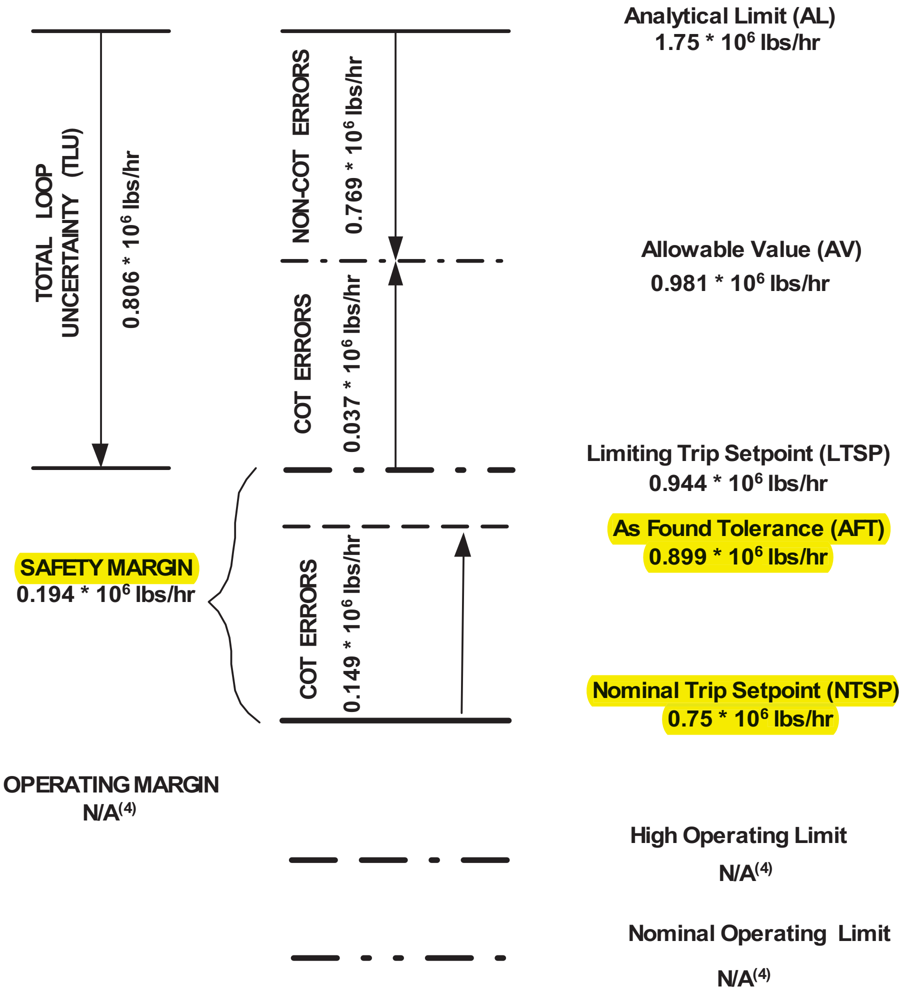

Figure 4.6.6

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(1) The equation to convert % ΔP error to % Flow error is: % flow span = (ΔP uncertainty) * 0.5 * (flow max / flow x) (Ref. 5.120). According to Reference 5.98, flow max = 4.47 * 10^6 lbs/hr and based on Reference 5.108, flow x = 0.494 * 10^6 lbs/hr. Therefore, the NON COT_{error} in terms of % Flow = $\pm$ 3.801 * 0.5 * (4.47 / 0.494) = 17.197 % Flow span = (17.197/100) * 4.47 = $\pm$ 0.769 * 10^6 lbs/hr.

(2) Using the information from Note 1 above and substituting the revised Nominal Trip Setpoint of 0.75* 10^6 lbs/hr , the AFT = COT_{error} in terms of % Flow = $\pm$ 1.118 * 0.5 * (4.47 / 0.75) = 3.332 % Flow span = (3.332/100) * 4.47 = $\pm$ 0.149 * 10^6 lbs/hr.

(3) The ALT = $\pm$ M2 = $\pm$ 0.5 % of ΔP span. Using the information from Note 1 above and substituting the revised Nominal Trip Setpoint of 0.75* 10^6 lbs/hr, the ALT in terms of % Flow = $\pm$ 0.5 * 0.5 * (4.47 / 0.75) = 1.49 % Flow span = (1.49/100) * 4.47 = $\pm$ 0.067 * 10^6 lbs/hr.

(4) The High Steam Flow portion of this ESFAS function is always active and will be locked in as a partial coincident trip at ≈ 0.75 * 10^6 lbs/hr, i.e., at ≈ 19.63 % Power where % power = (flow x / flow nom) * 100 = (0.75 / 3.82) * 100 = 19.63. Based on Reference 5.98, $Flow_{nom}$ (nominal steam flow at 100 % power) = 3.82 * 10^6 lbs/hr.

4.6.7 High High Steam Flow Coincident with Safety Injection

As Found Tolerance: $4.3439 * 10^6$ lbs/hr ± $0.026 * 10^6$ lbs/hr
(Refs. 5.1, 5.90, 5.98, 5.108, and 5.120)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of $7.668 * 10^6$ lbs/hr. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of $7.673 * 10^6$ lbs/hr. The current CTS Setting Limit for this function is $4.4 * 10^6$ lbs/hr. The CTS Setting Limit for this function of $4.4 * 10^6$ lbs/hr is set conservative with respect to the Allowable Value; however, the current CTS Setting Limit is set non-conservative with respect to the calculated As Found Tolerance value of $4.3439 * 10^6$ lbs/hr ± $0.026 * 10^6$ lbs/hr (i.e., $4.3699 * 10^6$ lbs/hr). The Actual Nominal Trip Setpoint of $4.3439 * 10^6$ lbs/hr is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of $4.4 * 10^6$ lbs/hr will be changed to an As Found Tolerance Value of $4.3439 * 10^6$ lbs/hr ± $0.026 * 10^6$ lbs/hr to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. This As Found Tolerance Value of $4.3439 * 10^6$ lbs/hr ± $0.026 * 10^6$ lbs/hr is based on maintaining a Nominal Trip Setpoint value of $4.3439 * 10^6$ lbs/hr.

The statistical combination of the COT and NON COT error components from CSA Calculation C10854 (Ref. 5.98) are given below. The COT and NON COT error components are used in Figure 4.6.7 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{EA}^2 + \text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + 3.333^2 + (0.250+0.187)^2 + 0.386^2 + 0.503^2 + 1.557^2 + 0.158^2 + 0.0^2 + 0.2^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm 3.800\%$ of ΔP span $= \pm 1.955$ % of Flow Span $= \pm 0.087 * 10^6$ lbs/hr(1)

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm 1.118\%$ of ΔP span $= \pm 0.575$ % of Flow Span $= \pm 0.026 * 10^6$ lbs/hr(2)

As Found Tolerance (AFT) = $4.3439 * 10^6$ lbs/hr ± $0.026 * 10^6$ lbs/hr(2)
As Left Tolerance (ALT) = $4.3439 * 10^6$ lbs/hr ± $0.011 * 10^6$ lbs/hr(3)

See Figure 4.6.7 for specific details.

KEWAUNEE'S HI HI STEAM FLOW COINCIDENT WITH SAFETY INJECTION

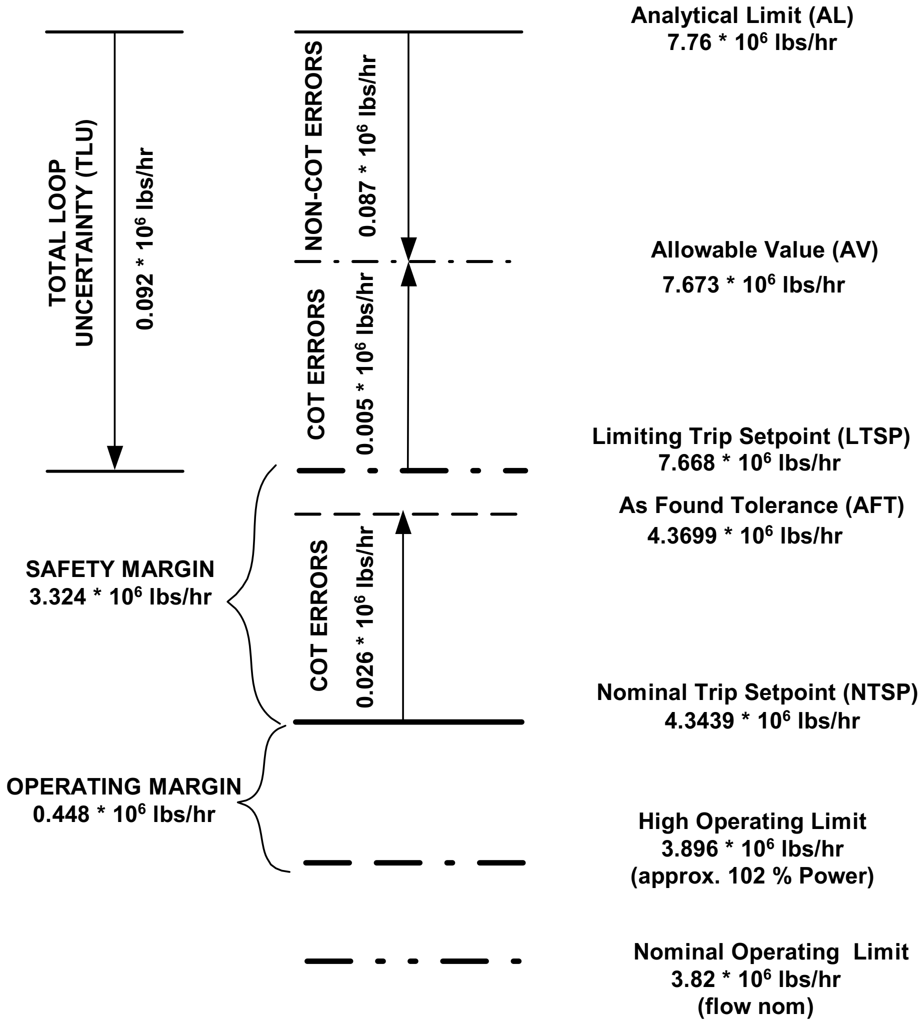

Figure 4.6.7

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(1) The equation to convert % ΔP error to % Flow error is: % flow span = (ΔP uncertainty) * 0.5 * (flow max / flow x) (Ref. 5.120). According to Reference 5.98, flow max = 4.47 * 10^6 lbs/hr and based on Reference 5.108, flow x = 4.3439 * 10^6 lbs/hr. Therefore, the NON COT_{error} in terms of % Flow = ± 3.800 * 0.5 * (4.47 / 4.3439) = 1.955 % Flow span = (1.955/100) * 4.47 = ± 0.087 * 10^6 lbs/hr.

(2) Using the information from Note 1 above, the AFT = COT_{error} in terms of % Flow = ± 1.118 * 0.5 * (4.47 / 4.3439) = 0.575 % Flow span = (0.575/100) * 4.47 = ± 0.026 * 10^6 lbs/hr.

(3) The ALT = ± M2 = ± 0.5 % of ΔP span. Using the information from Note 1 above, the ALT in terms of % Flow = ± 0.5 * 0.5 * (4.47 / 4.3439) = 0.257 % Flow span = (0.257/100) * 4.47 = ± 0.011 * 10^6 lbs/hr.

4.6.8 Low-Low T_{AVG} Coincidence input to Steam Line Isolation

As Found Tolerance Value: 541.0 °F ± 1.38 °F (Refs. 5.1, 5.90, 5.94, and 5.105)

The current Custom Technical Specification (CTS) Setting Limit for this function is ≥ 540.0 °F. The current Nominal Trip Setpoint for this function is ≥ 541.0 °F (Ref. 5.105). The Low T_{AVG} Coincidence input to the Steam Line Isolation ESFAS function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C11865 (Ref. 5.94), the COT error allowance for this function is ± 1.38 % of span = ± 1.38 °F. The As Found Tolerance based on the COT error from Calculation C11865 is 541 °F ± 1.38 °F. The CTS Setting Limit for this function of ≥ 540.0 °F is set slightly conservative with respect to the calculated As Found Tolerance value of 541 °F ± 1.38 °F (i.e. 539.62 °F). The As Found Tolerance being slightly non-conservative with respect to the current CTS Setting Limit is acceptable because there is no Analytical Limit associated with this function. The As Left Tolerance will be based on the COT error allowance minus Rack Drift (i.e., RD_2 from Ref. 5.94). The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 541 °F.

As Found Tolerance (AFT) = 541.0 °F ± 1.38 °F(1)
As Left Tolerance (ALT) = 541 °F ± 0.95 °F (2)

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(1) AFT = $\pm((M1 * 0.667)^2 + (M2 * 0.667)^2 + M4^2 + M8^2 + RD_2^2)^{½} = \pm((0.417 * 0.667)^2 + (0.417 * 0.667)^2 + 0.707^2 + 0.5^2 + 1.0^2)^{½} = \pm 1.38$ % of T_{AVG} span

(2) (2) ALT = $\pm((M1 * 0.667)^2 + (M2 * 0.667)^2 + M4^2 + M8^2)^{½} = \pm((0.417 * 0.667)^2 + (0.417 * 0.667)^2 + 0.707^2 + 0.5^2)^{½} = \pm 0.95$ % of T_{AVG} span

(3) The effective gain of the T_{AVG} summing junction is set by the relationship of the T_{AVG} span versus the span of T_{HOT} and T_{COLD} (i.e., 520 to 620 °F versus 500 to 650 °F, span equal to 150 °F). For Kewaunee, the effective gain is 0.6667 V/V, therefore % T_{AVG} span is equal to % T_{HOT} span or T_{COLD} span * 0.6667.

4.6.9 Steam Line Pressure - Low

As Found Tolerance: 514.0 PSIG ± 17.15 PSIG (Refs. 5.1, 5.90, 5.98, and 5.108)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 511.066 PSIG. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 504.01 PSIG. The Actual Nominal Trip Setpoint of 514.0 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specifications (CTS) Setting Limit of ≥ 500 PSIG is non-conservative with respect to the calculated Allowable Value and is conservative with respect to the calculated As Found Tolerance. The As Found Tolerance of 514 PSIG ± 17.15 PSIG is based on the calculated COT error allowance from Calculation C10854 (Ref. 5.98). The Custom Technical Specifications (CTS) Setting Limit of ≥ 500 PSIG will be changed to an As Found Tolerance of 514 PSIG ± 17.15 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. The calculated As Left Tolerance will be based on the COT error allowance from Calculation C10854 minus Rack Drift (RD). The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint of 514.0 PSIG.

The statistical combination of the COT and NON COT error components from CSA Calculation C10854 (Ref. 5.98) are given below. The COT and NON COT error components are used in Figure 4.6.9 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{EA}^2 + \text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{M3MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + 0.0^2 + (0.250 + 0.180)^2 + 0.429^2 + 0.0^2 + 1.475^2 + 0.158^2 + 0.0^2 + 0.283^2 + 0.2^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 1.715 % of span = ± 24.01 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{M3}^2 + \text{RD}^2)^{½}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm$ 1.225 % of span = ± 17.15 PSIG

As Found Tolerance (AFT) = 514.0 PSIG ± 17.15 PSIG
As Left Tolerance (ALT) = 514 PSIG ± 10.0 PSIG(1)

See Figure 4.6.9 for specific details.

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(1) ALT = $(\text{M1}^2 + \text{M2}^2 + \text{M3}^2)^{½} = \pm (0.0^2 + 0.5^2 + 0.5^2)^{½} = \pm$ 0.707 % of span = ± 9.898 PSIG (round to ± 10. PSIG)

KEWAUNEE'S STEAM LINE PRESSURE LOW ESFAS INITIATION

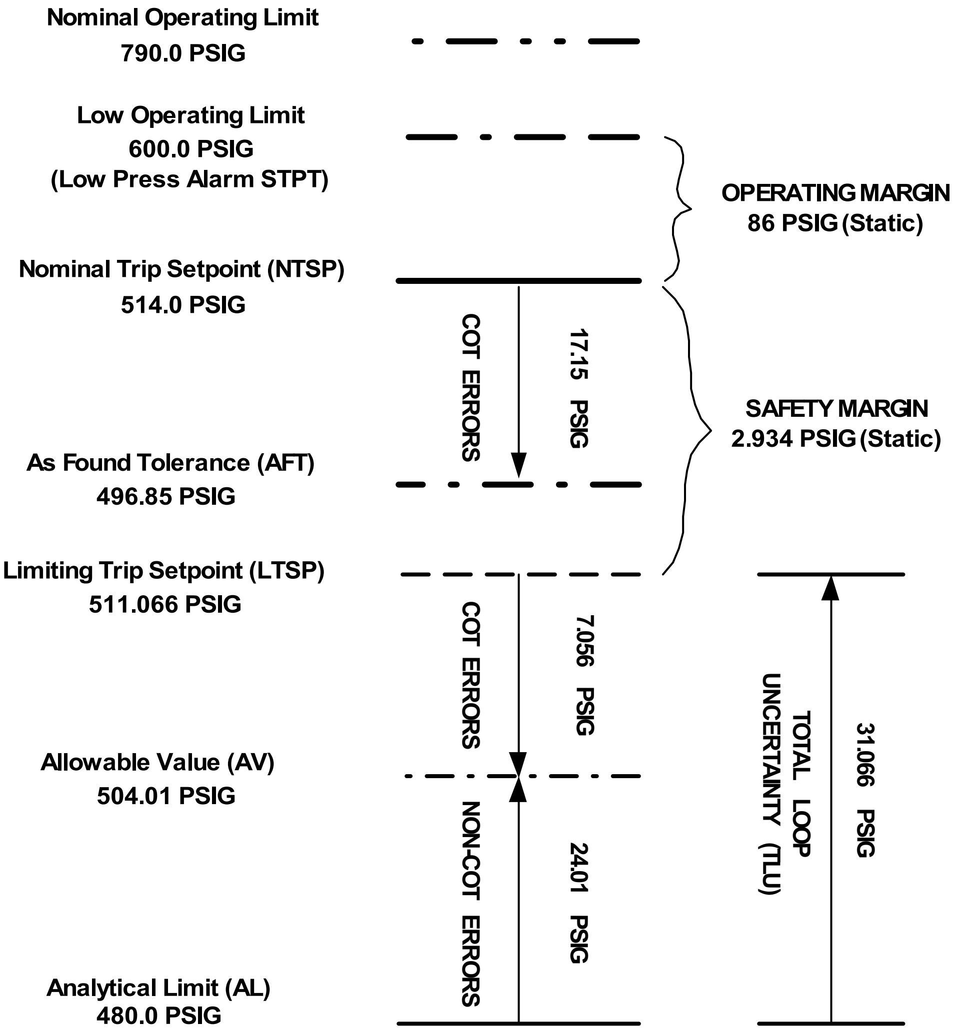

Figure 4.6.9

4.6.10 Steam Generator Water Level Low Low Reactor Trip/SI

See item 4.5.15.

4.6.11 SG Water Level - High High

See Section 3.5.3.

4.7 Limiting Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances for Kewaunee Instrumentation associated with LCO's 3.3.5, 3.3.6, and 3.3.7 to support the Setpoint Control Program

4.7.1 Safeguards Bus Undervoltage (Loss of Voltage)

As Found Tolerance: **84.47 ± 0.200 % of Bus Voltage = 101.69 ± 0.241 VAC with a time delay of 1.75 seconds ± 0.25 seconds (Refs. 5.1, 5.90, 5.102, & 5.129)**

The current Custom Technical Specification (CTS) Setting Limit for this function is 85 % ± 2 % of bus voltage in ≤ 2.5 secs. The current Nominal Trip Setpoint for this function is 101.49 to 101.89 VAC where 101.69 VAC is the centerline voltage = 84.47 % of bus voltage(1) (Ref. 5.102 & 5.129). This analysis assumes that 120.39 VAC from the potential transformer is equal to 100 % of bus voltage which is equal to 4160 VAC per the conversion factor as noted in footnote 1. The Safeguards Bus Undervoltage Loss of Power Trip is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) calculation has been performed for this function. The calibration accuracy for this trip is 101.69 ± 0.2 VAC = 84.47 ± 0.166 % of bus voltage (1) (Ref. 5.129). The COT error from Calculation C11709 is ± 0.200 % of bus voltage = ± 0.241 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.47 ± 0.200 % of bus voltage = 101.69 ± 0.241 VAC(1) based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.47 ± 0.166 % of bus voltage = 101.69 ± 0.200 VAC based on the device calibration accuracy from Reference 5.129. The As Found Tolerance and As Left Tolerance are based on maintaining a Nominal Trip Setpoint Value of 101.69 VAC = 84.47 % of bus voltage.

The time delay associated with this trip is based on a setpoint of 1.75 seconds ± 0.01 seconds (Ref. 5.129). Calculation C11709 (Ref. 5.102) gives a total error associated with the relays as 14.14 % of the settings. Utilizing the total error of 14.14 % of the setting provides a range of 1.50 seconds to 2.00 seconds based on a setpoint of 1.75 seconds. Therefore, the Time Delay As Found Tolerance is 1.75 seconds ± 0.25 seconds. The Time Delay As Left Tolerance is 1.75 ± 0.10(5) second based on the device calibration accuracy from Reference 5.129.

As Found Tolerance (AFT) = 84.47 ± 0.200 % of bus voltage = 101.69 ± 0.241 VAC(2)
As Left Tolerance (ALT) = 84.47 ± 0.166 % of bus voltage = 101.69 ± 0.200 VAC(3)
Time Delay As Found Tolerance = 1.75 Seconds ± 0.25 seconds
Time Delay As Left Tolerance = 1.75 Seconds ± 0.10 seconds(5)

As Found Tolerance (AFT) = 84.15 ± 0.200 % of bus voltage = 101.31 ± 0.241 VAC(4)
As Left Tolerance (ALT) = 84.15 ± 0.166 % of bus voltage = 101.31 ± 0.200 VAC(4)

---

(1) Convert % bus Voltage to VAC as follows:
4160*(% bus Volts / 100) / (sqrt (3) * 20 * 0.9975) = VAC
Where 20 is the PT turn down ratio and 0.9775 is the Ratio Correction Factor (Ref. 5.102).
(2) AFT = ± SCA = ± 0.200 % bus voltage (From Reference 5.102).
(3) ALT = Current Calibration Accuracy from Reference 5.129 = ± 0.166 % bus voltage.
(4) Calculation C11709 (Ref. 5.102) recommends a setpoint change for the Safeguards Bus Undervoltage Loss of Voltage Trip. The recommended setpoint will be 101.31 ± 0.200 VAC = 84.15 ± 0.166 % of bus voltage for the relay Dropout.

The COT error from Calculation C11709 is ± 0.200 % of bus voltage = ± 0.241 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.15 ± 0.200 % of bus voltage = 101.31 ± 0.241 VAC based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.15 ± 0.166 % of bus voltage = 101.31 ± 0.200 VAC based on the recommendation from Reference 5.102. The As Found Tolerance and As Left Tolerance are based on implementing the recommendations of Calculation C11709 and setting the Nominal Trip Setpoint to a value of 101.31 VAC = 84.15 % of bus voltage. The same Time Delay Tolerances apply for the new setpoints.

(5) Undervoltage relays 27A/B5, 27C/B5, 26A/B6, 27C/B6 have an As Left time delay of 0.01 seconds listed in the Electrical Preventive Maintenance Procedures with an As Found time delay of 0.1 seconds. The procedure value of 0.01 seconds is conservative to the As Left Tolerance of 0.1 seconds as described above.

4.7.2 Safeguards Bus Second Level Undervoltage (Degraded Voltage)

As Found Tolerance: **93.80 ± 0.179 % of bus voltage = 112.93 ± 0.215 VAC with a time delay of 6.72 seconds ± 0.68 seconds**
(Refs. 5.1, 5.90, 5.102, & 5.129)

The current Custom Technical Specification (CTS) Setting Limit for this function is 93.6 % ± 0.9 % of bus voltage in ≤ 7.4 secs. The current Nominal Trip Setpoint for this function is 112.73 to 113.13 VAC where 112.93 VAC is the centerline voltage = 93.80 % of bus voltage(1) (Ref. 5.102 & 5.129). This analysis assumes that 120.39 VAC from the potential transformer is equal to 100 % of bus voltage which is equal to 4160 VAC per the conversion factor as noted in footnote 1. The Safeguards Bus Second Level Undervoltage Degraded Voltage Trip is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) calculation has been performed for this function. The calibration accuracy for this trip is 112.93 ± 0.2 VAC = 93.80 ± 0.166 % of bus voltage (1) (Ref. 5.129). The COT error from Calculation C11709 is ± 0.179 % of bus voltage = ± 0.215 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Second Level Undervoltage Degraded Voltage Trip is 93.80 ± 0.179 % of bus voltage = 112.93 ± 0.215 VAC based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Second Level Undervoltage Degraded Voltage Trip is 93.80 ± 0.166 % of bus voltage = 112.93 ± 0.200 VAC based on the device calibration accuracy from Reference 5.129. The As Found Tolerance and As Left Tolerance are based on maintaining a Nominal Trip Setpoint Value of 112.93 VAC = 93.80 % of bus voltage.

The time delay associated with this trip is based on a setpoint of 6.72 seconds ± 0.01 seconds (Ref. 5.129). Calculation C11709 (Ref. 5.102) gives a total error associated with the relays as 10.1 % of the settings. Utilizing the total error of 10.1 % of the setting provides a range of 6.04 seconds to 7.40 seconds based on a setpoint of 6.72 seconds. Therefore, the Time Delay As Found Tolerance is 6.72 seconds ± 0.68 seconds. The Time Delay As Left Tolerance is 6.72 ± 0.10(5) second based on the device calibration accuracy from Reference 5.129.

As Found Tolerance (AFT) = 93.80 ± 0.179 % of bus voltage = 112.93 ± 0.215 VAC(2)
As Left Tolerance (ALT) = 93.80 ± 0.166 % of bus voltage = 112.93 ± 0.200 VAC (3)
Time Delay As Found Tolerance = 6.72 Seconds ± 0.68 seconds
Time Delay As Left Tolerance = 6.72 Seconds ± 0.10 seconds(5)

As Found Tolerance (AFT) = 93.50 ± 0.200 % of bus voltage = 112.57 ± 0.215 VAC(4)
As Left Tolerance (ALT) = 93.50 ± 0.166 % of bus voltage = 112.57 ± 0.200 VAC(4)

---

(1) Convert % bus Voltage to VAC as follows:
4160*(% bus Volts / 100) / (sqrt (3) * 20 * 0.9975) = VAC
Where 20 is the PT turn down ratio and 0.9775 is the Ratio Correction Factor (Ref. 5.102).
(2) AFT = ± SCA = ± 0.179 % bus voltage (From Reference 5.102).
(3) ALT = Current Calibration Accuracy from Reference 5.129 = ± 0.166 % bus voltage.
(4) Calculation C11709 (Ref. 5.102) recommends a setpoint change for the Safeguards Bus Undervoltage Degraded Voltage Trip. The recommended setpoint will be 112.57 ± 0.200 VAC = 93.50 ± 0.166 % of bus voltage for the relay Dropout. The COT error from Calculation C11709 is ± 0.179 % of bus voltage = ± 0.215 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Undervoltage Degraded Voltage Trip is 93.50 ± 0.179 % of bus voltage = 112.57 ± 0.215 VAC based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Undervoltage Degraded Voltage Trip is 93.50 ± 0.166 % of bus voltage = 112.57 ± 0.200 VAC based on the recommendation from Reference 5.102. The As Found Tolerance and As Left Tolerance are based on implementing the recommendations of Calculation C11709 and setting the Nominal Trip Setpoint to a value of 112.57 VAC = 93.50 % of bus voltage. The same Time Delay Tolerances apply for the new setpoints.
(5) Undervoltage (Degraded Voltage) relays 27AY/B5, 27CY/B5, 26AY/B6, 27CY/B6 have an As Left time delay of 0.01 seconds listed in the Electrical Preventive Maintenance Procedures with an As Found time delay of 0.1 seconds. The procedure value of 0.01 seconds is conservative to the As Left Tolerance of 0.1 seconds as described above.

4.7.3 Forebay Level

As Found Tolerance: 162” H2O ± 9” H2O (Refs. 5.1, 5.90, 5.101 & 5.121)

The current Custom Technical Specifications (CTS) do not list a Setting Limit value associated with the Forebay Level Trip. The Forebay Level Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1). The current As Found Nominal Trip Setpoint for this function is 162 Inches H2O Decreasing ± 9.0 Inches H2O per Reference 5.121. The current As Left Nominal Trip Setpoint is 162 Inches H2O Decreasing ± 4.5 Inches H2O per Reference 5.121. Per Calculation C11220 (Ref. 5.101) testing concluded that at a water level of 565’ 3”, acceptable conditions exist for continued operation of the SW pumps. The setpoint of 162” H2O is equivalent to 566’ Forebay water level per Reference 5.101, which yields a difference of 9” H2O to be used for the As Found Tolerance.

As Found Tolerance (AFT) = 162” H2O ± 9” H2O(1)
As Left Tolerance (ALT) = 162” H2O ± 4.5” H2O(2)

---

(1) AFT = Margin from minimum level for SW Pump operation – Existing Setpoint Equivalent (Ref. 5.101) = 566’ – 565’3” = 9”
(2) ALT = Current As Left Calibration Accuracy from Reference 5.121 = 4.5”

4.7.4 Containment Purge and Vent System Radiation Particulate Detector and Radioactive Gas Detector Containment Ventilation Isolation

Containment Gas Radiation Monitors (R12 and R21)

As Found Tolerance: **2.2 E+05 CPM + BKG**
(Refs. 5.1, 5.90, 5.113, 5.114, 5.115, 5.123, 5.124, 5.131, & 5.143)

The current Custom Technical Specifications (CTS) Setting Limit for this function states "≤ radiation levels in exhaust duct as defined in footnote(3)". The current Nominal Trip Setpoint (4) for the Containment Gas Radiation Monitors are 8.00 E +04 CPM for the High Alarm Setpoint per References 5.123 and 5.143. The Containment Gas Radiation monitors are not credited in the Chapter 14 Safety Analysis (Ref. 5.1). The Alert and Alarm setpoints are determined IAW the methodology outlined in the Kewaunee Power Station Offsite Dose Calculation Manual (ODCM) and documented in Calculation C10690 (Ref. 5.115). The High Alarm Setpoint provides the Containment Isolation signal. The calculated High Alarm Setpoint per the ODCM and Calculation C10690 (Refs. 5.113 & 5.115) is currently 2.2 E +05 CPM + Background (BKG). The Setpoints listed in Reference 5.123 are set conservative to the values determined in the ODCM and Calculation C10690 (Refs. 5.113 & 5.115). There are currently no Analytical Limits or Allowable Values associated with this function (Ref. 5.1). The determination of the setpoints is not within the scope of the Setpoint Control Program and the current High Alarm Nominal Trip Setting of 8.00E +04 CPM is conservative with respect to the calculated value listed in the ODCM and Calculation C10690. Based on Reference 5.113 & 5.115 the As Found Tolerance will be 2.2 E +05 CPM + Background. The As Left Tolerance will be based on the existing High Alarm Setpoint listed in Reference 5.123.

As Found Tolerance (AFT) = 2.2 E+05 CPM + BKG (1)
As Left Tolerance (ALT) = 8.00 E+04 CPM (2)

---

(1) AFT = Setpoint taken from Reference 5.113 & 5.115
(2) ALT = Calibration Procedure Setpoint = 8.0 E+04 CPM (Reference 5.123 & 5.124)
(3) Footnote three from Technical Specification Table 3.5-1 page 2 of 2 states "The setting limits for max radiation levels are derived from ODCM Specification 3.4.1 and Table 2.2, and USAR Section 6.5."
(4) The Alert Setpoint is determined IAW References 5.113 and 5.115 and is set at 2.00 E +04 CPM per Reference 5.123. The Alert Setpoint provides an alarm function only and the Containment Isolation signal is provided by the High Alarm Setpoint.

4.7.5 Containment Particulate Radiation Monitor (R11)

As Found Tolerance: 8.00 E+04 CPM
(Refs. 5.1, 5.90, 5.113, 5.114, 5.115, 5.122, 5.124, & 5.131)

The current Custom Technical Specifications (CTS) Setting Limit for this function states "$\leq$ radiation levels in exhaust duct as defined in footnote(3)". The current Nominal Trip Setpoint for the Containment Particulate Radiation Monitor is 5.00 E +04 CPM for the alert setpoint and 8.00 E +04 CPM for the High Alarm per Reference 5.122. The Containment Particulate Radiation monitor is not credited in the Chapter 14 Safety Analysis (Ref. 5.1). Per USAR Table 11.2.7 the Setpoint is set "Statistically significant level above background". The Design Change Process which is controlled by the 50.59/72.48 process is utilized to determine any setpoint changes associated with the Containment Particulate Radiation Monitors. The existing setpoints are shown on drawing E-2021 (Ref. 5.124) and were derived utilizing this process and will be maintained as the As Found Tolerance and the As Left Tolerance.

As Found Tolerance (AFT) = 8.00 E+04 CPM (1)
As Left Tolerance (ALT) = 8.00 E+04 CPM (2)

---

(1) AFT = Calibration Procedure Setpoint = 8.0 E+04 CPM (Reference 5.122, & 5.124)
(2) ALT = Calibration Procedure Setpoint = 8.0 E+04 CPM (Reference 5.122 & 5.124)
(3) Footnote three from Technical Specification Table 3.5-1 page 2 of 2 states "The setting limits for max radiation levels are derived from ODCM Specification 3.4.1 and Table 2.2, and USAR Section 6.5."

4.7.6 Control Room Ventilation Radiation Monitor (R23)

As Found Tolerance: 1.00 E+04 CPM (Refs. 5.1, 5.114, 5.124, & 5.125)

The current Custom Technical Specifications (CTS) Setting Limit does not specify a Setting Limit for this Radiation Monitor. The Improved Technical Specifications have added this monitor. The current Nominal Trip Setpoint for the Control Room Ventilation Radiation Monitor is 5.00 E +03 CPM for the alert setpoint and 1.00 E +04 CPM for the High Alarm per References 5.124 and 5.125. The Control Room Ventilation Radiation Monitor is not credited in the Chapter 14 Safety Analysis (Ref. 5.1). Per USAR Table 11.2.7 the Setpoint is set "Statistically significant level above background". The Design Change Process which is controlled by the 50.59/72.48 process is utilized to determine any setpoint changes associated with the Control Room Radiation Monitor. The existing setpoints are shown in drawing E-2021 (Ref. 5.124) and were derived utilizing this process and will be maintained as the As Found Tolerance and the As Left Tolerance.

As Found Tolerance (AFT) = 1.00 E+04 CPM (1)
As Left Tolerance (ALT) = 1.00 E+04 CPM (2)

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(1) AFT = Calibration Procedure Setpoint = 1.0 E+04 CPM (Reference 5.124, & 5.125)
(2) ALT = Calibration Procedure Setpoint = 1.0 E+04 CPM (Reference 5.124, & 5.125)

4.7.7 Turbine Building Service Water Header Isolation

As Found Tolerance: **82.5 PSIG ± 1.0 PSIG** **(Refs. 5.1, 5.114, 5.140, & 5.141)**

The current Custom Technical Specifications (CTS) does not address the Turbine Building Service Water Header Isolation function. Improved Technical Specifications (ITS) has added this function to ITS Table 3.3.2-1. Based on References 5.140 and 5.141, the current Nominal Trip Setpoint for Turbine Building Service Water Low Pressure Isolation is 82.5 PSIG (decreasing). The Turbine Building Service Water Header Isolation function is not credited in the Chapter 14 Safety Analysis (Ref. 5.1). Based on Reference 5.140, the calibration accuracy for the pressure switch is ± 1.0 PSIG. For this application, the As Found Tolerance and As Left Tolerance will be set at the same value, i.e., ± 1.0 PSIG.

As Found Tolerance (AFT) = 82.5 PSIG ± 1.0 PSIG
As Left Tolerance (ALT) = 82.5 PSIG ± 1.0 PSIG

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(3) AFT = Calibration Procedure Setpoint = ± 1.0 PSIG (Reference 5.140)
(4) ALT = Calibration Procedure Setpoint = ± 1.0 PSIG (Reference 5.140)

5.0 REFERENCES

5.1 Technical Report NE-0994, Revision 17, Safety Analysis Limits for Technical Specification Instrumentation - Companion to EE-0101, September 2009.

5.2 Technical Report EE-0101, Revision 10, Setpoint Basis Document – Analytical Limits, Setpoints and Calculations for Technical Specification Instrumentation At North Anna and Surry Power Stations, Dated 12-11-07.

5.3 Westinghouse - NAPS Reactor Protection System/Engineered Safety Features Actuation System Setpoint Methodology (NRC Letter - S/N 541, Dated 09-28-78).

5.4 Engineering Transmittal CEE 99-0028, Revision 0, Response to Open Items ITS LCO 3.3.1, Surry Power Station Units 1 and 2, Dated 10-29-99.

5.5 Dominion Virginia Power STD-EEN-0304, Revision 6, Calculating Instrumentation Uncertainties By the Square Root of the Sum of the Squares Method.

5.6 Dominion Virginia Power STD-GN-0030, Revision 8, Nuclear Plant Setpoints.

5.7 Surry Power Station Technical Specifications.

5.8 North Anna Power Station Technical Specifications.

5.9 USNRC Regulatory Guide 1.105, Revision 3 (December 1999), Setpoints for Safety-Related Instrumentation.

5.10 Improved Thermal Design Procedure, Instrument Uncertainties for North Anna Units 1 & 2 Core Uprating C. R. Tuley July 1986, Westinghouse Electric Corporation.

5.11 Dominion Virginia Power Technical Report EE-0099, Revision 0 (AR), North Anna Instrument Tolerance Document.

5.12 Dominion Virginia Power Technical Report EE-0100, Revision 2 with Appendices 5, 12, and 18.

5.13 Dominion Virginia Power Technical Report EE-0085, Revision 2 with Appendices 5, 12, and 18.

5.14 Engineering Transmittal CEE 95-037, Revision 2, Transmittal of Surveillance Limits for RPS and ESFAS Primary Trip Functions at Surry Power Station Units 1 and 2, Dated 03-20-02.

5.15 Dominion Virginia Power Calculation EE-0063, Revision 2, Setpoint Accuracy for Power Range Neutron Flux High Setpoint Reactor Trip, North Anna Power Station, Units 1 and 2.

5.16 Dominion Virginia Power Calculation EE-0738, Revision 1, Add. 00A, NIS Intermediate Range Channel Statistical Allowance Calculation.

5.17 Dominion Virginia Power Calculation EE-0710, Revision 0, North Anna Nuclear Instrumentation Source Range Uncertainty.

5.18 Dominion Virginia Power Calculation EE-0434, Revision 2, Delta T and T AVG Protection Loops, T-412, T-422 and T-432, North Anna Power Station, Units 1 and 2.

5.19 Dominion Virginia Power Calculation EE-0069, Revision 3, with Add 00A, Setpoint and Indication Accuracy for Pressurizer Pressure Loops.

5.20 Dominion Virginia Power Calculation EE-0058, Revision 2, CSA for North Anna Pressurizer Level Protection & Indication CSA.

5.21 Dominion Virginia Power Calculation EE-0060, Revision 3, CSA for North Anna Power Station Units 1 & 2 Reactor Coolant Flow Protection.

5.22 Dominion Virginia Power Calculation EE-0492, Revision 2, with Add. 00A, CSA Calculation for North Anna Power Station, Steam Generator Narrow Range Level, Units 1 & 2, Loops L-1474, L-1475, L-1476, L-1484, L-1485, L-1486, L-1494, L-1495, L-1496, L-2474, L-2475, L-2476, L-2484, L-2485, L-2486, L-2494, L-2495, & L-2496.

5.23 Dominion Virginia Power Calculation EE-0736, Revision 5, Channel Uncertainty for North Anna Units 1&2 Feedwater Flow and Steam Flow Channels Including Channel Check Criteria for Feedwater and Steam Flow Indication.

5.24 Dominion Virginia Power Calculation EE-0524, Revision 0 with Add. 0A and 0B, Reactor Coolant Pump Undervoltage and Underfrequency Trip Setpoints.

5.25 Dominion Virginia Power Calculation EE-0052, Revision 2, with Add. 00A, North Anna Containment Narrow Range Pressure Uncertainty.

5.26 Dominion Virginia Power Calculation EE-0121, Revision 3, with Add. 00A North Anna Main Steam Pressure Protection Channel Uncertainty.

5.27 Dominion Virginia Power Calculation EE-0092, Revision 4, North Anna Refueling Water Storage Tank Level Uncertainty – Wide Range.

5.28 Dominion Virginia Power Calculation EE-0198, Revision 1 with Add. 1A, Setpoint Accuracy for Power Range Neutron Flux High Setpoint Reactor Trip.

5.29 Dominion Virginia Power Calculation EE-0722, Revision 1, NIS Intermediate Range Channel Statistical Allowance Calculation.

5.30 Dominion Virginia Power Calculation EE-0719, Revision 0, Surry Nuclear Instrumentation Source Range Uncertainty.

5.31 Dominion Virginia Power Calculation EE-0415, Revision 2, Delta T and T Average Protection Loops, T-412, T-422 and T-432, Surry Power Station, Units 1 and 2.

5.32 Dominion Virginia Power Calculation EE-0514, Revision 1, Pressurizer Pressure Protection and Indication Uncertainties CSA.

5.33 Dominion Virginia Power Calculation EE-0458, Revision 1, with Add. 00A and 00B, Channel Statistical Allowance (CSA) Calculation for Surry Pressurizer Level Protection, Surry Units 1 and 2.

5.34 Dominion Virginia Power Calculation EE-0183, Revision 3, with Add. 00A, CSA Calculation for Surry Power Station Units 1 and 2 Reactor Coolant Flow.

5.35 Dominion Virginia Power Calculation EE-0432, Revision 4 with Add. 00A, CSA Calculation for Surry Power Station, Steam Generator Narrow Range Level, Units 1&2, Loops L-1474, L-1475, L-1476, L-1484, L-1485, L-1486, L-1494, L-1495, L-1496, L-2474, L-2475, L-2476, L-2484, L-2485, L-2486, L-2494, L-2495, L-2496.

5.36 Dominion Virginia Power Calculation EE-0355, Revision 3, with Add. 03A, 00B, 00C, and 00D, Channel Uncertainty Calculation for Surry, Units 1&2 Feedwater Flow, Steam Flow, Steam Pressure and Steam Header Pressure Protection and Control Including Channel Check Criteria for Feedwater and Steam Flow Indication.

5.37 Dominion Virginia Power Calculation EE-0412, Revision 0, with Add. 0A and 0B, Reactor Coolant Pump Undervoltage and Underfrequency Trip Setpoints.

5.38 Dominion Virginia Power Calculation EE-0457, Revision 1, CSA Calculation for Turbine First Stage Pressure, Steam Break Protection and High Steam Flow SI Actuation, Surry Power Station Units 1 and 2.

5.39 Dominion Virginia Power Calculation EE-0131, Revision 4, SPS Reactor Containment Pressure: Narrow Range Pressure Indication and Protection CSA.

5.40 Dominion Virginia Power Calculation EE-0141, Revision 1, Insulation Resistance (IR) Effects for Environmentally Qualified (EQ) Instrumentation.

5.41 Dominion Virginia Power Calculation EE-0112, Revision 2, with Add. 00A, Refueling Water Storage Tank Level Uncertainty.

5.42 Dominion Virginia Power Calculation EE-0724, Revision 0, Canal Level Probe Channel Statistical Accuracy Calculation Channel Numbers: 1-CW-LS-102. 1-CW-LS-103. 2-CW-LS-202. 2-CW-LS-203.

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

5.44 North Anna Instrument Calibration Procedure 1-ICP-RC-P-1455, Revision 4, Pressurizer Pressure Protection Channel 1 (1-RC-P-1455) Calibration.

5.45 North Anna Instrument Calibration Procedure 1-ICP-LO-PS-609-4, Revision 11, Reactor Trip From Turbine Trip Auto Stop Oil Pressure Switch (LO-PS-609-4) Calibration.

5.46 North Anna Instrument Calibration Procedure ICP-NI-1-N-41, Revision 36, Power Range Channel N-41 Protection Channel I.

5.47 North Anna Instrument Calibration Procedure ICP-RC-1-T-1412, Revision 33, Reactor Coolant Delta T/ TAVG Protection Channel I (1-RC-T-1412) Calibration.

5.48 North Anna Instrument Calibration Procedure 1-ICP-FW-L-1474, Revision 15, Steam Generator A Narrow Range Level Protection Channel I (1-FW-L-1474) Calibration.

5.49 North Anna Instrument Calibration Procedure 1-ICP-MS-F-1474, Revision 24, Steam Generator A Steam Flow and Feed Flow Protection Channel III (1-MS-F-1474 and 1-FW-F-1477) Calibration.

5.50 North Anna Instrument Calibration Procedure 1-ICP-MS-P-1474, Revision 6, Steam Line A Steam Pressure Protection Channel II (1-MS-P-1474) Calibration.

5.51 North Anna Instrument Calibration Procedure 1-ICP-NI-N-31, Revision 8, NIS Source Range Channel I (N-31) Calibration.

5.52 North Anna Instrument Calibration Procedure 1-ICP-QS-L-100A, Revision 10, Refueling Water Storage Tank Level Channel III (1-QS-L-100A) Calibration.

5.53 North Anna Instrument Calibration Procedure 1-ICP-RC-F-1414, Revision 4, Reactor Coolant Flow Loop A Protection Channel I (1-RC-F-1414) Calibration.

5.54 North Anna Instrument Calibration Procedure 1-ICP-RC-L-1459, Revision 4, Pressurizer Level Protection Channel 1 (1-RC-L-1459) Calibration.

5.55 orth Anna Instrument Calibration Procedure 1-ICP-LM-P-100B, Revision 2, Reactor Containment Pressure Protection Channel II (1-LM-P-100B) Calibration.

5.56 North Anna Instrument Calibration Procedure ICP-MS-1-P-1446A, Revision 20, P-1446A, First Stage Pressure Protection Channel III (1-MS-P-1446A) Calibration.

5.57 North Anna Instrument Calibration Procedure ICP-NI-1-N-35, Revision 22, Intermediate Range Channel N-35.

5.58 Surry Instrument Periodic Test Procedure 1-IPT-CC-CS-L-100A, Revision 7, Refueling Water Storage Tank Level Loop L-100A Channel Calibration.

5.59 Surry Instrument Periodic Test Procedure 1-IPT-CC-FW-F-476, Revision 13, Feedwater Flow Loop F-1-476 Channel Calibration.

5.60 Surry Instrument Periodic Test Procedure 1-IPT-CC-FW-L-474, Revision 10, Steam Generator Level Protection Loop L-1-474 Channel Calibration.

5.61 Surry Instrument Periodic Test Procedure 1-IPT-CC-LM-P-100A, Revision 11, Containment Pressure Loop P-LM-100A Channel Calibration.

5.62 Surry Instrument Periodic Test Procedure 1-IPT-CC-MS-F-474, Revision 14, Steam Line Flow Protection Loop F-1-474 Channel Calibration.

5.63 Surry Instrument Periodic Test Procedure 1-IPT-CC-MS-P-446, Revision 13, Turbine Load Loop P-1-446 Channel Calibration.

5.64 Surry Instrument Periodic Test Procedure 1-IPT-CC-MS-P-464, Revision 3, Steam Header Pressure Loop P-1-464 Channel Calibration.

5.65 Surry Instrument Periodic Test Procedure 1-IPT-CC-MS-P-474, Revision 8, Steam Line Pressure Loop P-1-474 Channel Calibration.

5.66 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-F-414, Revision 10, Reactor Coolant Flow Loop F-1-414 Channel Calibration.

5.67 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-L-459, Revision 17, Pressurizer Level Protection Loop L-1-459 Channel Calibration.

5.68 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-P-455, Revision 12, Pressurizer Pressure Protection Loop P-1-455 Channel Calibration.

5.69 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-T-412, Revision 29, Delta T and TAVG Protection Set I Loop T-1-412 Channel Calibration.

5.70 North Anna Maintenance Operating Procedure 1-MOP-55.80, Revision 5, Turbine Stop Valve Closure Position Indication Instrumentation.

5.71 Engineering Transmittal ET-NAF-970142, Revision 0, Surry Technical Specification 3.2 Limiting Safety Settings, Protective Instrumentation Modification to Surveillance Procedures Surry Power Station Units 1 and 2.

5.72 Engineering Transmittal CEE-97-029, Revision 0, Comments on NAF Engineering Transmittal ET-NAF-970142, Revision 0 (DRAFT), Surry Power Station Units 1 & 2.

5.73 Technical Report EE-0068, Revision 0 (AR), Instrument Tolerances for Westinghouse/Hagan 7100 Process Protection and Control System, Surry Power Station.

5.74 Calculation SM-932, Revision 0, with Add. 00A and 00B, Surry Core Uprating Rod Withdrawal at Power.

5.75 Calculation SM-0933, Revision 0, Generation of OTΔT, OPΔT and F(ΔI) Function Constants for Surry Core Uprating.

5.76 NAF Technical Report NE-680, Revision 1, Analysis and Evaluations Supporting Implementation of STAT DNB and a 1.62 FΔh at Surry Units 1 and 2.

5.77 59-DCP-06-013, NRC GSI-191, RWST Level ESFAS Function to Support Containment Sump Modifications / North Anna / Unit 2.

5.78 Engineering Transmittal CEE 98-005, Revision 0, Intake Canal Level Trip Setpoint Procedural Changes, Surry Power Station, Units 1 and 2.

5.79 Calculation ME-0318, Revision. 0, Add. 0A, Canal Level Probe Response Time.

5.80 Surry Instrument Periodic Test Procedure 1-IPT-CC-CW-L-102, Revision 10, Intake Canal Level Probe 1-CW-LS-102 Time Response Test and Channel Calibration.

5.81 Surry Instrument Periodic Test Procedure 1-PT-1.2, Revision 21, NIS Power Range Trip Channel Test.

5.82 Surry Instrument Periodic Test Procedure 1-PT-1.1, Revision 36, NIS Trip Channel Test Prior to Start-up.

5.83 Technical Report NE-1460, Revision 1, Implementation of GOTHIC Containment Analyses and Revisions to the LOCA Alternate Source Term Analysis to Support Resolution of NRC GL 2004-02 for Surry Power Station, Dated July 2006.

5.84 WCAP-11203, Improved Thermal Design Procedure Instrument Uncertainties for North Anna Units 1 & 2 Core Uprating.

5.85 Engineering Transmittal CEE-06-0010, Revision 0, Determination of RWST Level Allowable Values to Support Technical Report NE-1472 and Technical Specification Change Request N-051, North Anna Units 1 and 2, Dated 8-17-06.

5.86 Technical Report NE-1472, Revision 0, Implementation of GOTHIC Containment Analyses and Revisions to the LOCA Alternate Source Term Analysis to Support Resolution of NRC GL 2004-02 for North Anna Power Station, Dated 9-27-06.

5.87 Technical Report NE-1381, Revision 0, Evaluation of Surry Power Station Reactor Coolant System Leak Rate Calculation, Dated 8-15-2003.

5.88 Engineering Transmittal ET-NAF-08-0061, Revision 0, Implementation of Revised Safety Analysis Limit for High Pressurizer Pressure Reactor Trip, North Anna Units 1 and 2, Dated 9-9-2008.

5.89 59-DCP-06-015, NRC GSI-191, RWST Level ESFAS Function to Support Containment Sump Modifications / North Anna / Unit 1.

5.90 Technical Specifications for Kewaunee Power Station.

5.91 Dominion Calculation C11705, Revision 0, Kewaunee Unit 1 Channel Statistical Allowance (CSA) Calculation for the Power Range Neutron Flux High Setpoint Reactor Trip, Low Setpoint Reactor Trip and the P-10 permissive.

5.92 Dominion Calculation C10982, Revision 0, Pressurizer High Level Reactor Trip CSA.

5.93 Dominion Calculation C10818, Revision 0, Kewaunee Unit 1 Pressurizer Pressure Protection Channel Statistical Allowance (CSA) Calculation.

5.94 Dominion Calculation C11865, Revision 0, Kewaunee Unit 1 Channel Statistical Allowance (CSA) Calculation for the Overtemperature Delta T Reactor Trip, Overpower Delta T Reactor Trip, Low-Low T Average Input to Steam Line Isolation, and Low T Average Feedwater Regulator Valve Closure.

5.95 Dominion Calculation C11006, Revision 0, Containment Pressure Channel Statistical Allowance (CSA) for Safety Injection, Main Steam Isolation, and Containment Spray Initiation.

5.96 Dominion Calculation C10819, Revision 0, Kewaunee Unit 1 Reactor Coolant Low Flow Reactor Trip Channel Statistical Allowance (CSA) Calculation.

5.97 Dominion Calculation C11116, Revision 0, Kewaunee Unit 1 Steam Generator Narrow Range Level Protection Channel Statistical Allowance (CSA) Calculation.

5.98 Dominion Calculation C10854, Revision 0, Hi & Hi-Hi Steam Flow and Low Steam Line Pressure ESF Actuation CSA.

5.99 Technical Specification Task Force Improved Standard Technical Specifications Traveler, TSTF-493, Clarify Application of Setpoint Methodology for LSSS Functions, Revision 4.

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

5.101 Kewaunee Calculation C11220, Revision ORIG, Determination of Forebay Low-Low- Level Trip Instrument Accuracy.

5.102 Dominion Calculation C11709, Revision 1, Addendum A, Degraded and Loss of Voltage Relay Settings, Kewaunee Power Station.

5.103 Kewaunee Surveillance Procedure SP-48-003E, Revision 17, Nuclear Power Range Channel 1 (Red) N-41 Monthly Test.

5.104 Kewaunee Surveillance Procedure SP-48-004A, Revision 27, Nuclear Power Range Channel 1 (Red) N-41 Calibration.

5.105 Kewaunee Surveillance Procedure SP-47-011A, Revision 20, Reactor Coolant Temperature and Pressurizer Pressure Instrument Channel 1 (Red) Calibration.

5.106 Kewaunee Surveillance Procedure SP-36-014B-1, Revision D, Reactor Coolant Flow Channel 411 (Red) Instrument Calibration.

5.107 Kewaunee Surveillance Procedure SP-06-031A-1, Revision 3, Steam Generator Steam Pressure Loop 468 Transmitter Channel 1 (Red) Calibration.

5.108 Kewaunee Surveillance Procedure SP-06-034B-1, Revision 13, Steam Generator Flow Mismatch and Steam Pressure Instrument Channel 1 (Red) Calibration.

5.109 Kewaunee Surveillance Procedure SP-36-017B-1, Revision 2, Pressurizer Level Instrument Channel 426 (Red) Calibration.

5.110 Kewaunee Surveillance Procedure SP-18-043, Revision 27, Containment Pressure Instrument Channels Test.

5.111 Kewaunee Surveillance Procedure SP-18-044B, Revision 23, Containment Pressure Instrument Calibration.

5.112 Kewaunee Surveillance Procedure SP-05A-028B-3, Revision 3, Steam Generator Level Instrument Channel 463 (Yellow) Calibration.

5.113 Kewaunee Power Station Offsite Dose Calculation Manual (ODCM), Revision 11, February 22, 2007.

5.114 Kewaunee Power Station Updated Safety Analysis Report, Revision 21.3, dated 6/30/09.

5.115 Kewaunee Calculation C10690, Revision A, ODCM Setpoint Calculations.

5.116 Kewaunee Surveillance Procedure SP-48-287A-4, Revision 13, Intermediate Range N-35 Drawer Calibration.

5.117 Kewaunee Surveillance Procedure SP-48-287A-1, Revision G, Source Range N-31 Drawer Calibration.

5.118 ISA-RP67.04-Part II-1994, Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation.

5.119 Surry Technical Specification Change Request No. 318 (Revised Setting Limits and Overtemperature & Overpower ΔT Time Constants) Licensing Amendments DPR-32 Amendment No. 261 and DPR-37 Amendment No. 261.

5.120 Technical Report No. EE-0039 Revision 0, Flow Channel Uncertainties, North Anna and Surry Power Stations.

5.121 Kewaunee Surveillance Procedure SP-04-135, Revision 20, Forebay Area Water Level Instruments Calibration.

5.122 Kewaunee Surveillance Procedure SP-45-049.11, Revision 21, RMS Channel R-11 Containment Particulate Radiation Monitor Quarterly Functional Test.

5.123 Kewaunee Surveillance Procedure SP-45-049.12, Revision Z, RMS Channel R-12 Containment Gas Radiation Monitor Quarterly Functional Test.

5.124 Kewaunee Integrated Logic Diagram Radiation Monitoring E-2021, Revision AG.

5.125 Kewaunee Instrument Calibration Procedure MA-KW-ISP-RM-001-23, Revision 1, RMS Channel R-23 Control Room Ventilation Radiation Monitor Quarterly Functional Test.

5.126 Dominion Calculation C11890, Revision 0, Kewaunee Unit 1 Reactor Coolant Pump Underfrequency Trip Channel Statistical Allowance (CSA) Calculation.

5.127 Kewaunee Electrical Surveillance Procedure MA-KW-ESP-EHV-001A, Revision 3, BUS 1-1 4KV Voltage and Frequency Test and Calibration.

5.128 Dominion Calculation C11891, Revision 0, Kewaunee Unit 1 Reactor Coolant Pump Undervoltage Reactor Trip Channel Statistical Allowance (CSA) Calculation.

5.129 Kewaunee Electrical Preventive Maintenance Procedure MA-KW-EPM-EHV-015, Revision 0, BUS 1-5 Loss of Voltage Relay Calibration.

5.130 Kewaunee Drawing XK-100-621, Revision 3N, Interconnection Wiring Diagram.

5.131 Kewaunee DCR 2172, Provide Overall System Upgrade of Process and Area Rad Monitoring Systems.

5.132 Kewaunee Surveillance Procedure SP-54-059, Revision 29, Turbine First Stage Pressure Loop Calibration.

5.133 Kewaunee Power Station Technical Requirements Manual, Core Operating Limits Report (COLR) Cycle 29, Revision 2.

5.134 Kewaunee Alarm Response Procedure OP-KW-ARP-47062-A, Revision 0, S/G A Program Level Deviation.

5.135 Kewaunee Drawing E-2006, Revision T, Integrated Logic Diagram Feedwater System.

5.136 7300 Process Instrumentation Scaling, I&C Training Manual, Westinghouse Nuclear Training Services, Copyright 1981, Westinghouse Electric Corporation.

5.137 WCAP-8773, Calculation Manual Westinghouse 7100 Series Process Control Systems, Dated April 1976.

5.138 WCAP-10298-A, Dropped Rod Methodology for Negative Rate Trip Plants, June 1983.

5.139 Surry Power Station Design Change DCP 07-047, Implement Requirments of TSCR 318 / Surry / Units 1 & 2.

5.140 Kewaunee Instrument Surveillance Procedure MA-KW-ISP-SW-001A, Revision 2, Service Water Header A Pressure Switch Calibration.

5.141 Kewaunee Calculation C11345, Revision A, Addendum B, Re-evaulation of Turbine Building SW Header Isolation Set point.

5.142 Kewaunee Condition Report CR361418, Improved Technical Specifications Change to Nuclear Instrumentation System Rate Trips.

5.143 Kewaunee Surveillance Procedure SP-45-049.21, Revision 23, RMS Channel R-21 Containment Stack Radiation Monitor Quarterly Functional Test.

Licensee Response/NRC Response/NRC Question Closure

Id	**2611**
NRC Question Number	**KAB-070**
Select Application	**NRC Question Closure**
Response Date/Time	
Closure Statement	**This question is closed and no further information is required at this time to draft the Safety Evaluation.**
Response Statement	
Question Closure Date	**3/18/2010**
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**3/18/2010 8:44 AM**
Modified By	
Date Modified	

ITS NRC Questions

Id	**1611**
NRC Question Number	**KAB-071**
Category	**Technical**
ITS Section	**3.3**
ITS Number	**3.3.2**
DOC Number	
JFD Number	
JFD Bases Number	
Page Number(s)	**213**
NRC Reviewer Supervisor	**Rob Elliott**
Technical Branch POC	**Add Name**
Conf Call Requested	**N**
NRC Question	**On page 213 of Attachment 1, volume 8, function 7.b, “Service Water Pressure - Low” requires performance of surveillance requirement (SR) 3.3.2.4 and SR 3.3.2.6. Both SRs are performed in accordance with the setpoint control program. However, service water pressure is not evaluated or listed in Kewaunee’s setpoint methodology document, “Technical Report EE-0116,” Revision 5. Please correct the discrepancy or provide an explanation.**
Attach File 1	
Attach File 2	
Issue Date	**1/26/2010**
Added By	**Kristy Bucholtz**
Date Modified	
Modified By	
Date Added	**1/26/2010 10:38 AM**
Notification	**NRC/LICENSEE Supervision**

Licensee Response/NRC Response/NRC Question Closure

Id	**2121**
NRC Question Number	**KAB-071**
Select Application	**Licensee Response**
Response Date/Time	**2/9/2010 8:35 AM**
Closure Statement	
Response Statement	**KPS agrees with the NRC reviewer that the Service Water Pressure – Low setpoint was not included in Technical Report EE-0116, Rev. 5 (the revision provided to the NRC in LAR 249 supplement letter from J. Allan Price (Dominion Energy Kewaunee, Inc.) to the NRC Document Control Desk, dated October 17, 2009). However, Technical Report EE-0116, Rev. 6 was approved on 1-14-10 and now includes Service Water Pressure – Low in Section 4.7.7. The Kewaunee-specific sections of the EE-0116, Rev. 6 document are attached to the response to KAB-070 and replace the previously provided Rev. 5. Differences from the two revisions are highlighted for ease of use. Section 4.7.7 is on Page 195 of 205.**
Question Closure Date	
Attachment 1	**KAB-071EE116R6(SPS and NAPS removed).pdf** (744KB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Victor Cusumano** **Jerry Jones** **Bryan Kays** **Ray Schiele**
Added By	**Robert Hanley**
Date Added	**2/9/2010 8:42 AM**
Modified By	
Date Modified	

Dominion℠

Technical Report Cover Sheet

EE-0116, Rev. 6

NDCM-3.11 **Attachment 1**

TECHNICAL REPORT No. EE-0116, REVISION 6

ALLOWABLE VALUES FOR NORTH ANNA IMPROVED TECHNICAL SPECIFICATIONS (ITS) TABLES 3.3.1-1 AND 3.3.2-1, SETTING LIMITS FOR SURRY CUSTOM TECHNICAL SPECIFICATIONS (CTS), SECTIONS 2.3 AND 3.7, AND ALLOWABLE VALUES FOR KEWAUNEE POWER STATION IMPROVED TECHNICAL SPECIFICATIONS (ITS) FUNCTIONS LISTED IN SPECIFICATION 5.5.16

NORTH ANNA POWER STATION, SURRY POWER STATION, AND KEWAUNEE POWER STATION

CORPORATE ELECTRICAL/I&C/COMPUTERS
DOMINION NUCLEAR ENGINEERING

January 2010

Prepared By: Donald McGrath Date 01-13-10

Prepared By: A. W. Baugas Date 1/13/10

Reviewed By: Date 1/13/10

Concurrence By: Donald McGrath for Victor Myers Per Telecon on 1/12/10 Date 01/13/10

Approved By: Date 1/14/10

QA Category SR

Key Words: Allowable Values
As Found Tolerances
ESFAS Instrumentation
Improved Technical Specifications
Limiting Safety System Settings
Reactor Protection System Instrumentation
Setting Limits
Setpoints

(June 2006)

Record of Revision

Rev 0 Original Issue.

Rev 1

1 Changed the calculation of the Allowable Values for North Anna's High Steam Flow in 2/3 Steam Lines ESFAS initiation on Page 23. The revised Allowable Values are based on using only 1 Rack Drift (RD) term for the function. This change yields more conservative Allowable Values.

2. Changed the calculation of the Allowable Values for Surry's High Steam Flow in 2/3 Steam Lines ESFAS initiation on Pages 29 and 30. The revised Allowable Values are based on using only 1 Rack Drift (RD) term for the function. This change yields more conservative Allowable Values.

3. Changed the Allowable Values and verbiage on Page 42 for the North Anna High Steam Flow in 2/3 Steam Lines ESFAS initiation.

4. Deleted the Allowable Values for the enable manual block of Safety Injection for North Anna Permissives P-11 and P-12 and revised the verbiage accordingly on Page 47.

5. Changed the Allowable Values and verbiage on Page 56 for the Surry High Steam Flow in 2/3 Steam Lines ESFAS initiation.

6. Deleted the Allowable Values for the enable manual block of Safety Injection for Surry Permissives P-11 and P-12 and revised the verbiage accordingly on Page 63.

Rev 2

1. Page 16 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span in Figure 3.2-5 to obtain a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

2. Page 18 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span to be consistent with Calculation EE-0415. This change yields a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

3. Page 24 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span in Figure 3.3-2 to obtain a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

4. Page 25 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span to be consistent with Calculation EE-0434. This change yields a more conservative Allowable Value for the OTΔT Reactor Trip Setpoint.

5. Pages 25 and 26 – Revised calculations shown in Methods 1a through 2b based on Rack Drift Term $RD_4 = 0.0$ % span.

6. Page 31 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span in Figure 3.3-4 to obtain a more conservative Allowable Value for the OPΔT Reactor Trip Setpoint.

7. Page 32 - Changed Rack Drift term RD_4 from 1.0 % span to 0.0 % span to be consistent with Calculation EE-0415. This change yields a more conservative Allowable Value for the OPΔT Reactor Trip Setpoint. The Allowable Value calculation shown on Page 32 was revised based on $RD_3 = 0.0$ % span.

8. Pages 34 and 35 – Revised NAPS OTΔT Reactor Trip Allowable Value and associated verbiage in Item 4.1.8.

9. Page 47 – Added another Allowable Value for NAPS Permissive P-12 and revised associated verbiage in Item 4.2.38.

10. Page 49 – Revised SPS OTΔT Reactor Trip Allowable Value and associated verbiage in Item 4.3.6.

11. Page 49 – Revised verbiage associated with the SPS OPΔT Reactor Trip Allowable Value in Item 4.3.7.

12. Page 63 - Added another Allowable Value for SPS Permissive P-12 and revised associated verbiage in Item 4.4.42.

Rev 3 Revision 3 to this Technical Report is a major revision. The Allowable Values for North Anna's ITS and the Setting Limits for Surry's CTS are derived and based on Methods 1 or 2 as described in Part II of ISA-RP67.04.02-2000. This revision will require a complete review from cover to cover. This Technical Report will be used as the design basis for Technical Specifications Change Request 318 at Surry Power Station. In addition, this Technical Report will also be used as the design input for a future Technical Specifications Change Request for North Anna to change selected Allowable Values as noted in this report. In accordance with NDCM 3.11 the "Required Actions" and "Tracking Mechanism" will be documented in Engineering Transmittal ET-CEE-06-0020, Rev. 0 "Transmittal of CDS and PRC for Technical Report EE-0116, Rev. 3". In addition, the results of Technical Report EE-0116, Rev. 3 will be screened as part of ET-CEE-06-0020, rev. 0 and will not be repeated herein.

Rev 4

1. Page 5 - Added Cot or Non-Cot to the error terms in Table 2.1.

2. Page 9 – Changed the wording under item 3 to reflect that some Allowable Values have been rounded as per discussions with the NRC and Surry TSCR 318.

3. Page 13 – Changed the Rack Error Terms for M1MTE and M5MTE due to the revised CSA calculation EE-0063.

4. Page 33 - Changed the Power Range Neutron Flux High Setpoint Reactor Trip due to the revised CSA calculation EE-0063.

5. Page 34 - Changed Figure 4.1.2 for the Power Range Neutron Flux High Reactor Trip and changed the Power Range Neutron Flux Low Setpoint Reactor Trip due to the revised CSA calculation EE-0063.

6. Page 35 – Changed Figure 4.1.3 for the Power Range Neutron Flux Low Setpoint Reactor Trip due to the revised CSA calculation EE-0063.

7. Page 45 – Changed the Pressurizer High Pressure Reactor Trip due to the Safety Analysis Limit being changed from 2381.3 PSIG to 2391.3 PSIG based on ET-NAF-08-0061.

8. Page 47 – Changed Figure 4.1.10 for the Pressurizer High Pressure Reactor Trip due to the Safety Analysis Limit being changed from 2381.3 PSIG to 2391.3 PSIG based on ET-NAF-08-0061.

9. Page 48 – Changed the Reactor Coolant Flow Low Reactor trip due to the revised CSA calculation EE-0060.

10. Page 49 – Changed Figure 4.1.12 for Low Reactor Coolant Flow Reactor Trip due to the revision of CSA calculation EE-0060.

11. Page 53 – Changed the Permissive P-8, Power Range Neutron Flux due to the revised CSA calculation EE-0063.

12. Page 54 – Changed Figure 4.1.24 for the Power Range Reactor Trip Permissive P-8 due to the revised CSA calculation EE-0063.

13. Page 57 – Changed Figure 4.2.3 for Containment Pressure HI-1 ESFAS Initiation due to the revised Containment Partial Pressure operating Limits per Technical Report NE-1472, Revision 0.

14. Page 62 – Changed the T_{AVG} Low-Low ESFAS Initiation due to the revised CSA calculation EE-0434.

15. Page 64 – Changed Figure 4.2.7 for T_{AVG} Low Low ESFAS Initiation due to the revised CSA calculation EE-0434.

16. Page 68 – Changed Figure 4.2.11 for Containment Pressure HI-3 ESFAS Initiation due to the revised Containment Partial Pressure operating Limits per Technical Report NE-1472, Revision 0.

17. Page 71 – Changed Figure 4.2.20 for Containment Pressure HI-2 ESFAS Initiation due to the revised Containment Partial Pressure operating Limits per Technical Report NE-1472, Revision 0.

18. Page 75 – Deleted the Analysis for $\geq$ 19.0 % Wide Range Level and the Analysis for $\leq$ 20.0 Wide Range Level for the Refueling Water Storage Tank Level – Low Low. With the implementation of DCP 06-013 and 06- 015 these analysis are no longer valid.

19. Page 77 – Deleted Figure 4.2.34a. This Figure is no longer applicable with the implementation of DCP 06-013 and 06-015. Changed Figure number to 4.2.34.

20. Page 78 – Changed the T_{AVG}, P-12 ESFAS Permissive due to the revised CSA calculation EE-0434.

21. Page 79 – Changed Figure 4.2.38 for ESFAS Permissive P-12 due to the revised CSA calculation EE-0434.

22. Page 103 – Incorporated Addendum 1 for the Turbine First Stage Pressure Input to Permissive P-7.

23. Page 106 – Changed the word “or” to “and” for Permissive P-10, Power Range Neutron Flux.

24. Page 107 – Changed the Containment Pressure – High, Engineered Safety Features Actuation System (EFAS) Instrumentation Setting Limits due to the revised Safety Analysis Limits in Technical Report NE-0994, Revision 15.

25. Page 108 – Changed Figure 4.4.2 for the new Safety Analysis Limit from Technical Report EE-0994, Revision 15 and updated operating limits per Technical Report NE-1460, Revision 1.

26. Page 119 – Determined the Voltage and Time corresponding to the new Allowable Value for Low Intake Canal Level.

27. Page 122 – Changed the Refueling Water Storage Tank Level Low – Low RMT Initiation, EFAS Instrumentation Setting Limits due to the revised Safety Analysis Limits in Technical Report NE-0994, Revision 14.

28. Page 124 – Changed Figure 4.4.12 due to the revised Safety Analysis Limit in technical Report NE-0994, Revision 14.

29. Page 128 – Changed References 5.1, 5.2, and 5.15 to reflect the current revision.

30. Page 129 – Changed References 5.18, 5.21, 5.23, 5.26, 5.27, 5.33 to reflect the current revision.

31. Page 130- Changed References 5.35, 5.36, 5.40, 5.41, 5.44 through 5.62 to reflect the current revision.

32. Page 132 – Changed References 5.63 through 5.65 and 5.67 through 5.69 to reflect the current revision. Deleted Reference 5.77.

33. Page 133 – Changed References 5.80 through 5.82 to reflect the current revision. Added Reference 5.88, ET-NAF-08-0061, Rev. 0 "Implementation of Revised Safety Analysis Limit for High Pressurizer Pressure Reactor Trip, North Anna Units 1 and 2".

Rev. 5 Revision 5 to this Technical Report is a major revision. Kewaunee Power Station's Setpoint Control Program has been added to the report to support Kewaunee's conversion to Improved Technical Specifications (ITS).

1. Page 3 – Added Kewaunee's Setpoint Control Program to Section 1.1, Purpose.

2. Page 3 – Added Kewaunee LCO's 3.3.1, 3.3.2, 3.3.5, 3.3.6, and 3.3.7 to Section 1.2, Scope.

3. Page 4 – Added and updated definitions in Section 2.1 to reflect Kewaunee's Setpoint Control Program and the adoption of TSTF-493, Rev. 4, Option B.

4. Page 5 – Added and updated definitions in Section 2.1 to reflect Kewaunee's Setpoint Control Program and the requirements from TSTF-493, Rev. 4 and RIS 2006-17.

5. Page 9 – Updated Section 2.2.2 to reflect current conditions for North Anna and Surry. Also, a discussion for Kewaunee was added to address the Setpoint Control Program.

6. Page 10 – Added a discussion in Sections 2.2.2 and 2.2.3 pertaining to the issuance of RIS 2006-17.

7. Page 11 – Added a discussion in Section 2.2.4 pertaining to the issuance of TSTF-493, Rev. 4.

8. Pages 12 and 13 – Added Section 2.2.6 to address Kewaunee's adoption of TSTF-493, Rev. 4, Option B.

9. Page 14 – Added Kewaunee to the discussion in Sections 3.1 and 3.2.

10. Page 15 – Updated information to reflect current conditions for North Anna and Surry and to add Kewaunee's Setpoint Control Program nomenclature.

11. Page 18 - Updated information to reflect current conditions for Surry.

12. Page 19 – Added discussion for Kewaunee's Protection and Control System.

13. Page 20 - Continued discussion of Kewaunee's Protection and Control System and updated information to reflect current conditions for North Anna.

14. Pages 21, 22, and 23 – Revised the Multiple Parameter Protection Functions discussion to evaluate Kewaunee's OTΔT instead of Surry's.

15. Page 24 - Added Kewaunee in the Notes section where applicable.

16. Pages 39 Through 45 - Added Section 3.5 to describe Kewaunee's Setpoint Methodology.

17. Page 65 – Revised wording of the Allowable Value for North Anna's Steam Flow Feed Flow Mismatch Reactor Trip.

18. Pages 74 through 76 – Revised North Anna's High Steam Flow ESFAS analysis to reflect the results of Calculation EE-0736, Rev. 5 and to reflect conditions at 20 % power.

19. Page 91 and 92 – Added the analysis for North Anna's RWST Low Level ESFAS function based on DCP 59-DCP-06-013 and DCP 59-DCP-06-015.

20. Pages 104 through 107 – Corrected error in Surry's OTΔT analysis. There is no change to the current LSSS and there is still positive margin to the Safety Analysis Limit for the three conditions analyzed.

21. Page 118 – Corrected error in the description of the operation of P-7 and P-10.

22. Page 129 and 130 – Updated Surry's High Steam Flow ESFAS analysis based on unit specific "P_{REF}" values and to reflect conditions at 20 % power.

23. Pages 143 through 169 – Added Section 4.5 to perform the setpoint analysis for Kewaunee's Reactor Protection System (LCO 3.3.1) to support the Setpoint Control Program.

24. Pages 170 through 185 – Added Section 4.6 to perform the setpoint analysis for Kewaunee's Engineered Safety Features Actuation System (LCO 3.3.2) to support the Setpoint Control Program.

25. Pages 186 through 190 – Added Section 4.7 to perform the setpoint analysis for Kewaunee's Loss of Offsite Power (LOOP) Diesel Generator (DG) Start Instrumentation (LCO 3.3.5), Containment Purge and Vent Isolation Instrumentation (LCO 3.3.6), and Control Room Post Accident Recirculation (CRPAR) Actuation Instrumentation (LCO 3.3.7) to support the Setpoint Control Program.

26. Pages 191 through 199 – Updated references for North Anna and Surry and added references for Kewaunee to support the analyses performed in Sections 4.5 through 4.7.

Rev. 6

1. General Change – Deleted Reference 5.2 from all analyzed RPS/RTS and ESFAS functions for North Anna and Surry in Sections 4.1 through 4.4.
2. Updated Section 4.3.7 to note that the Pressurizer Low Pressure Reactor Trip Allowable Value and Nominal Trip Setpoint was changed based on Reference 5.139.
3. Updated Section 4.3.18 to note that the Permissive P-7, Block Low Power Trips Allowable Value and Nominal Trip Setpoint was changed based on Reference 5.139.
4. Updated Section 4.4.4 to note that the Pressurizer Pressure Low-Low ESFAS Function Allowable Value and Nominal Trip Setpoint was changed based on Reference 5.139.
5. Revised Section 4.5.3 to change the analysis for the Power Range Neutron Flux High Positive Rate Reactor Trip to allow the currently installed Nominal Trip Setpoint and Rate Lag Derivative Time Constant to remain in place for the ITS conversion.
6. Revised Section 4.5.4 to change the analysis for the Power Range Neutron Flux High Negative Rate Reactor Trip to allow the currently installed Nominal Trip Setpoint and Rate Lag Derivative Time Constant to remain in place for the ITS conversion.
7. Revised Section 4.5.6 to base the Source Range Neutron Flux High Reactor Trip analysis on a process range of 0 to 5.301 Decades versus 0 to 6 Decades.
8. Revised Section 4.6.6 High Steam Flow Coincident with Safety Injection and Coincident with T_{AVG} Low-Low to allow the Nominal Trip Set point to be changed from 0.494 * 10^6 lbs/hr to 0.75 * 10^6 lbs/hr.
9. Added Section 4.7.7 to address the inclusion of the Turbine Building Service Water Header Isolation Function in ITS Table 3.3.2-1.
10. Added References 5.136 through 5.142 to support the some of the changes described above.

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide a comprehensive and controlled reference which details the design basis for the Allowable Values that appear in North Anna Power Station Improved Technical Specifications (ITS), Kewaunee Power Station Setpoint Control Program, and the LSSS/Setting Limit Values that appear in Surry Power Station Custom Technical Specifications (CTS).

1.2 Scope

- This document provides the basis for the Allowable Values to be used in North Anna Power Station Improved Technical Specifications, Table 3.3.1-1, Reactor Trip System Instrumentation (NAPS).

- This document provides the basis for the Allowable Values to be used in North Anna Power Station Improved Technical Specifications, Table 3.3.2-1, Engineered Safety Feature Actuation System Instrumentation (NAPS).

- This document provides the basis for the Limiting Safety System Settings (LSSS) to be used in Surry Power Station Custom Technical Specifications, Section 2.3, Limiting Safety System Settings, Protective Instrumentation.

- This document provides the basis for the Setting Limit Values to be used in Surry Power Station Custom Technical Specifications, Table 3.7-4, Engineered Safety Feature System Initiation Limits Instrument Setting and Table 3.7-2, Engineered Safeguards Action Instrument Operating Conditions.

- This document provides the basis for the Reactor Protection System (RPS) Instrumentation (LCO 3.3.1) Limiting Trip Setpoints, Nominal Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

- This document provides the basis for the Engineered Safety Features Actuation System (ESFAS) Instrumentation Functions (LCO 3.3.2) Limiting Trip Setpoints, Nominal Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

- This document provides the basis for the Loss of Offsite Power (LOOP) Diesel Generator (DG) Start Instrumentation (LCO 3.3.5) Limiting Trip Setpoints, Nominal Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

- This document provides the basis for the Containment Purge and Vent Isolation Instrumentation (LCO 3.3.6) and the Control Room Post Accident Recirculation (CRPAR) Actuation Instrumentation (LCO 3.3.7) As Found and As Left Tolerances to be used in Kewaunee Power Station's Setpoint Control Program to support the conversion to Improved Technical Specifications.

2.0 OVERVIEW

2.1 Definitions

Accuracy - A degree of conformity of an indicated value to a recognized, accepted standard value or ideal value.

Allowable Value (AV) - is the threshold value used to determine channel operability during the performance of channel functional tests and channel calibrations. The AV is the limiting as found setting for the channel trip setpoint that accounts for all of the NON-COT error components from the CSA Calculation in accordance with Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994.

Analytical Limit (AL) - The setpoint value assumed in the Safety Analysis. In the context of this document, the Analytical Limit is the same as the Safety Analysis Limit (SAL).

As Found Tolerance (AFT) – For Surry and North Anna, the As Found Tolerance is equal to the Allowable Value or Limiting Safety System Setting (LSSS)/Setting Limit listed in Technical Specifications. For Kewaunee, the As Found Tolerance is equal to the statistical combination of the rack error components and rack drift.

As Left Tolerance (ALT) – is not applicable for Surry and North Anna. For Kewaunee the As Left Tolerance is equal to the statistical combination of the rack error components minus the rack drift.

Calibrated Range – The calibration span of the sensor/transmitter as it applies to the indicated process range of the loop/system.

Channel Statistical Allowance (CSA) - The total instrument loop uncertainty (usually expressed in percent of instrument span) where non-interactive error components are combined statistically and interactive error components are summed arithmetically in accordance with Dominion Standard STD-EEN-0304 (Ref. 5.5). The generic CSA equation and a summary of error terms are provided below in Table 2.1.

Channel Operational Test (COT) - A COT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. The COT may be performed by means of any series of sequential, overlapping, or total channel steps. In the context of this document, the Channel Operational Test is the same as a Channel Periodic Test or Channel Functional Test.

Instrument Loop - An arrangement or chain of modules or components as required to generate one or more protective/control signals and/or provide indication and recording functions. An Instrument Loop normally includes the following five elements; the process, a transmitter/sensor, process electronics, indications and/or automatic control elements.

Limiting Safety System Setting (LSSS) – The LSSS is a term used in the Surry Power Station CTS to define the threshold value used to determine channel operability during the performance of channel functional tests and channel calibrations. In the context of this document, the CTS LSSS or Setting Limit used for Surry Power Station is equivalent to the ITS Allowable Value used for North Anna Power Station and the As Found Tolerance for Kewaunee.

Limiting Trip Setpoint (LTSP) – Based on RIS 2006-17 and TSTF-493, Rev. 4, the LTSP is the limiting setting for the channel trip setpoint considering all credible instrument errors associated with the instrument channel (Refs. 5.99 and 5.100).

Margin - The resultant value when the Channel Statistical Allowance (CSA) value is subtracted from the Total Allowance Value (usually expressed in percent of span or the process/signal values corresponding to these).

Module - A generic term for a Westinghouse Nuclear Instrumentation Module, Westinghouse 7300 Series PC Card, Foxboro Module, NUS Module, or a Westinghouse/Hagan 7100 Electronic Module.

Nominal Trip Setpoint (NTSP) - The desired setpoint for the variable. Initial calibration and subsequent re-calibrations should be made at the Nominal Trip Setpoint value specified in approved plant documentation. According to RIS 2006-17 and TSTF-493, Rev. 4 (Refs. 5.99 and 5.100), the NTSP is the Limiting Trip Setpoint with margin added. The NTSP is always equal to or more conservative than the LTSP.

Operating Margin - The difference between the nominal operating value for the process parameter and the most limiting trip/alarm setpoint/control limit (usually expressed in percent of span or the process/signal values corresponding to these).

Process Range - The upper and lower limits of the operating region for a device, e.g., for a Pressurizer Pressure Transmitter, 0 to 3000 PSIG, for Steam Generator Level, 0 to 100 % Level. This is not necessarily the calibrated range of the device, e.g., for the Pressurizer Pressure Transmitter, the typical calibrated range is 1700 to 2500 PSIG.

Rack Error Components - These are the error terms associated with the process modules that are used to develop a Channel Statistical Allowance (CSA) value for a particular trip/alarm function. These rack error components are the calibration tolerances associated with the process modules for a module calibration (M1, M2 ... Mn) or (RCA & RCSA) for string calibration and an uncertainty value to account for Rack Drift (RD). These rack error components are combined statistically to determine the maximum allowable error which, ideally, should be used to determine the Allowable Value/LSSS/Setting Limit.

Safety Analysis Limit (SAL) - The setpoint value assumed in the Safety Analysis. In the context of this document, the Safety Analysis Limit is equivalent to the Analytical Limit (AL).

Span - The difference between the upper and lower range values of a process parameter or the signal values corresponding to these.

Tolerance - The allowable deviation from an ideal calculated value.

Total Allowance - The difference between the Nominal Trip Setpoint and the Safety Analysis Limit (usually expressed in percent of span or the process/signal values corresponding to these).

Total Loop Uncertainty (TLU) – In the context of this document, the TLU is equivalent to the Channel Statistical Allowance (CSA). A summary of TLU/CSA error terms is provided in Table 2.1 below.

Table 2.1: Channel Statistical Allowance (CSA) Equation and Error Term Definitions	
$$\mathbf{CSA = SE \pm [EA^2 + PMA^2 + PEA^2 + (SCA{+}SMTE)^2 + SD^2 + SPE^2 + STE^2 + SPSE^2 + (M1{+}M1MTE)^2 + (M2{+}M2MTE)^2 + \ldots + (Mn{+}MnMTE)^2 + RD^2 + RTE^2 + RRA^2]^{1/2}}$$	
Systematic Error (SE) (NON-COT)	Systematic Error is treated as a bias (unidirectional) and is always placed outside of the radical. Examples of Systematic Error are transmitter reference leg heatup, uncorrected Sensor Pressure Effects (SPE) and the SG Mid Deck Plate bias.
Environmental Allowance (EA) (NON-COT)	Environmental Allowance is normally associated with instrument loop sensors and equipment that is subjected to a HARSH environment during DBE and/or PDBE conditions. EA is made up of Insulation Resistance (IR) Effects, Radiation Effects (RE), Steam Pressure Temperature Effects (SPTE) and Seismic Mounting Effects (SME).
Process Measurement Accuracy (PMA) (NON-COT)	Process Measurement Accuracy is an allowance for non-instrument related effects that directly influence the accuracy of the instrument loop. Examples of PMA are fluid stratification effects on temperature measurement and the effects of fluid density changes on level measurement.
Primary Element Accuracy (PEA) (NON-COT)	Primary Element Accuracy is an allowance for the inaccuracies of the system element that quantitatively converts the measured variable energy into a form suitable for measurement.
Sensor Calibration Accuracy (SCA) (NON-COT)	Sensor Calibration Accuracy is a number or quantity that defines a limit that errors will not exceed when a sensor is used under specified operating conditions, i.e., the calibration accuracy of the sensor.
Sensor Measuring & Test Equipment (SMTE) (NON-COT)	Sensor Measuring & Test Equipment is associated with the accuracy of the Measuring and Test Equipment (M&TE) used to calibrate the loop sensor(s). Examples of SMTE are Test Gauges and Digital Multimeters (DMM).
Sensor Drift (SD) (NON-COT)	Sensor Drift is an allowance for the change in the input versus output relationship of the sensor over a period of time under specified reference operating conditions.
Sensor Pressure Effects (SPE) (NON-COT)	Sensor Pressure Effects are allowances for the steady-state pressure applied to a device. Normally, SPE applies only for differential pressure devices and is associated with the change in input-output relationship due to a change in static pressure. SPE is divided into two terms, Static Pressure Zero Effect (SPZE) and Static Pressure Span Effect (SPSE).
Sensor Temperature Effects (STE) (NON-COT)	Sensor Temperature Effect is an allowance for the effects of changes in the ambient temperature surrounding the sensor.
Sensor Power Supply Effect (SPSE) (NON-COT)	Sensor Power Supply Effect is an allowance for the effects of changes in the power supply voltage applied to the sensor.
Module Calibration Accuracy (M1 through Mn) (COT)	Module M1 to Mn is an Allowance for the accuracy of an assembly of interconnected components that constitute an identifiable device, instrument, or piece of equipment. A module can be disconnected, removed as a unit and replaced with a spare. It has definable performance characteristics that permit it to be tested as a unit.
Module Measuring & Test Equipment (MnMTE) (NON-COT)	Module Measuring & Test Equipment is associated with the accuracy of the Measuring and Test Equipment (M&TE) used to calibrate the loop module(s). Examples of MnMTE are Decade Boxes, Digital Multimeters (DMM), Test Point Resistors (TPR), Oscilloscopes and Recorders.
Rack Drift (RD) (COT)	Rack Drift is an allowance for the change in the input versus output relationship of the Rack Modules (M1 through Mn) over a period of time under specified reference operating conditions.
Rack Temperature Effect (RTE) (NON-COT)	Sensor Temperature Effect is an allowance for the effects of changes in the ambient temperature surrounding the Process Racks.
Rack Readability Allowance (RRA) (N/A)	Rack Readability Allowance is an allowance for the inability to read analog indicators because of parallax distortion.

2.2 The Significance of the Allowable Value

2.2.1 Background

Historically, for plants that have used Westinghouse Standardized Technical Specifications (STS) such as North Anna, two values have been provided for each Reactor Trip System (RTS) and Engineered Safety Features Actuation System (ESFAS) trip function; they are referred to as the "Nominal Trip Setpoint" and the "Allowable Value" (in the context of this document, the Allowable Value, Limiting Safety System Setting “LSSS” and the Setting Limit are the same). The difference in percent of span between the Nominal Trip Setpoint and the Allowable Value was calculated, in most cases, based on a summation of the errors associated with the rack components and rack drift. For linear, non-complex trip functions, this value normally worked out to be between 1.0 % and 2.0 % of span. For complex trip functions or functions that had limited margin with respect to the Safety Analysis Limit, other calculational methods were used to determine the difference between the Nominal Trip Setpoint and the Allowable Value. For plants that do not use the Westinghouse STS version of Technical Specifications such as Surry, normally only one setpoint value (assumed to be the Limiting Safety System Setting “LSSS” or the Setting Limit at Surry) is provided in the text with no guidance as to how to set the actual "Nominal" Trip Setpoint in the plant.

Based on the early versions of the Westinghouse STS, the original definition of the LSSS (i.e., the Allowable Value) was stated as follows:

"A setting chosen to prevent exceeding a Safety Analysis Limit".

This Allowable Value was intended to be used during monthly or quarterly Functional Testing as a "flag" such that if a bistable (comparator) Trip Setpoint exceeded this value, the protection channel would be declared inoperable and plant staff would be required to initiate corrective action. The intended significance of this value is that it is the point where if the value is exceeded, the implication is that the actual rack electronics and/or associated rack error components have exceeded the values assumed in the Channel Statistical Allowance (CSA) Calculation and consequently, the margin with respect to the Safety Analysis Limit has been reduced.

The Allowable Value takes on added significance when there is little or no retained/available margin with respect to the Safety Analysis Limit and conversely takes on reduced significance in proportion to the amount of retained/available margin.

2.2.2 Addressing Recent NRC Concerns Associated with Allowable Values

Dominion Corporate I&C Engineering attended a meeting with the Nuclear Regulatory Commission (NRC) and Nuclear Energy Institute (NEI) in Rockville, MD on October 8, 2003 to evaluate NRC concerns associated with the “Allowable Values” used in Technical Specifications. The “Allowable Values” of interest are those associated with Reactor Protection System (RPS) (e.g., also known as the Reactor Trip System “RTS”) and Engineered Safety Features Actuation System (ESFAS) Functions that are credited in the Plant Specific Safety Analysis. The NRC expressed a basic concern at the meeting where they have identified various plants that use a method to calculate “Allowable Values” for RTS and ESFAS functions that will reduce or eliminate margin to the Analytical Limit (AL), i.e., also known as the Safety Analysis

Limit (SAL). In the worst case scenario, the margin may be determined to be negative such that the protection function is operating outside of the analyzed region.

On August 13, 2003, NRC Staff met with members of the ISA 67.04 committee and other industry groups in Rockville, MD to discuss instrument setpoint methodology and lay out their position. The major area of discussion focused on the instrument setpoint methodology recommended in ISA Standard S67.04 used by many licensees for determining protection system instrumentation setpoints. Part II of the standard, not endorsed by the NRC Staff, includes three methods for calculating "Allowable Values" which represent the "Limiting Safety System Settings" (LSSS) as described in 10CFR50.36. As stated by the NRC, Methods 1 and 2 determine "Allowable Values" that are sufficiently conservative and are acceptable to the NRC Staff. According to the NRC, Method 3 does not appear to provide an acceptable degree of conservatism and is of concern to the NRC Staff. In addition, there is also a disagreement between the NRC Staff and NEI/ISA/Some Industry Groups as to the meaning/intent of the LSSS. These items will be addressed in this document as they apply to Surry and North Anna.

As of August 2002 North Anna adopted Improved Technical Specifications (ITS). Within the North Anna ITS and ITS Bases, Allowable Values are explicitly defined and are uniquely associated with each RTS and ESFAS function, to include Backup Trips and Permissives. The Allowable Values specified in North Anna's ITS as described in this Technical Report are based on Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994.

Surry Power Station has not adopted ITS and has decided to continue using their Custom Technical Specifications (CTS). For plants licensed before 1974, prior to the introduction of Standardized Technical Specifications (STS), the setpoints (i.e., Technical Specification Limits) included in CTS for RPS and ESFAS instrumentation were based on the plant specific setpoint study and/or based on settings provided in the Westinghouse Precautions, Limitations and Setpoints (PLS) document. The RPS and ESFAS trip setpoints specified in CTS did not include allowances for instrument uncertainties associated with channel functional testing (i.e., the COT). These allowances were left up to the licensee to deal with and justify. At the present time, this applies to Surry. In many cases, the original CTS setpoints for RPS and ESFAS instrumentation have been determined to be unacceptable based on today's standards and setpoint methodologies. To address this discrepancy, Technical Specification Change Request (TSCR) No. 318 was prepared to revise 16 Limiting Safety System Settings for the Reactor Protection System and 11 Setting Limits for the Engineered Safety Features Actuation System. The revised Limiting Safety System Settings and Setting Limits were calculated in accordance with Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994. TSCR No. 318 was approved by the USNRC via Surry Technical Specifications Amendments 261/261 dated September 23, 2008 (Serial # 080594). The revised Limiting Safety System Settings, Setting Limits, and four setpoint changes were implemented for Surry Units 1 and 2 in November of 2008.

At the present time, Kewaunee Power Station is also using Custom Technical Specifications (CTS). Kewaunee's CTS is very similar to the CTS used at Surry Power Station. Dominion has decided that Kewaunee will convert to Improved Technical Specifications (ITS) in the near future. As part of the ITS conversion, Kewaunee will remove their Reactor Protection System LSSSs, ESFAS Setting Limits (known as Allowable Values in ITS), Diesel Generator (LOOP), Containment Purge and Vent Isolation, and Control Room Post Accident Recirculation Actuation from Technical Specifications and maintain control of these and other critical limits in a Setpoint Control Program as allowed by Option B of TSTF-493, Revision 4 (Ref. 5.99). The Setpoint Control Program will be administered as defined in ITS, Section 5.5.16 "Setpoint Control Program". Like North Anna and Surry, the Allowable Values for RPS and ESFAS Instrumentation, as administered by the Setpoint Control Program will be calculated in accordance with Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994. The Kewaunee Diesel Generator (LOOP), Containment Purge and Vent Isolation, and Control Room Post Accident Recirculation Actuation instrumentation will be handled using Methods 1 and 2 as applicable.

The following subsections will focus on the meaning/intent of the Limiting Safety System Setting (LSSS) and the Allowable Value (AV) as understood by the NRC, ISA/NEI/Various Industry Groups and Dominion.

2.2.3 The NRC Staff Position Concerning the LSSS and AV

The following LSSS information is based on information from the NRC presentation to the ISA 67.04 Committee on August 13, 2003.

10CFR50.36(C)(1)(ii)(A) defines the Limiting Safety System Setting (LSSS) as the setting that must be chosen so that the automatic protective action will correct the abnormal situation before a safety limit is exceeded.

New Improved TS Bases defines allowable value (AV) to be equivalent to LSSS and defines that a channel is operable if the trip setpoint is found not to exceed the AV during the Channel Operational Test (COT).

Prior to the issuance of NRC Regulatory Issue Summary (RIS) 2006-17, the NRC Staff believed that the Allowable Value (AV) is equivalent to the Limiting Safety System Setting (LSSS). Since the issuance of RIS 2006-17 (Ref. 5.100), the NRC's staff position is that the Limiting Trip Setpoint (LSP) protects the Safety Limit (SL) and relationship between the Allowable Value and the LSSS has been expanded upon as discussed in Section 2.2.6.(1)

2.2.4 The ISA/NEI/Various Industry Groups Position Concerning the LSSS and AV

The following information is based on the ISA 67.04 Subcommittee handout from August 13, 2003.

Position Statements

- The difference between the Allowable Value (AV) and the Analytical Limit (AL) is not a direct defense of the AL.
- The Trip Setpoint (TSP) protects the AL.
- The AV confirms the TSP.

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(1) There is a difference in the terminology and abbreviations used in TSTF-493, Rev. 4 versus RIS 2006-17 with respect to the Limiting Trip Setpoint and the Safety Limit.

Summary

- Reg Guide 1.105 endorses the calculation of the TSP using statistical methods.
- The AV, based on a portion of the errors, does not invalidate the TSP.
- The TSP protects the AL.
- The AV validates an error contribution assumption via periodic surveillance testing.
- As long as the AV is not exceeded, the channel is OPERABLE.
- During Surveillance Testing, the AV serves as the LSSS.
- The errors between the AV and the AL are not part of the LSSS as defined by 10CFR50.36.

In summary, ISA/NEI/Various Industry Groups believe that the Allowable Value (AV) is equivalent to the Limiting Safety System Setting (LSSS). However, their position is that the TSP is used to protect the Analytical Limit (AL). All of the items listed above are true, with the exception of "The TSP protects the AL". This is the statement that is under dispute.

Since August of 2003, the Industry has been developing Technical Specification Task Force Improved Standard Technical Specifications Change Traveler TSTF-493. This document addresses the agreement made between the USNRC and the industry concerning the issues listed above. Dominion's implementation of the requirements set forth in TSTF-493, Revision 4 (Ref. 5.99) as they apply to Kewaunee Power Station will be addressed in Sections 2.2.6 and 3.5.

2.2.5 The Dominion Position Concerning the LSSS and AV for North Anna and Surry

Information Intentionally Removed
Specific to North Anna Power Station and Surry Power Station Only

Information Intentionally Removed
Specific to North Anna Power Station and Surry Power Station Only

2.2.6 The Dominion Position Concerning the LSSS and AV for Kewaunee

Dominion has decided to adopt Improved Technical Specifications (ITS) for Kewaunee. As part of the ITS conversion, Dominion has chosen to implement Option B of TSTF-493, Revision 4 (Ref. 5.99). TSTF-493, Revision 4, Option B allows for the relocation of Reactor Protection System “RPS” (also known as the Reactor Trip System “RTS”) and Engineered Safety Features Actuation System – “ESFAS” (also known as Engineered Safety Features – “ESF”) Allowable Values (also known as the Limiting Safety System Settings – “LSSSs” or Setting Limits) from Section 3.3 of Technical Specifications to a Licensee controlled program as defined in ITS Section 5.5.16. In addition, the Diesel Generator (LOOP), Containment Purge and Vent Isolation, and Control Room Post Accident Recirculation Actuation instrumentation will also be relocated to the Licensee controlled program as defined in ITS Section 5.5.16. To implement TSTF-493, Option B, Dominion will incorporate the relevant positions taken by the industry as detailed in TSTF-493, Revision 4 and those taken by the USNRC as detailed in NRC Regulatory Issue Summary 2006-17, Dated September 19, 2006 (Refs. 5.99 and 5.100) into the Setpoint Control Program in accordance with ITS Section 5.5.16.

New and/or revised terminology and requirements have been incorporated into TSTF-493 and NRC Regulatory Issue Summary (RIS) 2006-17 that are to be used for the determination of RPS and ESFAS Setpoints. The new terminology and requirements detailed in TSTF-493, Revision 4 and RIS 2006-17 will be incorporated into Kewaunee’s Setpoint Control Program as described in ITS Section 5.5.16. In addition to the new terminology and requirements, the USNRC has taken the position that the Limiting Trip Setpoint (LTSP) protects the Safety Limit (SL) (Ref. 5.100). This revised position is a change from the historical definition of the Allowable Value as delineated in Standardized Technical Specifications

(STS), i.e., "A setting chosen to prevent exceeding a Safety Analysis Limit" (Ref. 5.3). Since the Limiting Trip Setpoint (LTSP) accounts for all credible instrument errors associated with the instrument channel, it is a more conservative setting than the associated Allowable Value as defined in Section 3.5. With respect to Kewaunee's conversion to ITS, Dominion agrees with this revised position based on explanations and guidance provided in TSTF-493, Revision 4 and RIS 2006-17.

Like North Anna and Surry, Kewaunee's Setpoint Methodology is based on Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994. Using Methods 1 or 2 will ensure that the Allowable Value (equivalent to the Minimum or Maximum Allowable Value for Surry and North Anna) will account for all credible instrument and process errors that are not tested or quantified during the performance of the Channel Operational Test (COT). This Setpoint Methodology addresses the basic NRC concern brought up back in 2003 that Method 3 (used by some Licensees to determine Allowable Values) as described in ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994 may yield Allowable Values that will not protect the Safety Limit under all postulated conditions. In addition to using Methods 1 or 2, Kewaunee's Setpoint Methodology will incorporate the revised terminology and additional requirements imposed by TSTF-493, Revision 4 and RIS 2006-17. A detailed discussion of Kewaunee's Setpoint Methodology incorporating the revised terminology and requirements from TSTF-493 and RIS 2006-17 is provided in Section 3.5.

3.0 METHODOLOGY

3.1 Introduction

Many Westinghouse Plants continue to use Westinghouse or other Engineering Firms to perform some or all of their Safety Analysis Functions. In addition, Westinghouse has also performed the RPS (RTS) and ESFAS Setpoint Study for many of their plants. Typically, the Setpoint Study for these plants included the development of Channel Statistical Allowance (CSA) Calculations for Primary and some of the Backup RTS and ESFAS Trip Functions. Derived from these Setpoint Studies and CSA Calculations are the Allowable Values that appear in various versions of Standardized Technical Specifications (STS). For the Westinghouse Plants that use Custom Technical Specifications (CTS), the setpoint values specified for RPS and ESFAS Trip Functions are not defined as Allowable Values and typically, they are the same setpoint values as those found in the original Precautions, Limitations and Setpoints (PLS) Document for that particular plant. This was the case for Surry's Custom Technical Specifications until the implementation of Technical Specifications Change Request No. 318 ultimately resulting in TS Amendments 261/261 for Units 1 and 2, respectively (Ref. 5.119).

Dominion is unique in the fact that a majority of the UFSAR Chapter 14 (Surry and Kewaunee) and Chapter 15 (North Anna) Safety Analysis is performed in house by the Corporate Nuclear Analysis & Fuels Department. In addition, Channel Statistical Allowance Calculations for Primary and Backup RPS (RTS) and ESFAS Trip Functions are performed in house by the Corporate Electrical/I&C/Computers Department. Because Dominion performs their own Safety Analysis and CSA Calculations, the methodology used to determine Improved Technical Specifications (NUREG-1431 "ITS") Allowable Values for North Anna, As Found Tolerances for Kewaunee, and LSSS/Setting Limits for Surry Custom Technical Specifications will be similar and in some cases more conservative than that used by Westinghouse in the past to determine Allowable Values for later versions of Standardized Technical Specifications. In addition, the methods used in this Technical Report to calculate the limiting values for North Anna, Kewaunee, and Surry will be consistent with the requirements of Methods 1 or 2 as described in ISA-RP67.04.02-2000 (Ref 5.43).

3.2 Functional Groups for RPS (RTS) and ESFAS Instrumentation.

Based on Dominion Technical Report NE-0994 (Ref. 5.1), the Reactor Protection System (RPS)/Reactor Trip System (RTS) and the Engineered Safety Features Actuation System (ESFAS) Instrumentation at North Anna, Kewaunee, and Surry can be divided into two major categories, i.e., Primary Trip Functions and Backup Trip Functions. Primary Trip Functions are credited in the Plant Safety Analysis and have an associated Analytical Limit (i.e., Safety Analysis Limit or Safety Limit). Backup Trip Functions are not credited in the Plant Safety Analysis but are included in the Reactor Protection System and the Engineered Safety Features Actuation System to enhance the overall effectiveness of the system.

Primary Trip Functions include the following:

- Primary Reactor Trip Functions
- Primary Reactor Trip Permissives
- Primary ESFAS Actuation Functions
- Primary ESFAS Permissives

Backup Trip Functions include the following:

- Backup Reactor Trip Functions
- Backup Reactor Trip Permissives
- Backup ESFAS Permissives

In addition to the above, there are three basic functional groups of Westinghouse Nuclear Instrumentation System (NIS), Foxboro H-Line, NUS Replacement Modules, Westinghouse/Hagan 7100, and Westinghouse 7300 Instrumentation that develop the majority of the RPS/RTS and ESFAS trips. These basic functional groups are divided into the three categories listed below:

1. Single parameter protection function
2. Dual parameter protection function
3. Multiple parameter protection function (i.e., more than two process parameters)

Different methods are used to calculate or validate the Allowable Values for North Anna, As Found Tolerances for Kewaunee, and LSSS/Setting Limits for Surry depending on whether the function is considered to be Primary or Backup. In addition, the functional group category will also effect how the Allowable Value, As Found Tolerance or LSSS/Setting Limit is calculated. Some examples of functional groups are given below.

Single Parameter Protection Functions

- Power Range Neutron Flux High and Low Reactor Trips
- Pressurizer High and Low Pressure Reactor Trips
- Low Reactor Coolant Flow Reactor Trip
- Containment Hi-1, Hi-2 and Hi-3 (North Anna only) Pressure ESFAS initiation
- Compensated Low Steam Line Pressure ESFAS initiation
- Steam Generator Lo-2 Level ESFAS initiation

Dual Parameter Protection Functions

- Surry High Steam Flow in 2/3 Lines ESFAS initiation
- Surry High ΔP Steam Line vs. Steam Header ESFAS initiation
- North Anna High ΔP Steam Line vs. Steam Line ESFAS initiation

Multiple Parameter Protection Functions

- Steam Flow Feed Flow Mismatch Reactor Trip
- Overpower ΔT Reactor Trip
- Overtemperature ΔT Reactor Trip

Single Parameter Protection Functions

North Anna

The Nuclear Steam Supply System (NSSS) Protection and Control System at North Anna is made up of the Westinghouse Nuclear Instrumentation System (NIS) and the Westinghouse 7300 Series Process Control System. Most of the RTS and ESFAS trips generated from these systems are single parameter protection functions. Figures 3.2-1 and 3.2-2 illustrate the configuration of the Westinghouse NIS and the 7300 Process Control System.

Westinghouse Nuclear Instrumentation System - Power Range Reactor Trips

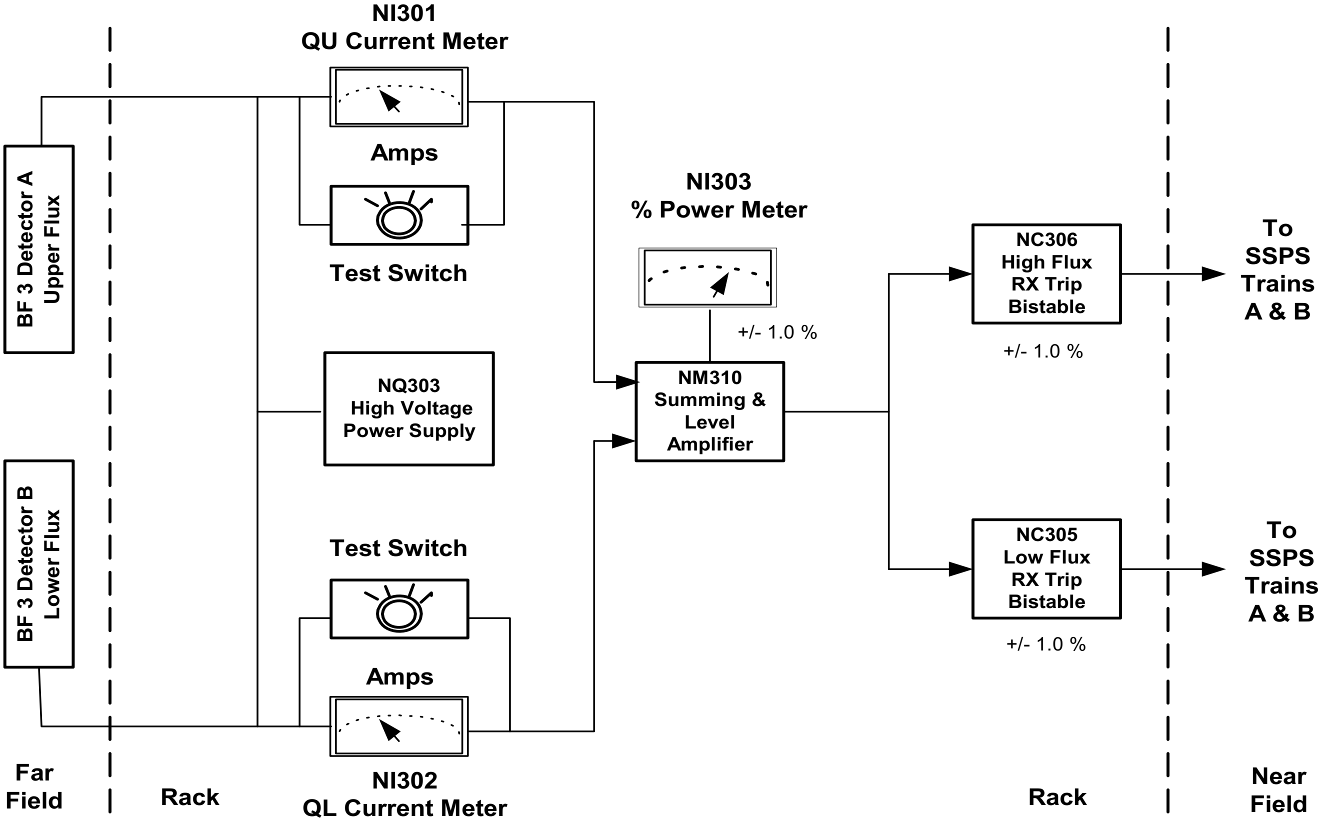


Figure 3.2-1

Refer to Figure 3.2-1 :

CSA Calculations performed for Reactor Trips generated by NIS typically include rack error terms associated with the meter indications (i.e., Amps, % Full Power, Counts per Second, etc.) and the bistables that generate the trip.

In the case of the Power Range High Flux Reactor Trip as shown on Figure 3.2-1, the rack error terms as defined in CSA Calculation EE-0063 (Ref. 5.15) are :

(M1 + M1TE) + (M5 + M5MTE) + RD + RTE

Where:
M1 = Module 1 Summing and Level Amplifier = ± 0.100 %
M1MTE = Module 1 Measuring and Test Equipment = ± 0.110 %
M5 = Module 5 Bistable Relay Driver = ± 0.833 %
M5MTE = Module 5 Measuring and Test Equipment = ± 0.943 %
RD = Rack Drift = ± 1.000 %
RTE = Rack Temperature Effects = ± 0.500 %

Westinghouse 7300 Process Control System
Low Reactor Coolant Flow Reactor Trip

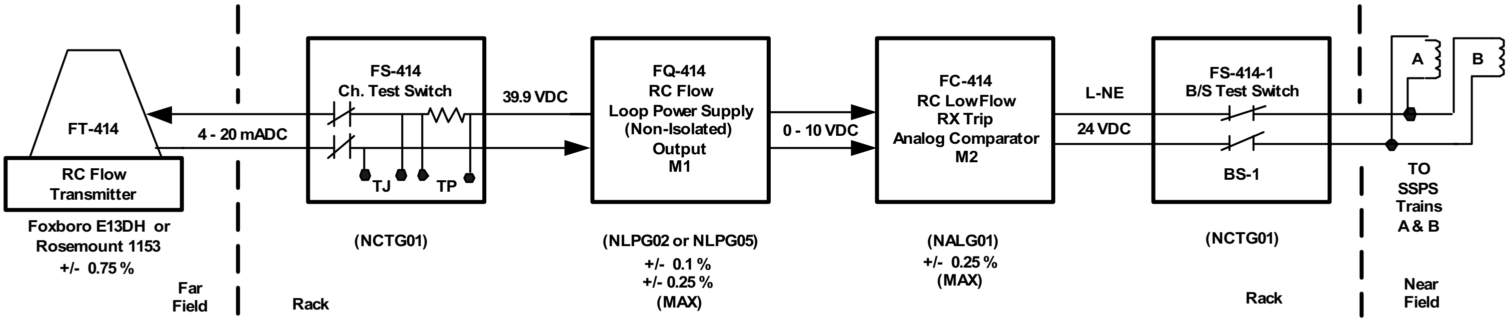


Figure 3.2-2

Refer to Figure 3.2-2 :

CSA Calculations performed for Reactor Trips generated by the Westinghouse 7300 Process Control System include rack error terms associated with the PC Cards that perform signal modification and the bistables that generate the trip.

In the case of the Low Reactor Coolant Flow Reactor Trip as shown on Figure 3.2-2, the rack error terms as defined in CSA Calculation EE-0060 (Ref. 5.21) are :

(M1 + M1MTE) + (M2 + M2MTE) + RD + RTE

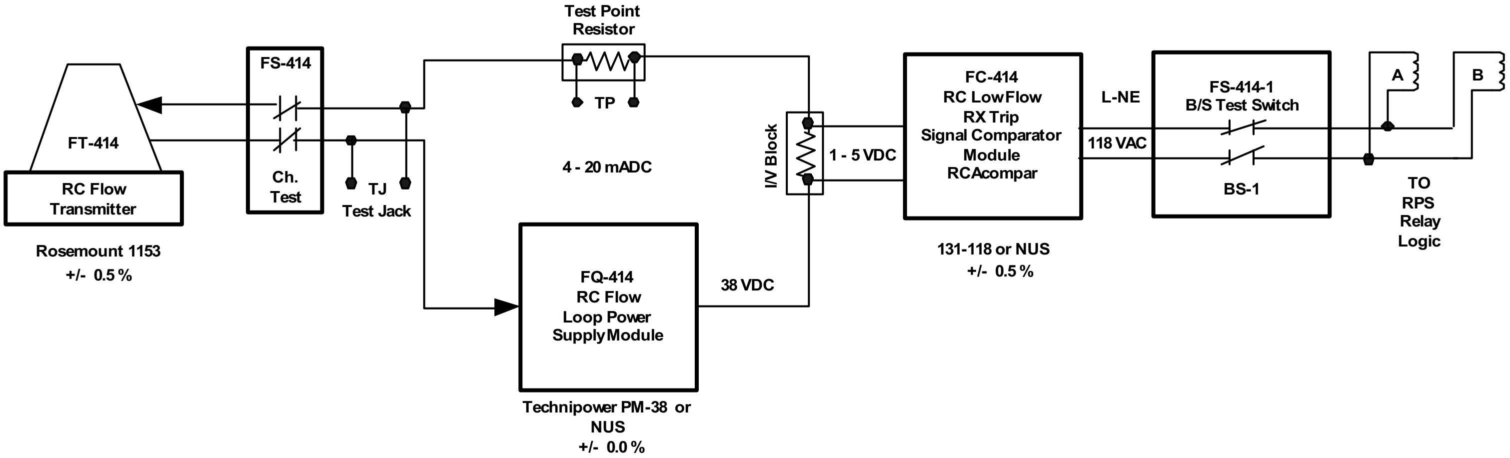
Where: M1 = Module 1 Loop Power Supply = ± 0.100 %
M1MTE = Module 1 Measuring and Test Equipment = ± 0.153 %
M2 = Module 2 Analog Comparator "Bistable" = ± 0.250 %
M2MTE = Module 2 Measuring and Test Equipment = ± 0.030 %
RD = Rack Drift = ± 1.000 %
RTE = Rack Temperature Effects = ± 0.500 %

These rack error terms along with other error terms from the CSA Calculation will be used to validate the existing Allowable Values at North Anna or to calculate revised Allowable Values, if necessary.

Surry

The NSSS Protection and Control System at Surry uses the same Westinghouse Nuclear Instrumentation System (NIS) as North Anna. However, a majority of NSSS Protection and Control is developed from the Westinghouse/Hagan 7100 Series Process Control System (using NUS Replacement Modules for some functions). Like North Anna, most of the RPS and ESFAS trips generated from these systems are single parameter protection functions. For the Westinghouse NIS, Figure 3.2-1 is also applicable for Surry. Figure 3.2-3 illustrates the configuration of the Westinghouse/Hagan 7100 Process Control System for a single input protection function.

Westinghouse 7100 Process Control System
Low Reactor Coolant Flow Reactor Trip



<u>**Figure 3.2-3**</u>

Refer to Figure 3.2-3 :

CSA Calculations performed for Reactor Trips generated by the Westinghouse/Hagan 7100 Process Control System also include rack error terms associated with the modules that perform signal modification and the bistables that generate the trip. The Westinghouse 7100 Process Control System mainly operates using current loops where the power supplies are not used as signal converters. In many cases, for a single parameter protection function, the only rack module that will have a tolerance associated with it will be the Signal Comparator (i.e., the Bistable). In the case of Surry's Low Reactor Coolant Flow Reactor Trip as shown in Figure 3.2-3, the rack error terms from CSA Calculation EE-0183 (Ref. 5.34) are :

$$(M5 + M5MTE) + RD + RTE$$

Where:
M5 = Rack Comparator Setting Accuracy = $\pm$ 0.50 %
M5MTE = Rack Measuring and Test Equipment = $\pm$ 0.15 %
RD = Rack Drift = $\pm$ 1.00 %
RTE = Rack Temperature Effects = $\pm$ 0.50 %

Note the difference between North Anna's rack error terms compared with the rack error terms listed above for Surry. The error terms for the Loop Power Supply are not included in Surry's CSA Calculation because it is not used as a signal converter.

Kewaunee

The NSSS Protection and Control System at Kewaunee uses the same Westinghouse Nuclear Instrumentation System (NIS) as does North Anna and Surry for Power Range. Most of the NSSS Protection and Control is developed from the Foxboro H-Line Process Control System (using NUS Replacement Modules for some functions). Like North Anna and Surry, most of the RPS and ESFAS trips generated from these systems are single parameter protection functions. For the Westinghouse Power Range NIS, Figure 3.2-1 is also applicable for Kewaunee. Figure 3.2-4 illustrates the configuration of the Foxboro H-Line Process Control System for a single input protection function.

Foxboro H-Line Process Control System
Low Reactor Coolant Flow Reactor Trip

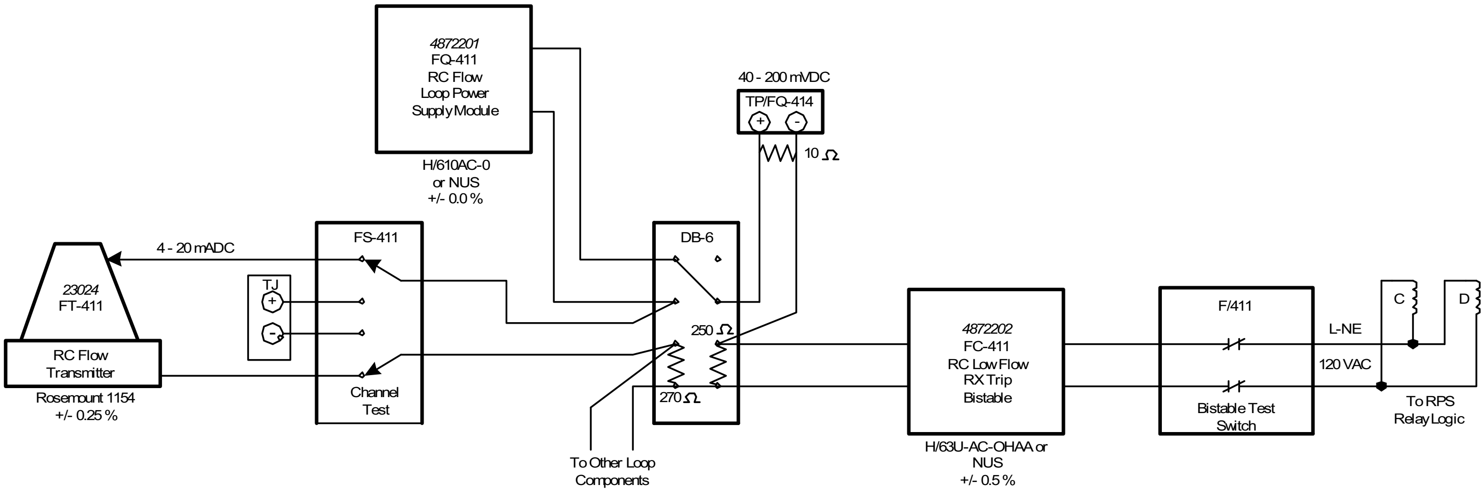


Figure 3.2-4

Refer to Figure 3.2-4 :

CSA Calculations performed for Reactor Trips generated by the Foxboro H-Line Control System also include rack error terms associated with the modules that perform signal modification and the bistables that generate the trip. The Foxboro H-Line Process Control System mainly operates using current loops where the power supplies are not used as signal converters. In many cases, for a single parameter protection function, the only rack module that will have a tolerance associated with it will be the Bistable Module.

In the case of Kewaunee's Low Reactor Coolant Flow Reactor Trip as shown in Figure 3.2-4, the rack error terms from CSA Calculation C10819 (Ref. 5.96) are :

$$(M2_{BISTABLE} + M2MTE) + RD + RTE$$

Where: $M2_{BISTABLE}$ = Rack Bistable Setting Accuracy = ± 0.50 %
M2MTE = Rack Measuring and Test Equipment = ± 0.20 %
RD = Rack Drift = ± 1.00 %
RTE = Rack Temperature Effects = ± 0.50 %

Note the difference between North Anna's rack error terms compared with the rack error terms listed above for Kewaunee. The error terms for the Loop Power Supply are not included in Kewaunee's CSA Calculation because it is not used as a signal converter.

Dual Parameter Protection Functions

Westinghouse 7300 Process Control System
High Steam Flow in 2/3 Lines ESFAS - Channel 3

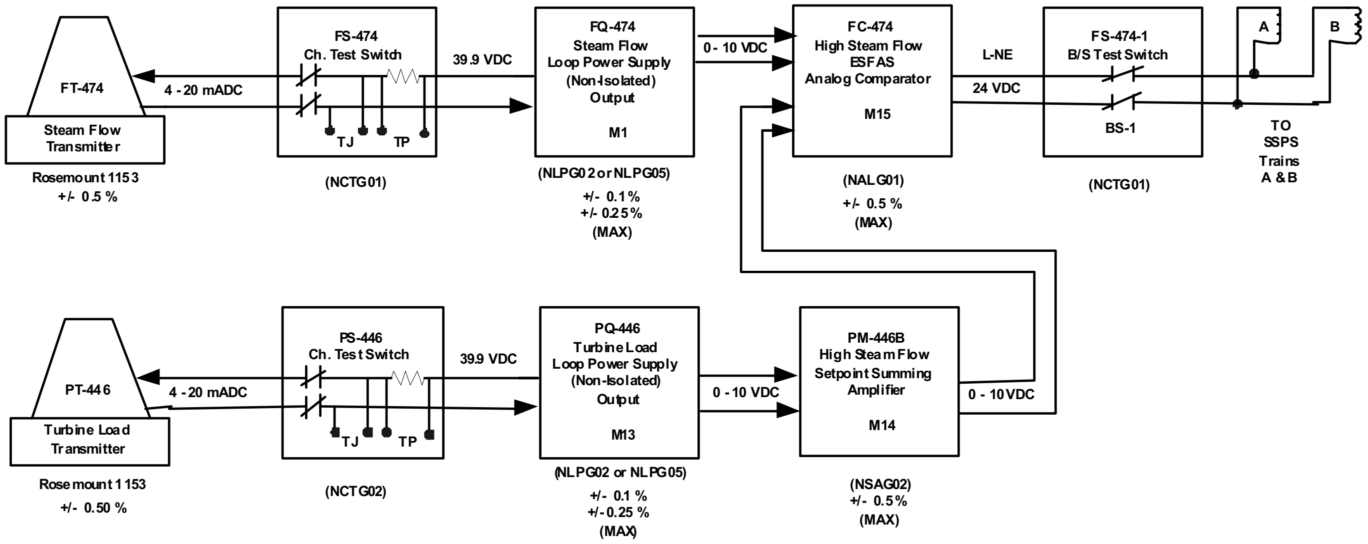


Figure 3.2-5

Figure 3.2-5 illustrates a typical dual input protection function for North Anna. Channel Statistical Allowance Calculations for dual parameter protection functions are different than single parameter functions. For example, there are more rack error terms associated with the development of the trip than a single parameter function. The rack error terms associated with North Anna's High Steam Flow in 2/3 Lines ESFAS trip based on Calculation EE-0736 (Ref. 5.23) are given below :

$$(M1 + M1MTE) + (M13 + M13MTE) + (M14 + M14MTE) + (M15 + M15MTE) + RD + RTE$$

Where: M1 = Steam Flow Loop Power Supply Accuracy = ± 0.10 %
M1MTE = Module M1 Measuring and Test Equipment = ± 0.153 %
M13 = Turbine Load Loop Power Supply Accuracy = ± 0.10 %
M13MTE = Module M13 Measuring and Test Equipment = ± 0.153 %
M14 = High Steam Flow Setpoint Summator Accuracy = ± 0.50 %
M14MTE = Module M14 Measuring and Test Equipment = ± 0.042 %
M15 = High Steam Flow Comparator Setting Accuracy = ± 0.50 %
M15MTE = Module M15 Measuring and Test Equipment = ± 0.042 %
RD = Rack Drift = ± 1.00 %
RTE = Rack Temperature Effects = ± 0.50 %

The rack error terms described in the example above along with other error terms from the CSA Calculation will be used to validate the existing Allowable Values at North Anna or to calculate revised Allowable Values, if necessary. The configuration of dual parameter protection functions at Surry is similar to North Anna's. The major differences between the rack error components for both plants are based on the process control equipment as illustrated above for single input protection functions.

Multiple Parameter Protection Functions

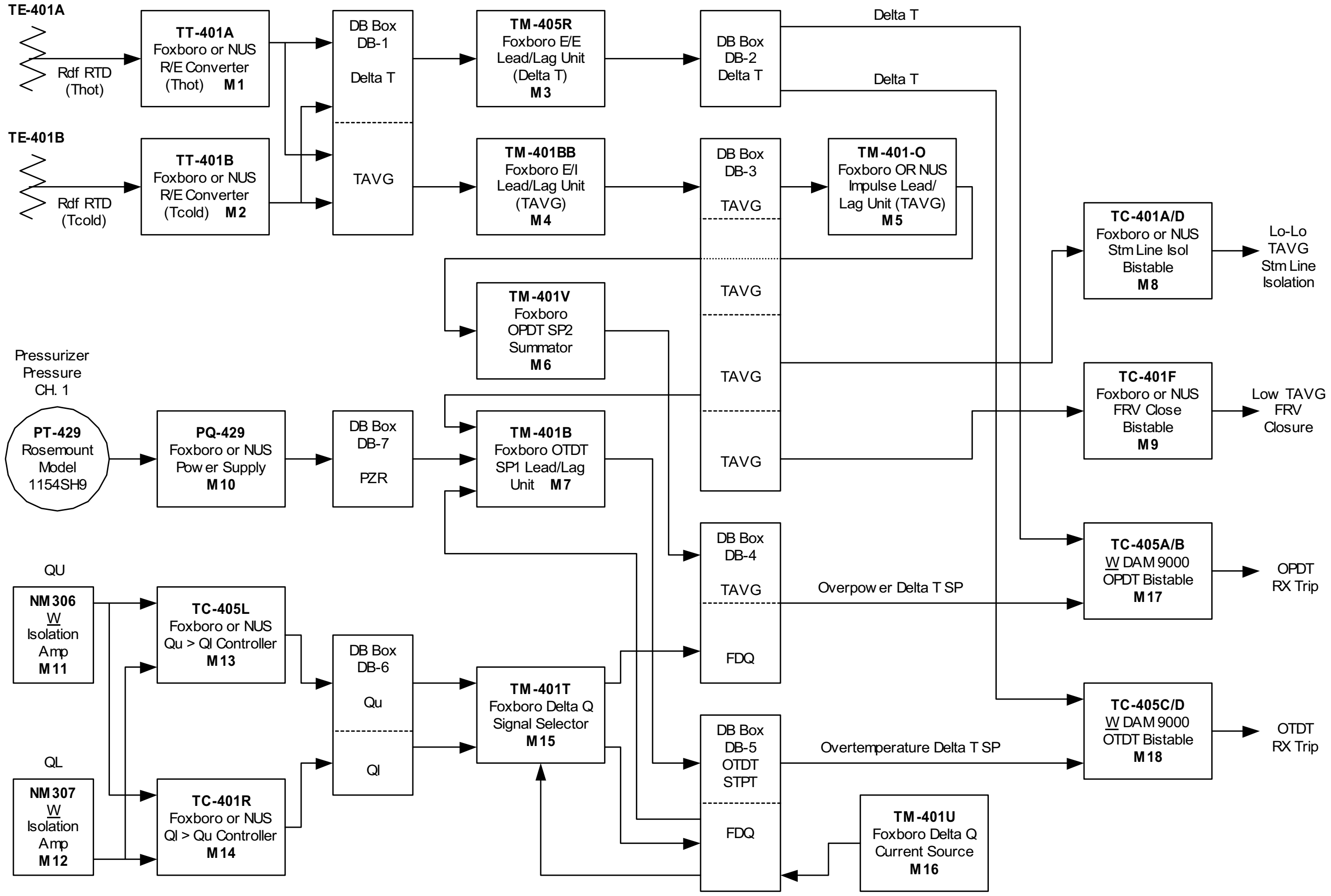
Kewaunee

There are three multiple parameter protection functions at North Anna and Kewaunee, and four multiple parameter functions at Surry. Figure 3.2-6 is a block diagram that illustrates Kewaunee's Overtemperature ΔT Reactor Trip configuration (note that Overpower ΔT and Low T_{AVG} are also shown on the drawing). The configuration of North Anna's and Surry's Overtemperature ΔT Reactor Trip is similar, noting that the process control equipment is different.

As can be seen from Figure 3.2-6, Kewaunee's Overtemperature ΔT Reactor Trip function is derived from five process parameters, they are :

- T_{HOT}
- T_{COLD}
- Pressurizer Pressure
- Function of Delta Flux (FΔI) made up of Upper Flux (Q_U) and Lower Flux (Q_L)

Kewaunee Power Station Overtemperature ΔT Reactor Trip



<u>**Figure 3.2-6**</u>

The Overtemperature ΔT Reactor Trip function is further broken down into channels as defined below :

- ΔT Channel, made up of T_{HOT} and T_{COLD}
- T_{AVG} Channel, made up of T_{HOT} and T_{COLD}
- Pressurizer Pressure Channel
- Function of Delta Flux (FΔI), made up of Q_U and Q_L

Because there are five inputs to Kewaunee's Overtemperature ΔT function, the rack error components will be grouped as channel inputs versus a string of modules as shown above for the Dual Parameter Function example. This type of assessment will yield a conservative and valid Allowable Value (for Kewaunee, the Allowable Value will be the As Found Tolerance) using the four step method described in Sections 3.4 and 3.5 (Section 3.5 is Kewaunee specific). CSA Calculation C11865 (Ref. 5.94) was performed using a module calibration method, which for a multiple-parameter function will result in a very conservative CSA value. However, using a module calibration method for a complex, multiple-parameter function will result in an Allowable Value, LSSS/Setting Limit, or As Found Tolerance that is non-conservative. The rack error components for each Overtemperature ΔT input channel are given below.

$$\Delta T \text{ Channel} = (RCA_1 + RMTE_1) + RD_1 + RTE_1$$

$$T_{AVG} \text{ Channel} = (RCA_2 + RMTE_2) + RD_2 + RTE_2$$

$$\text{Pressurizer Pressure Channel} = (RCA_3 + RMTE_3) + RD_3 + RTE_3$$

$$F\Delta I \text{ Channel} = (RCA_4 + RMTE_4) + RD_4 + RTE_4$$

$$OT\Delta T \text{ Setpoint} = (RCA_5 + RMTE_5)$$

$$OT\Delta T \text{ Bistable} = (RCSA + RMTE_6)$$

Where:

RCA_1 = ΔT Channel Calibration Accuracy = ± 0.707 % (M3)
$RMTE_1$ = ΔT Channel Rack Measuring and Test Equipment = ± 0.173 % (M3MTE)
RD_1 = ΔT Channel Rack Drift = ± 1.00 %
RTE_1 = ΔT Channel Rack Temperature Effect = ± 0.50 %
RCA_2 = T_{AVG} Channel Calibration Accuracy = ± 0.707 % (M4)
$RMTE_2$ = T_{AVG} Channel Rack Measuring and Test Equipment = ± 0.245 % (M4MTE)
RD_2 = T_{AVG} Channel Rack Drift = ± 1.00 %
RTE_2 = T_{AVG} Channel Rack Temperature Effect = ± 0.50 %
RCA_3 = Pressurizer Pressure Channel Calibration Accuracy = ± 0.00 %
$RMTE_3$ = Pressurizer Pressure Channel Rack Measuring and Test Equipment = ± 0.0 %
RD_3 = Pressurizer Pressure Channel Rack Drift = ± 0.00 %
RTE_3 = Pressurizer Pressure Channel Rack Temperature Effect = ± 0.00 %
RCA_4 = FΔI Channel Calibration Accuracy = ± 0.50 % (M15)
$RMTE_4$ = FΔI Channel Rack Measuring and Test Equipment = ± 0.346 % (M15MTE)
RD_4 = FΔI Channel Rack Drift = ± 1.00 %
RTE_4 = FΔI Channel Rack Temperature Effect = ± 0.50 %
RCA_5 = OTΔT Setpoint Summator Calibration Accuracy = ± 0.50 % (M7)
$RMTE_5$ = OTΔT Setpoint Summator Rack Measuring and Test Equipment = ± 0.374 % (M7MTE)
RCSA = OTΔT Reactor Trip Bistable = ± 0.50 % (M18)
$RMTE_6$ = OTΔT Reactor Trip Bistable Rack Measuring and Test Equipment = ± 0.224 % (M18MTE)

Some of the error terms listed above will be used to determine the Allowable Value (i.e., the As Found Tolerance) for Kewaunee's Overtemperature ΔT Reactor Trip. Similar error terms will be used throughout this document to evaluate the other multiple parameter protection functions at both plants.

3.3 The Instrumentation, Systems and Automation Society (ISA) Methodologies Used to Calculate Allowable Values

The following base line parameters will be used to illustrate how the Allowable Value is calculated using Methods 1, 2 and 3 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994.

Analytical Limit (AL)	= 6.00 PSIG
Total Instrument Loop Uncertainty (TLU)	= 1.39 PSIG
Calculated Instrument Uncertainties used for COT (COT)	= 1.10 PSIG
Calculated Instrument Uncertainties not used for COT (NON-COT)	= 0.85 PSIG

Notes:

1. In the context of this document, the Analytical Limit (AL), Safety Limit (SL), and the Safety Analysis Limit (SAL) have the same meaning.

2. In the context of this document, Total Instrument Loop Uncertainty (TLU) and the Channel Statistical Allowance (CSA) have the same meaning.

3. COT means Channel Operational Test.

4. COT Instrument Uncertainties are made up of the portion of the loop that is tested during the COT. For Surry, Kewaunee, and North Anna, these error components are:

   - Rack or Module Calibration Accuracy (RCA or M1, M2 ... Mn)
   - Rack Comparator Setting Accuracy or Comparator Module Calibration Accuracy (RCSA or Mn)
   - Rack Drift (RD)

5. NON-COT Instrument Uncertainties are made up of the portion of the loop that is not tested during the COT. For Surry, Kewaunee, and North Anna, these error components may include:

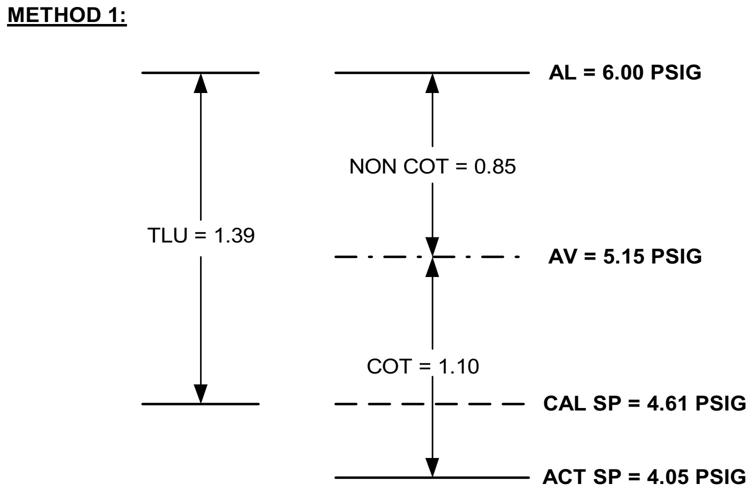
   - Systematic Error (SE)
   - Environmental Allowance (EA)
   - Process Measurement Accuracy (PMA)
   - Primary Element Accuracy (PEA)
   - Sensor Calibration Accuracy and Sensor Measuring and Test Equipment (SCA + SMTE)
   - Sensor Drift (SD)
   - Sensor Pressure Effect(s) (SPE)
   - Sensor Temperature Effect (STE)
   - Sensor Power Supply Effect (SPSE)
   - Rack Measuring and Test Equipment (RMTE or M1MTE, M2MTE ... MnMTE)
   - Rack Temperature Effect (RTE)

3.3.1 Method 1

Method 1 has been evaluated by the NRC Staff and was found to be an acceptable method to be used to calculate Allowable Values. Method 1 uses a TLU equal to 1.39 PSIG. The TLU was arrived at statistically using the Square Root Sum of the Squares (SRSS) method of combining channel error components. This is an accepted industry standard and is used here at Dominion Virginia Power. The channel error components used for the COT are equal to 1.10 PSIG and the error components used for the NON-COT are equal to 0.85. With a TLU equal to 1.39 PSIG and NON-COT errors equal 0.85 PSIG, then statistically, the COT error would be equal to 1.10 PSIG as shown below.

$$[(0.85)^2 + (1.10)^2]^{1/2} = 1.39 \quad \text{or} \quad [(1.39)^2 - (0.85)^2]^{1/2} = 1.10$$

If the COT error allowance were to be removed from the TLU, the statistical combination of the NON-COT error allowances would be equal to 0.85 PSIG. This means that the LSSS would have to be set such that the margin of 0.85 PSIG is maintained between the AV and the AL. To accomplish this using a COT error allowance of 1.10 PSIG, a determinant assessment must be used such that the COT allowance can only be equal to the TLU minus the NON-COT allowance, i.e., COT = 1.39 PSIG – 0.85 PSIG = 0.54 PSIG. In Method 1, the user decides that for the Channel Operational Test, the full COT allowance of 1.10 PSIG is to be retained. To maintain the full COT error allowance, the actual trip setpoint (ACT SP) is set below the calculated trip setpoint (CAL SP). Note that the difference between the CAL SP and the Allowable Value (AV) is 0.54 PSIG. The remainder of the desired COT allowance of 1.10 PSIG is obtained by lowering the ACT SP below the CAL SP by 0.56 PSIG to yield the ACT SP value of 4.05 PSIG. Method 1 ensures that the full NON-COT allowance of 0.85 PSIG is available under all conditions for the non-tested channel error components.



LEGEND: TLU = TOTAL LOOP UNCERTAINTY AL = ANALYTICAL LIMIT (SAL) AV = ALLOWABLE VALUE
NON COT = NON TESTED LOOP UNCERTAINTY COT = TESTED LOOP UNCERTAINTY
CAL SP = CALCULATED SETPOINT ACT SP = ACTUAL SETPOINT

Figure 3.3-1

3.3.2 Method 2

Method 2 has been evaluated by the NRC Staff and was found to be an acceptable method to be used to calculate Allowable Values. Method 2 is essentially the same as Method 1 with the exception that the ACT SP is set equal to the CAL SP (i.e., 4.61 PSIG). This method does not allow for the full value of the COT error components as determined in the TLU (i.e., CSA Calculation). In some cases, this could cause the plant to find the AS FOUND Trip Setpoint outside of the AV more often than would be the case using Method 1. Like Method 1, Method 2 ensures that the statistical combination of the NON-COT error allowances (equal to 0.85 PSIG) is maintained between the AV and the AL under all conditions.

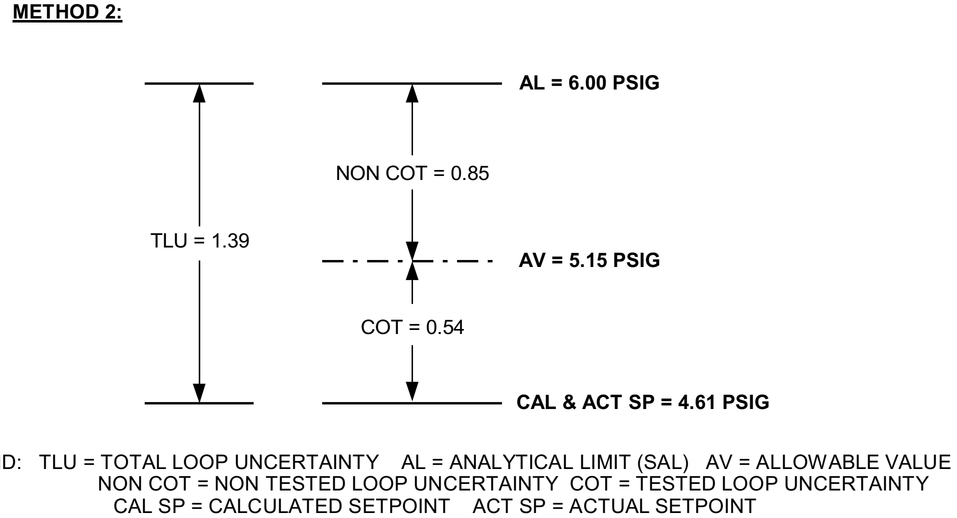
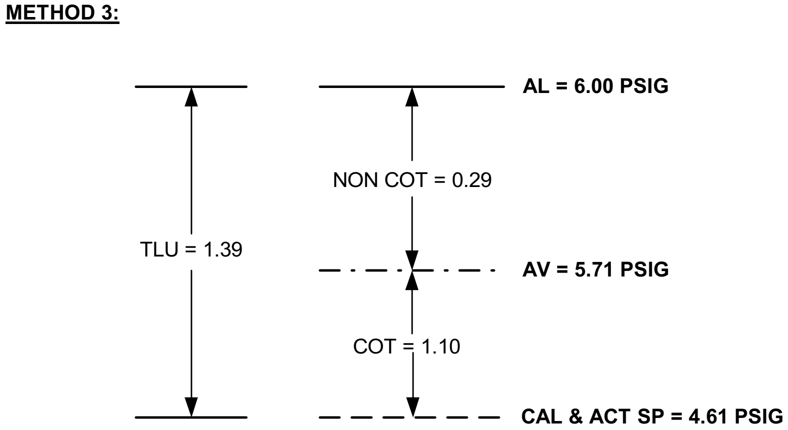


Figure 3.3-2

3.3.3 Method 3

Method 3 has been evaluated by the NRC Staff and was found to be an unacceptable method to be used to calculate Allowable Values. Method 3 has been used to calculate the Allowable Value in many Westinghouse Plants that used early versions of Standardized Technical Specifications (STS) as discussed above in Section 3.1. Using a determinant assessment, Method 3 does not ensure that the full NON-COT uncertainty allowance is maintained between the AV and the AL. To ensure that the NON-COT uncertainty allowance is maintained under all conditions, the AV must be set for ≤ 5.15 PSIG. As can be seen from the illustration below, the AV using Method 3 is set for 5.71 PSIG, i.e., CAL SP/ACT SP + COT = 5.71 PSIG. If the rack error components are allowed an offset of 1.10 PSIG before the channel is declared INOPERABLE, then the allowance for the NON-COT uncertainty is decreased to 0.29 PSIG. If the AS FOUND COT error was found to be (+) 1.05 PSIG and the AS FOUND NON-COT error was determined to be (+) 0.85 PSIG, then the channel trip function would have exceeded the Analytical Limit (i.e., SAL) and should be declared INOPERABLE. However, in accordance with Technical Specifications, the channel does not have to be declared INOPERABLE until the AS FOUND Trip Setpoint exceeds the Allowable Value. This is the concern that the NRC Staff has with Method 3. In the case of Method 3 using a determinant assessment, the AV does not protect the AL and does not identify an inoperable channel under all operating conditions.



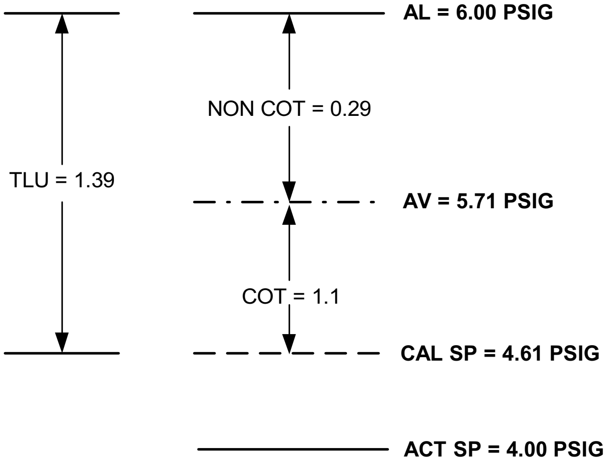
LEGEND: TLU = TOTAL LOOP UNCERTAINTY AL = ANALYTICAL LIMIT (SAL) AV = ALLOWABLE VALUE
NON COT = NON TESTED LOOP UNCERTAINTY COT = TESTED LOOP UNCERTAINTY
CAL SP = CALCULATED SETPOINT ACT SP = ACTUAL SETPOINT

Figure 3.3-3

3.3.4 Method 3 with Additional Margin

Method 3 using additional margin for the ACT SP has been evaluated by the NRC Staff and was found to be an unacceptable method to be used to calculate Allowable Values. Method 3 with additional margin is identical to Method 3 with the exception that the ACT SP is set below the CAL SP. In the case used for this illustration, the ACT SP is set for 4.00 PSIG which provides a margin of 0.61 PSIG to the CAL SP and 1.71 PSIG to the AV. This method actually yields less conservative results than Method 3 for two reasons. First, the AV is still set for 5.71 PSIG yielding a NON-COT allowance of 0.29 PSIG. As discussed above, using a determinant assessment, the NON-COT allowance of 0.29 PSIG does not fully account for the statistical combination of the non-tested loop error components. Second, the calculated COT allowance was determined to be 1.10 PSIG. Allowing an error of 1.71 PSIG between the ACT SP and the AV is beyond the assumptions used to develop the TLU (i.e., CSA Calculation). Allowing an error of 1.71 PSIG for the Trip Setpoint before the channel is declared INOPERABLE is inconsistent with the applicable TLU assumptions and will not ensure that the rack components are operating within the assumptions of the CSA Calculation and/or the manufacturer specifications. Also note that the difference between the ACT SP and the AV is larger than the calculated TLU for the entire channel.

METHOD 3 WITH ADDITIONAL MARGIN:



LEGEND: TLU = TOTAL LOOP UNCERTAINTY AL = ANALYTICAL LIMIT (SAL) AV = ALLOWABLE VALUE
NON COT = NON TESTED LOOP UNCERTAINTY COT = TESTED LOOP UNCERTAINTY
CAL SP = CALCULATED SETPOINT ACT SP = ACTUAL SETPOINT

Figure 3.3-4

3.4 Methodology for Determining North Anna “Allowable Values” and Surry “LSSS/Setting Limits”

Information Intentionally Removed
Specific to North Anna Power Station and Surry Power Station Only

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Specific to North Anna Power Station and Surry Power Station Only

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Specific to North Anna Power Station and Surry Power Station Only

3.5 Methodology for Determining Kewaunee's "Allowable Value" and "Limiting Trip Setpoint" Based on TSTF-493 and RIS 2006-17

Kewaunee's setpoint methodology is identical to that of Surry and North Anna noting that the requirements and revised terminology imposed by TSTF-493 and RIS 2006-17 (Refs. 5.99 and 5.100) will be incorporated into the methodology as appropriate. Kewaunee Power Station has chosen to implement TSTF-493, Revision 4, Option B as part of the conversion to Improved Technical Specifications. As stated above in Section 2.2.6, TSTF-493, Revision 4, Option B allows for the relocation of the Allowable Values associated with LCO's 3.3.1, 3.3.2, 3.3.5, 3.3.6, and 3.3.7 from Section 3.3 of Technical Specifications to a Licensee controlled program as defined in ITS Section 5.5.16. The Licensee controlled program is defined in ITS Section 5.5.16 as the "Setpoint Control Program".

The Setpoint Control Program establishes the requirements for ensuring that setpoints for automatic protective devices are initially within and remain within the Technical Specification requirements. The Setpoint Control Program will govern the process for implementing changes to instrumentation setpoints and will describe the setpoint methodology used to ensure that setpoints are established in accordance with the requirements of Methods 1 or 2 from ISA-RP67.04.02-2000 and ISA-RP67.04-Part II-1994, TSTF-493, Revision 4, Option B, and RIS 2006-17. The automatic protective devices related to variables that perform a significant safety function at Kewaunee Power Station as delineated by 10 CFR 50.36(c)(1)(ii)(A) are described in detail in Sections 4.5, 4.6, and 4.7.

3.5.1 Primary RPS and ESFAS Trips, Permissives, and Other LCO's Credited in the Kewaunee Safety Analysis

A four step process is used to determine the Allowable Value (AV), Limiting Trip Setpoint (LTSP), Nominal Trip Setpoint (NTSP), and the As Found Tolerance (AFT) for Trip Functions, Permissives, and other LCO's at Kewaunee Power Station that are credited in the Safety Analysis. This four step process is based on the requirements of Methods 1 or 2 as described in ISA-RP67.04.02-2000 (Ref 5.43) and the revised terminology described in TSTF-493, Revision 4, and RIS 2006-17. In the order of operation, the four steps are described below and they are illustrated in Figure 3.5-1

1. Determine the Minimum (decreasing trip) or Maximum (increasing trip) Limiting Trip Setpoint (LTSP). The Maximum Limiting Trip Setpoint is arrived at by subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) (also known as the Safety Analysis Limit). The Minimum Limiting Trip Setpoint is arrived at by adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL).

2. Determine the Minimum (decreasing trip) or Maximum (increasing trip) Allowable Value (AV). This Maximum Allowable Value is arrived at by subtracting the statistical combination (i.e., Square Root of the Sum of the Squares "SRRS") of the NON COT Loop Error Components (i.e., the loop error terms that are not tested or quantified during the Channel Operational Test "COT") from the Analytical Limit (AL). The Minimum Allowable Value is arrived at by adding the statistical combination of the NON COT Loop Error Components to the Analytical Limit (AL).

3. Determine the Nominal Trip Setpoint (NTSP). After the LTSP is determined in step 1, the current Nominal Trip Setpoint for the function can be evaluated for acceptability. It may be desirable to move the current Nominal Trip Setpoint in a more conservative direction to obtain additional margin to the Analytical Limit and/or to allow for the full COT error allowance between the Nominal Trip Setpoint and the As Found Tolerance (AFT). Conversely, the current Nominal Trip Setpoint may be overly conservative resulting in reduced operating margin. If there is sufficient margin to the Analytical Limit, then it may be desirable to move the existing Nominal Trip Setpoint in the non-conservative direction to obtain additional operating margin. In all cases, the NTSP must be set equal to or, preferably, conservative with respect to the LTSP.

4. Determine the As Found Tolerance (AFT). Note that the As Found Tolerance for Kewaunee is equivalent to the Allowable Values/Limiting Safety System Settings/Setting Limits used for North Anna and Surry. After the AV is determined in step 2, the As Found Tolerance can be determined based on the NTSP. The AFT for an increasing trip function is arrived at by adding the statistical combination (i.e., Square Root of the Sum of the Squares “SRRS”) of the COT Loop Error Components (i.e., the loop error terms that are tested or quantified during the Channel Operational Test “COT”) to the Nominal Trip Setpoint (NTSP). The AFT for a decreasing trip function is arrived at by subtracting the statistical combination of the COT Loop Error Components from the Nominal Trip Setpoint. In all cases, the As Found Tolerance must be set equal to or, preferably, conservative with respect to the Allowable Value.

Kewaunee's Four Step Process

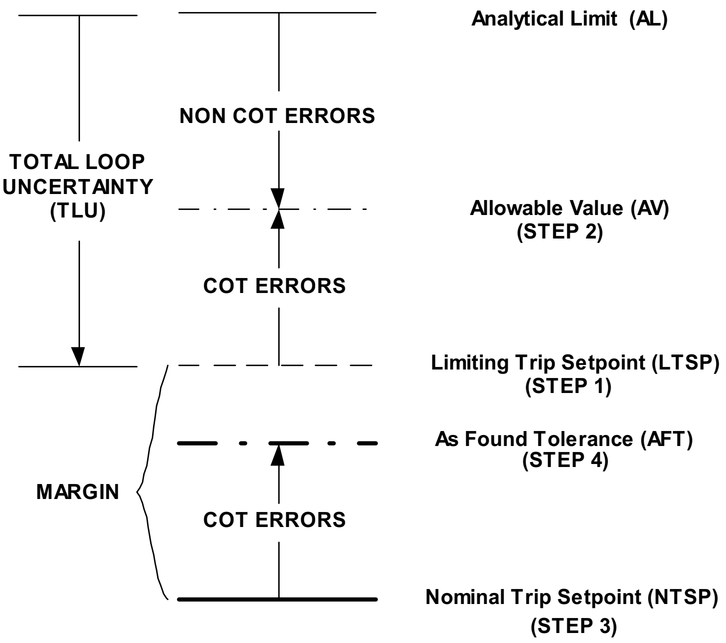

Figure 3.5-1

3.5.2 Backup RPS and ESFAS Trips, Permissives, and Other LCO's Not Credited in the Kewaunee Safety Analysis

A two step process is used to determine the As Found Tolerance for Backup RPS and ESFAS Functions at Kewaunee Power Station that are not credited in the Safety Analysis. Backup RPS/ ESFAS and other LCO's Trip Functions do not have a documented Safety Limit; therefore, Limiting Trip Setpoints and Allowable Values do not need to be calculated. In some cases for Backup Trips, a TLU (i.e., CSA Calculation) may not be available to perform the process described below. In such a case, the process is subjective and should be based on the best available information. The two step process is described below.

1. Determine the Nominal Trip Setpoint (NTSP). The current Nominal Trip Setpoint for the function should be evaluated for acceptability. It may be desirable to move the current Nominal Trip Setpoint in a more conservative direction to obtain additional margin to ensure the function will support the associated Primary Trip, if applicable. Conversely, the current Nominal Trip Setpoint may be overly conservative resulting in reduced operating margin. If there is sufficient margin with respect to the associated Primary Trip Analytical Limit (if applicable), then it may be desirable to move the existing Nominal Trip Setpoint in the non-conservative direction to obtain additional operating margin.

2. Determine the As Found Tolerance (AFT). The AFT for an increasing trip function is arrived at by adding the statistical combination (i.e., Square Root of the Sum of the Squares "SRRS") of the COT Loop Error Components (i.e., the loop error terms that are tested or quantified during the Channel Operational Test "COT") to the Nominal Trip Setpoint (NTSP). The AFT for a decreasing trip function is arrived at by subtracting the statistical combination of the COT Loop Error Components from the Nominal Trip Setpoint (NTSP).

3.5.3 Calculating Limiting Trip Setpoints, Allowable Values, and As Found Tolerances for Kewaunee Power Station

Kewaunee's Steam Generator Water Level High - High

Currently, Kewaunee's Custom Technical Specifications (Ref. 5.90) does not specify a Setting Limit for the Steam Generator High-High Water Level ESFAS Trip. This function will be included in the Setpoint Control Program in accordance with ITS Table 3.3.2.1, item 5.b. Based on the requirements of ITS Section 5.5.16, this function will be evaluated based on the four step method described in Section 3.5.1 to ensure that it is bounded by the CSA Calculation of record and by the Safety Analysis assumptions documented in Technical Report NE-0994 (Ref. 5.1). The example given below will be adjusted to include the revised terminology and requirements specified in TSTF-493, Revision 4 and RIS 2006-17 to support the conversion to ITS and the implementation of the Kewaunee Setpoint Control Program.

Given Information:

Analytical Limit = 100.0 % Narrow Range Level (Ref. 5.1)

Current CTS Setting Limit = not specified

Current Nominal Trip Setpoint = 66.5 % Narrow Range Level (Ref. 5.112)

Total Loop Uncertainty/Channel Statistical Allowance = (+) 3.967 to (+) 7.923 % Narrow Range Level (only the most positive value is used for the analysis) (Ref. 5.97)

Type of Trip = Increasing Trip, Normally Energized (Ref. 5.112)

Functional Group = Primary Trip, Single Parameter Protection Function (Refs. 5.1 and 5.112)

Step 1 - Determine the Limiting Trip Setpoint (LTSP)

The Limiting Trip Setpoint (LTSP) is equal to the Analytical Limit (AL) minus the Total Loop Uncertainty (TLU). Thus, the LTSP is equal to:

$$\text{LTSP} = 100.0\ \% - 7.923\ \%$$

$$\text{LTSP} = 92.077\ \%\ \text{Narrow Range Level}$$

Step 2 - Determine the Allowable Value (AV)

The Allowable Value (AV) is equal to the Analytical Limit (AL) minus the NON-COT loop error components taken from the Total Loop Uncertainty (TLU) calculation. The NON-COT loop error components from Kewaunee CSA Calculation C11116 (Ref. 5.97) are detailed below:

Systematic Error (SE) = ± 0.000 % of span
Process Measurement Accuracy (PMA_3) = ± 5.945 % of span
Primary Element Accuracy (PEA) = ± 0.000 % of span
Sensor Calibration Accuracy + Sensor Measuring & Test Equipment (SCA+SMTE) = ± 0.467 % of span
Sensor Drift (SD) = ± 0.280 % of span
Sensor Pressure Effects (SPE) ± 0.577 % of span
Sensor Temperature Effects (STE) = ± 1.241 % of span
Sensor Power Supply Effect (SPSE) = ± 0.060 % of span
Module 1 Measuring and Test Equipment (M1MTE) = ± 0.000 % of span
Module 3 Measuring and Test Equipment (M3MTE) = ± 0.200 % of span
Rack Temperature Effect (RTE) = ± 0.500 % of span

Combining the NON-COT loop error components using the Square Root of the Sum of the Squares (SRSS) method as described in Dominion Standard STD-EEN-0304 (Ref. 5.5), we have the following NON-COT total error:

$\text{NON COT}_{\text{error}} = SE + PMA_3 \pm [PEA^2 + (SCA+SMTE)^2 + SD^2 + SPE^2 + STE^2 + SPSE^2 + M1MTE^2 + M3MTE^2 + RTE^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 + 5.945 \pm [0.0^2 + (0.25+0.217)^2 + 0.280^2 + 0.577^2 + 1.241^2 + 0.060^2 + 0.0^2 + 0.20^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} =$ 7.514 % Narrow Range Level

The Allowable Value (AV) for an increasing trip based on the requirements of Methods 1 or 2 as described in ISA-RP67.04.02-2000 (Ref. 5.43) is determined by subtracting the total NON-COT error from the Analytical Limit as shown below.

$$AV = 100.0\ \% - 7.514\ \%$$

$$AV = 92.486\ \%\ \text{Narrow Range Level}$$

Step 3 - Determine the Nominal Trip Setpoint (NTSP)

As determined in Step 1, the Limiting Trip Setpoint is equal to 92.077 % Narrow Range Level. The current Nominal Trip Setpoint for this function at Kewaunee is 66.5 % Narrow Range Level. The Nominal Trip Setpoint is conservative with respect to the Limiting Trip Setpoint. The nominal operating band for Steam Generator Level at 100 % power is 44.0 % Level ± 5.0 % Level (Refs. 5.134 and 5.135). Subtracting the worst case normal operating level of 49.0 % from the Nominal Trip Setpoint of 66.5 % yields an operating margin of 17.5 % level. This operating margin encompasses the entire Total Loop Uncertainty and should allow for stable operation. Therefore, the current Nominal Trip Setpoint of 66.5 % Narrow Range Level will be retained.

Step 4 - Determine the As Found Tolerance (AFT)

As determined in Step 2, the Allowable Value (AV) is equal to 92.486 % Narrow Range Level. The As Found Tolerance will be based on the COT error components taken from Calculation C11116 (Ref. 5.97) as shown below.

The As Found Tolerance is equal to the Nominal Trip Setpoint plus the COT loop error components taken from the Total Loop Uncertainty (TLU) calculation. The COT loop error components from CSA Calculation C11116 are detailed below:

Module 1 – Foxboro or NUS Loop Power Supply (M1) = ± 0.00 % of span
Module 3 – Foxboro or NUS Bistable Module (M3) = ± 0.50 % of span
Rack Drift (RD) = ± 1.0 % of span

Combining the COT loop error components using the Square Root of the Sum of the Squares (SRSS) method as described in Dominion Standard STD-EEN-0304 (Ref. 5.5), we have the following COT total error:

$$COT_{error} = \pm (M1^2 + M3^2 + RD^2)^{1/2}$$

$$COT_{error} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$$

$$COT_{error} = \pm 1.12 \text{ \% Narrow Range Level}$$

As described in Step 4 above, the As Found Tolerance (AFT) for an increasing trip is determined by adding the total COT error to the Nominal Trip Setpoint as shown below.

$$AFT = 66.5 \text{ \%} + 1.12 \text{ \%} = 67.62 \text{ \% Narrow Range Level}$$

This As Found Tolerance of 67.62 % Narrow Range Level will be included in the Setpoint Control Program to support Kewaunee's conversion to ITS, noting the Nominal Trip Setpoint is equal to 66.5 % Narrow Range Level. The Nominal Trip Setpoint and the As Found Tolerance are both set below the Allowable Value of 92.486 % Narrow Range Level and the Limiting Trip Setpoint of 92.077 % Narrow Range Level.

As Found Tolerance (AFT) = 66.5 % Narrow Range Level ± 1.12 % Narrow Range Level
As Left Tolerance (ALT) = 66.5 % Narrow Range Level ± 0.50 % Narrow Range Level(1)

Steps 1 through 4 as they apply for Kewaunee's Steam Generator High-High Water Level Reactor Trip are illustrated below in Figure 3.5-2.

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(1) ALT = COT error minus Rack Drift (RD) = $\pm (0.0^2 + 0.5^2)^{1/2} = \pm 0.5$ % of span = ± 0.5 % NR Level

KEWAUNEE'S STEAM GENERATOR HI-HI WATER LEVEL ESFAS

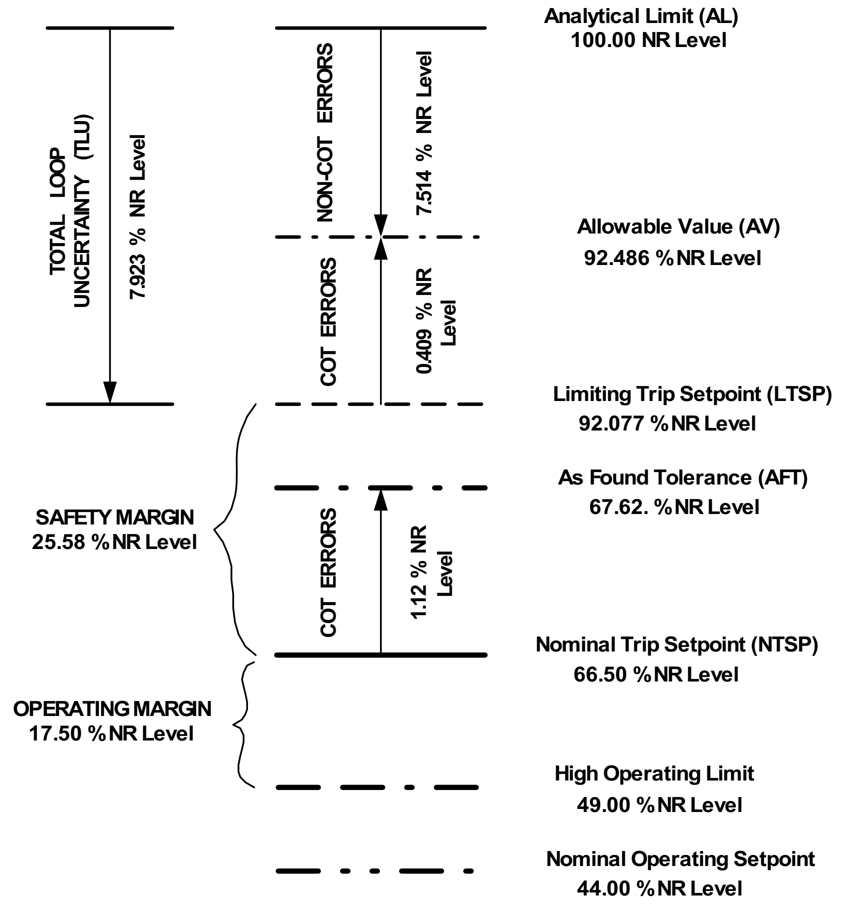

Figure 3.5-2

In addition to the above, TSTF-493, Revision 4 and RIS 2006-17 also stipulate that the As Left Tolerance be specified as part of the Setpoint Control Program. The As Left Tolerances will be specified for Kewaunee's RPS instrumentation, ESFAS instrumentation, and other instrumentation associated with LCO's 3.3.5, 3.3.6, and 3.3.7 in Sections 4.5, 4.6, and 4.7, respectively. In general, for single input parameters, the As Left Tolerance will be equal to the calibration accuracy of the module or the SRSS of calibration accuracies of the modules used to develop the trip function. For multiple input parameters, the As Left Tolerance will be developed as described in Sections 4.5, 4.6, and 4.7.

4.0 RESULTS

4.1 Allowable Values for North Anna ITS Table 3.3.1-1 (RTS Instrumentation)

Information Intentionally Removed
Specific to North Anna Power Station Only

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4.2 Allowable Values for North Anna ITS Table 3.3.2-1 (ESFAS Instrumentation)

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Specific to North Anna Power Station Only

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4.3 Limiting Safety System Settings (LSSS) for Surry Power Station Custom Technical Specifications, Section 2.3, Limiting Safety System Settings, Protective Instrumentation and Protective Instrumentation Settings for Reactor Trip Interlocks.

Information Intentionally Removed
Specific to Surry Power Station Only

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Specific to Surry Power Station Only**

4.4 Setting Limits for Surry Power Station Custom Technical Specifications, Table 3.7-4, Engineered Safety Features Actuation System Instrumentation Setting Limits and Table 3.7-2, Engineered Safety Features Actuation System Instrumentation Operating Conditions

Information Intentionally Removed
Specific to Surry Power Station Only

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Specific to Surry Power Station Only

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Specific to Surry Power Station Only**

4.5 Limiting Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances for Kewaunee Reactor Protection System (RPS) Instrumentation to Support the Setpoint Control Program

Note : Only the limiting As Found Tolerance value will be addressed in analysis for each Reactor Trip Function described below.

Reactor Trips

4.5.1 Power Range Neutron Flux High Setpoint Reactor Trip

As Found Tolerance Value : 105 % RTP ± 1.5 % RTP (Refs. 5.1, 5.90, 5.91, 5.103, and 5.104)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 110.96 % Rated Thermal Power (RTP). Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 111.19 % RTP. The Nominal Trip Setpoint (NTSP) of 105.0 % RTP is conservative with respect to the Limiting Trip Setpoint and the As Found Tolerance Value of ≤ 106.5 % RTP is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value of ≤ 109 % RTP will be changed to an As Found Tolerance value ≤ 106.5 % RTP to conform to the requirements of TSTF-493, Rev. 4 and RIS 2006-17. The As Found Tolerance is based on a Nominal Trip Setpoint value of 105 % RTP. The Nominal Trip Setpoint value of 105 % RTP will allow a 1.5 % RTP margin to be used for the COT error components. The revised As Found Tolerance value of ≤ 106.5 % RTP is conservative with respect to the calculated value of ≤ 106.56 % RTP using the CSA rack error terms from Calculation C11705 (Ref 5.91).

The calculated As Found Tolerance value for this function is ≤ 106.562 % RTP. The 0.062 % RTP offset will be subtracted from the calculated value to arrive at a value that can be determined on the indicator. The statistical combination of the COT and NON COT error components from CSA Calculation C11705 (Ref. 5.91) are given below. The COT and NON COT error components are used in Figure 4.5.1 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$$\text{NON COT}_{\text{error}} = \text{SE} \pm (\text{PMA}_1^2 + \text{PMA}_3^2 + \text{M1MTE}^2 + \text{M3MTE} + \text{RTE}^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = 0.333 \pm (1.417^2 + 5.124^2 + 0.185^2 + 0.193^2 + 0.5^2)^{1/2}$$

$$\text{NON COT}_{\text{error}} = \pm 5.679 \text{ \% of span} = \pm 6.815 \text{ \% RTP}$$

$$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M3}^2 + \text{RD}^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm (0.05^2 + 0.833^2 + 1.0^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm 1.302 \text{ \% of span} = \pm 1.562 \text{ \% RTP (for conservatism round to} \pm 1.5 \text{ \% RTP)}$$

As Found Tolerance (AFT) = 105 % RTP ± 1.5 % RTP
As Left Tolerance (ALT) = 105 % RTP ± 1.0 % RTP[(1)]

See Figure 4.5.1 for specific details.

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(1) As Left Tolerance = $\pm (M1^2 + M3^2)^{1/2} = \pm (0.05^2 + 0.833^2)^{1/2} = \pm 0.834$ % of span = ± 1.001 % RTP

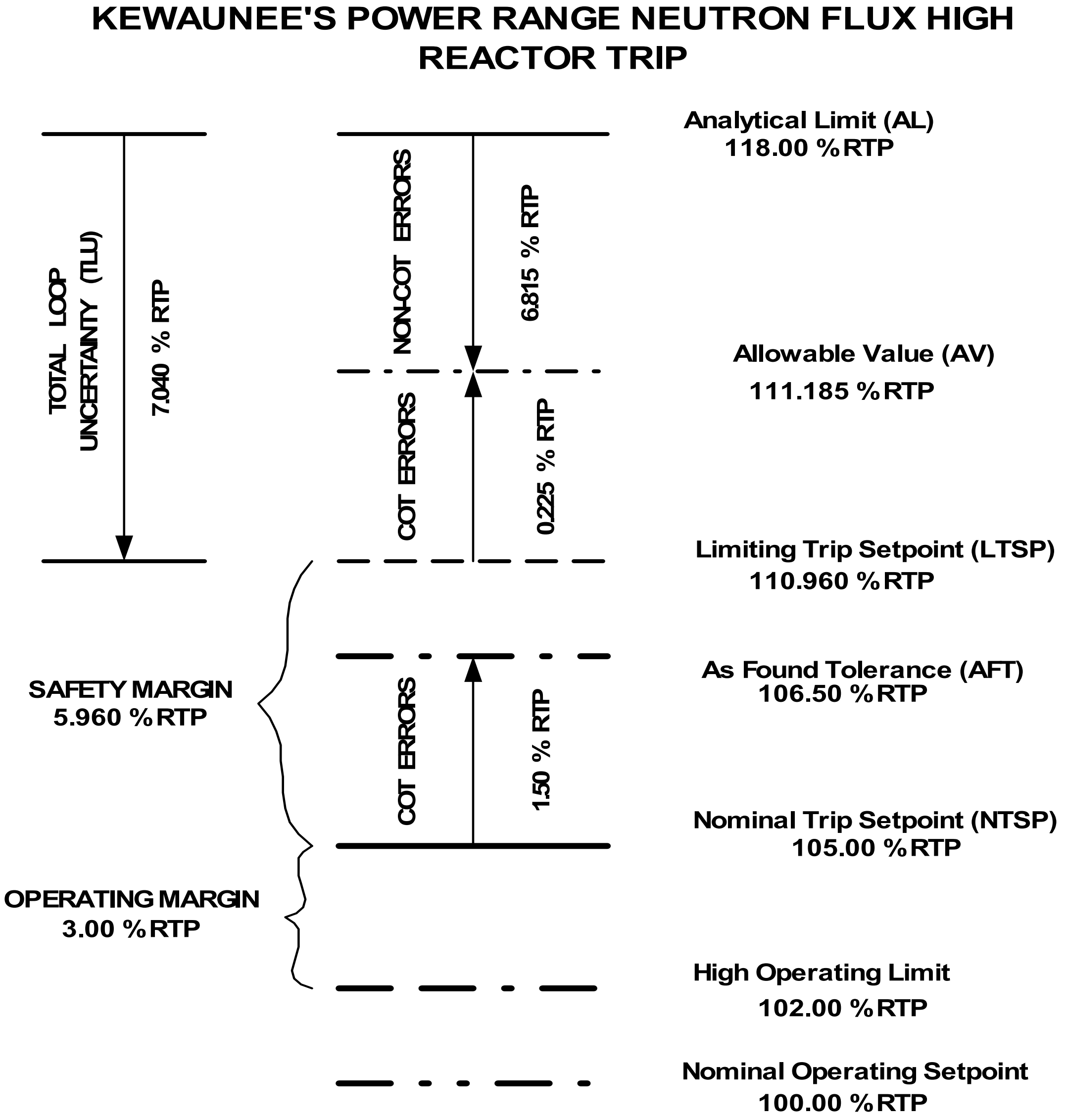

Figure 4.5.1

4.5.2 Power Range Neutron Flux Low Setpoint Reactor Trip

As Found Tolerance: 24.5 % RTP ± 1.5 % RTP (Refs. 5.1, 5.90, 5.91, 5.103, and 5.104)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 27.96 % Rated Thermal Power (RTP). Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 28.19 % RTP. The Nominal Trip Setpoint (NTSP) of 24.5 % RTP is conservative with respect to the Limiting Trip Setpoint and the As Found Tolerance Value of ≤ 26.062 % RTP (conservatively round to ≤ 26.0) is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value of ≤ 25 % RTP will be changed to an As Found Tolerance value of ≤ 26 % RTP to conform to the requirements of TSTF-493, Rev. 4 and RIS 2006-17. The As Found Tolerance is based on a Nominal Trip Setpoint value of 24.5 % RTP. The Nominal Trip Setpoint value of 24.5 % RTP will allow a 1.5 % RTP margin to be used for the COT error components.

The statistical combination of the COT and NON COT error components from CSA Calculation C11705 (Ref. 5.91) are given below. The COT and NON COT error components are used in Figure 4.5.2 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm (\text{PMA}_1^2 + \text{PMA}_3^2 + \text{M1MTE}^2 + \text{M4MTE} + \text{RTE}^2)^{1/2}$

$\text{NON COT}_{\text{error}} = 0.333 \pm (1.417^2 + 5.124^2 + 0.185^2 + 0.193^2 + 0.5^2)^{1/2}$

$\text{NON COT}_{\text{error}} = \pm 5.679$ % of span = ± 6.815 % RTP

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M4}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.05^2 + 0.833^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm 1.302$ % of span = ± 1.562 % RTP (for conservatism round to ± 1.5 % RTP)

As Found Tolerance (AFT) = 24.5 % RTP ± 1.5 % RTP
As Left Tolerance (ALT) = 24.5% RTP ± 1.0 % RTP(1)

See Figure 4.5.2 for specific details.

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(2) As Left Tolerance = $\pm (\text{M1}^2 + \text{M4}^2)^{1/2} = \pm (0.05^2 + 0.833^2)^{1/2} = \pm 0.834$ % of span = ± 1.001 % RTP

KEWAUNEE'S POWER RANGE NEUTRON FLUX LOW SETPOINT REACTOR TRIP

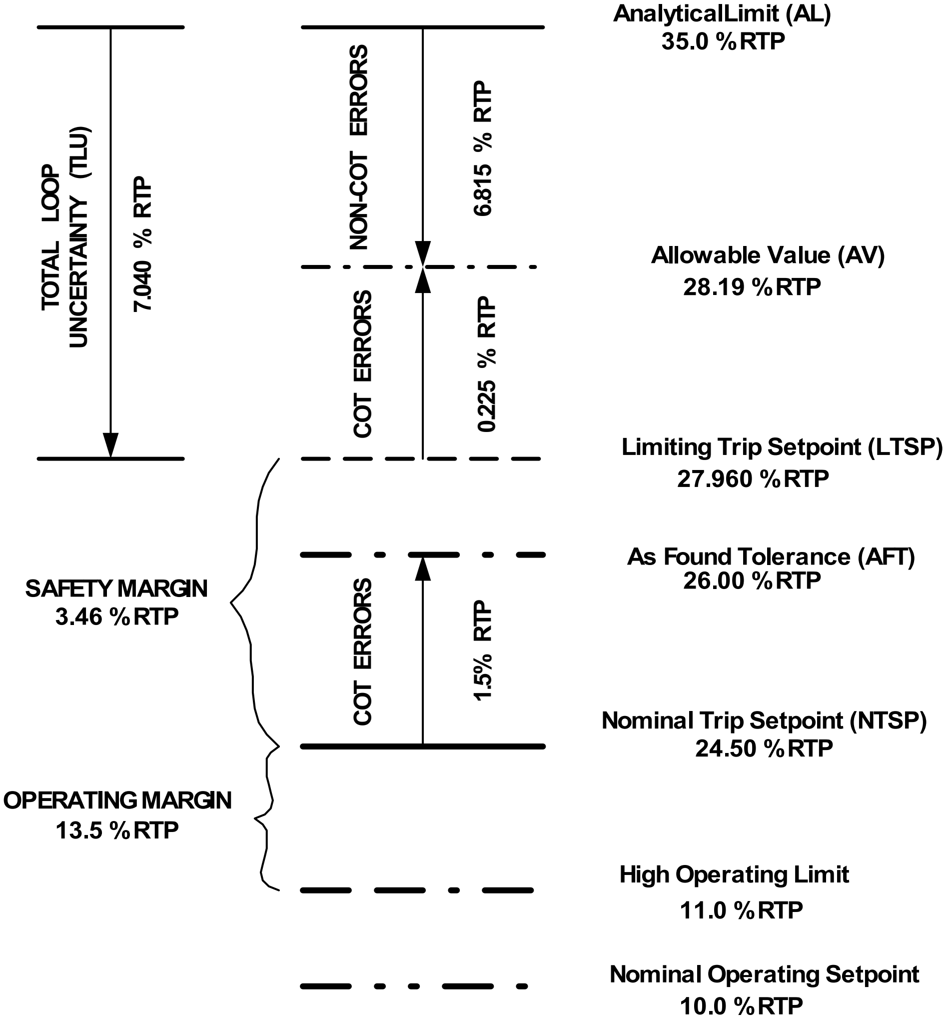

Figure 4.5.2

4.5.3 Power Range Neutron Flux High Positive Rate Reactor Trip

As Found Tolerance: **5.0 % RTP ± 1.3 % RTP with a time constant of 2.3 seconds ± 0.2 seconds (Refs. 5.1, 5.11, 5.12, 5.13, 5.73, 5.90, 5.91, 5.104, 5.136, & 5.142)**

The current Kewaunee Custom Technical Specifications (CTS) LSSS value for this function is 15.0 % / Δq / 5.0 seconds. The manner in which this specification is presented in Kewaunee's CTS is different than the typical presentation in Standardized Technical Specifications (STS) or in Improved Technical Specifications (ITS). The typical expression for this function in STS or ITS would be "≤ 15.0 % RTP with a time constant ≥ 5.0 Seconds." For consistency and clarity, the expression for this function will be written in the ITS format. The current static Nominal Trip Setpoint (NTSP) for this function is (+) 5.0 % RTP and the Rate Lag Derivative Time Constant associated with this function is currently set at a nominal value of 2 seconds versus the required CTS LSSS value of 5.0 seconds.

For Rate Lag Derivative functions, conservative settings are ≥ the desired/required time constant. The Power Range Neutron Flux Positive Rate Reactor Trip is developed based on a combination of the dynamic compensation from the Rate Lag Derivative Module (NM311) and the static trip setpoint installed in the Bistable Relay Driver (NC303). When Kewaunee's current settings for Rate Lag Derivative Module (i.e., nominal 2 second time constant) and the Bistable Relay Driver (i.e., nominal trip setpoint is + 5.0 % RTP) are combined, the Power Range Neutron Flux Positive Rate Reactor Trip function is set conservative when compared to the current CTS LSSS settings (i.e., + 15.0 % RTP with a time constant of 5 seconds) for all postulated conditions which include both a ramp and a step. The major contributing factor that results in this determination is based on the fact that the nominal trip setpoint is set at 5.0 % RTP versus 15.0 % RTP. The currently installed settings versus the current LSSS settings will be compared below for both a step and a ramp.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a step input is:

$$V_{OUT} = G * (e^{-t/t1} * (V_F - V_I) + B)$$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 0.1 second)
$t1$ = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_F = Voltage input to the Rate Lag Derivative Module after the step change = 8.771 VDC
V_I = Voltage input to the Rate Lag Derivative Module before the step change = 8.333 VDC
B = Rate Lag Derivative Module Bias = 0.000 VDC

There is no pedestal voltage for the NIS Rate Lag Derivative Modules. For a step change starting at V_{OUT} = 0.000 VDC with the currently installed settings, i.e., + 5.0 % RTP = (5 %/120 %) * 10.000 VDC = + 0.417 VDC and a nominal Rate Lag Derivative Time Constant of 2 seconds, the Power Range Neutron Flux Positive Rate Reactor Trip will occur with a power change of 5.256 % RTP. This includes a conservative assumption of 0.1 seconds used for the time of interest (i.e., t) to account for on-board module lag(s) and the process lags. Therefore, the common parameters are:

Bistable Relay Driver Setpoint = 5.0 % RTP = 0.417 VDC
Rate Lag Derivative Time Constant = 2 seconds

To make the Positive Rate Bistable Relay Driver trip, we must use a step change of 0.438 VDC to account for lags in the system as discussed above. This step change voltage is calculated as:

$(1 / e^{-0.1/2}) * 0.417$ VDC = 0.438 VDC

With the currently installed settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/2} * (8.771 - 8.333) + 0.000)$
$V_{OUT(NM311)}$ = 0.417 VDC (Bistable Relay Driver TRIP), noting that actual power is equal to (0.438 VDC / 10.000 VDC) * 120 % RTP = (+) 5.256 % RTP.

Using the same input parameters and substituting Kewaunee's current LSSS settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/5} * (8.771 - 8.333) + 0.000)$
$V_{OUT(NM311)}$ = 0.429 VDC (Bistable Relay Driver RESET), noting that actual power is equal to (+) 5.256 % RTP. However, the installed setpoint for the Bistable Relay Driver would be set at (+) 15.0 % RTP = (15 % RTP / 120 % RTP) * 10.000 VDC = 1.250 VDC.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a ramp input is:

$V_{OUT} = G * V_I + t1 * RR * G * (1 - e^{-t/t1}) + B$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 5 seconds)
t1 = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_I = Voltage input to the Rate Lag Derivative Module before the ramp starts = 8.333 VDC
RR = Ramp Rate (VDC/Second)
B = Rate Lag Derivative Module Bias = 0.000 VDC

The assumption used for this example for the Ramp Rate (RR) is a (+) 15.0 RTP power change in 5 seconds. That means the indicated power on the Full Power Meter goes from 100 % RTP to 115 % RTP in 5 seconds. So the Ramp Rate will be [(15 % RTP / 120 % RTP) * 10.000 VDC] / 5 seconds = 0.250 VDC / second = 3.0 % RTP / second. The currently installed settings versus the current Technical Specifications LSSS settings will be compared below for a ramp of (+) 3.0 % RTP / second at a time of interest (t) of 5 seconds after the ramp begins.

With the currently installed settings, the Positive Rate Trip will respond as shown below:

Nominal Trip Setpoint = (+) 5.0 % RTP = 0.417 VDC
Nominal Rate Lag Derivative Time Constant = 2 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 2 * 0.250 * 1.0000 (1 - e^{-5/2}) + 0.000$
$V_{OUT(NM311)}$ = 0.459 VDC (Bistable Relay Driver TRIP)

With the current Technical Specifications LSSS settings, the Positive Rate Trip will respond as shown below:

Nominal Trip Setpoint = (+) 15.0 % RTP = 1.250 VDC
Nominal Rate Lag Derivative Time Constant = 5 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 5 * 0.250 * 1.0000 (1 - e^{-5/5}) + 0.000$
$V_{OUT(NM311)}$ = 0.790 VDC (Bistable Relay Driver RESET)

As can be seen from the examples above, from a dynamic perspective, the current Technical Specifications LSSS setting for the Rate Lag Derivative Time Constant (i.e., time constant = 5 seconds) will yield the most conservative output from NM311 for both a ramp and a step. However, when the dynamics and the statics are combined for the overall function, noting that the installed static nominal trip setpoint is set conservative by 10.0 % RTP, the currently installed settings are conservative for all conditions. It should also be noted that Kewaunee's currently installed settings of (+) 5.0 % RTP with a Rate Lag Derivative Time Constant of 2 seconds are consistent with the nominal Standardized Technical Specifications (STS) values for this function and are identical to North Anna's settings for this function.

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. CSA Calculation 11705 (Ref. 5.91) and Instrument Surveillance Procedure SP-48-004A (Ref. 5.104) were used to perform this analysis.

Static As Found Tolerance (AFT) = 5.0 % RTP ± 1.3 % RTP(1)
Static As Left Tolerance (ALT) = 5.0% RTP ± 0.5 % RTP(2)
Dynamic As Found Tolerance = 2.3 seconds ± 0.2 seconds(3)
Dynamic As Left Tolerance = 2.3 seconds ± 0.2 seconds(3)

---

(1) $AFT = \pm (M1^2+NM311^2+NC303^2+RD^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2+1.0^2)^{1/2} = \pm 1.086$ % span = ± 1.303 % RTP
(2) $ALT = \pm (M1^2+NM311^2+NC303^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2)^{1/2} = \pm 0.424$ % span = ± 0.508 % RTP
(3) The Dynamic Tolerance is equal to ± 10 % of the desired time constant based on Reference 5.73.

Note: the calibration accuracy of NC303 is ± 0.5 % RTP = ± (0.5 % / 120 %) * 100 % span = ± 0.417 % span

4.5.4 Power Range Neutron Flux High Negative Rate Reactor Trip

As Found Tolerance: 5.0 % RTP ± 1.3 % RTP with a time constant of 2.3 seconds ± 0.2 seconds (Refs. 5.1, 5.11, 5.12, 5.13, 5.73, 5.90, 5.91, 5.104, 5.136, & 5.142)

The current Kewaunee Custom Technical Specifications (CTS) LSSS value for this function is 10.0 % / Δq / 5.0 seconds. The manner in which this specification is presented in Kewaunee's CTS is different than the typical presentation in Standardized Technical Specifications (STS) or in Improved Technical Specifications (ITS). The typical expression for this function in STS or ITS would be "≤ 10.0 % RTP with a time constant ≥ 5.0 Seconds." For consistency and clarity, the expression for this function will be written in the ITS format. The current static Nominal Trip Setpoint (NTSP) for this function is (-) 5.0 % RTP and the Rate Lag Derivative Time Constant associated with this function is currently set at a nominal value of 2 seconds versus the required CTS LSSS value of 5.0 seconds.

For Rate Lag Derivative functions, conservative settings are ≥ the desired/required time constant. The Power Range Neutron Flux Negative Rate Reactor Trip is developed based on a combination of the dynamic compensation from the Rate Lag Derivative Module (NM311) and the static trip setpoint installed in the Bistable Relay Driver (NC301). When Kewaunee's current settings for Rate Lag Derivative Module (i.e., nominal 2 second time constant) and the Bistable Relay Driver (i.e., nominal trip setpoint is + 5 % RTP) are combined, the Power Range Neutron Flux Negative Rate Reactor Trip function is set conservative when compared to the current CTS LSSS settings (i.e., - 10 % RTP with a time constant of 5 seconds) for all postulated conditions which include both a ramp and a step. The major contributing factor that results in this determination is based on the fact that the nominal trip setpoint is set at – 5.0 % RTP versus – 10.0 % RTP. The currently installed settings versus the current LSSS settings will be compared below for both a step and a ramp.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a step input is:

$$V_{OUT} = G * (e^{-t/t1} * (V_F - V_I) + B)$$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 0.1 second)
t1 = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_F = Voltage input to the Rate Lag Derivative Module after the step change = 7.895 VDC
V_I = Voltage input to the Rate Lag Derivative Module before the step change = 8.333 VDC
B = Rate Lag Derivative Module Bias = 0.000 VDC

There is no pedestal voltage for the NIS Rate Lag Derivative Modules. For a step change starting at V_{OUT} = 0.000 VDC with the currently installed settings, i.e., - 5.0 % RTP = (- 5 %/120 %) * 10.000 VDC = - 0.417 VDC and a nominal Rate Lag Derivative Time Constant of 2 seconds, the Power Range Neutron Flux Negative Rate Reactor Trip will occur with a power change of - 5.256 % RTP. This includes a conservative assumption of 0.1 seconds used for the time of interest (i.e., t) to account for on-board module lag(s) and the process lags. Therefore, the common parameters are:

Bistable Relay Driver Setpoint = - 5.0 % RTP = - 0.417 VDC
Rate Lag Derivative Time Constant = 2 seconds

To make the Negative Rate Bistable Relay Driver trip, we must use a step change of - 0.438 VDC to account for lags in the system as discussed above. This step change voltage is calculated as:

$(1 / e^{-0.1/2}) * - 0.417$ VDC = - 0.438 VDC

With the currently installed settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/2} * (7.895 – 8.333) + 0.000)$
$V_{OUT(NM311)}$ = - 0.417 VDC (Bistable Relay Driver TRIP), noting that actual power is equal to (-) 5.256 % RTP.

Using the same input parameters and substituting Kewaunee's current LSSS settings, NM311 will output the following:

$V_{OUT(NM311)} = 1.0000 * (e^{-0.1/5} * (7.895 – 8.333) + 0.000)$
$V_{OUT(NM311)}$ = - 0.429 VDC (Bistable Relay Driver RESET), noting that actual power is equal to (-) 5.256 % RTP. However, the installed setpoint for the Bistable Relay Driver would be set at (-) 10 % RTP = (-10 % RTP / 120 % RTP) * 10.000 VDC = - 0.833 VDC.

Based on References 5.12, 5.13, 5.136, and 5.137, the equation to determine the output of a Rate Lag Derivative Module for a ramp input is:

$V_{OUT} = G * V_I + t1 * RR * G * (1 - e^{-t/t1}) + B$

Where:

G = Module Gain = 1.0000 V/V
e = antilog of the natural log (e^x)
t = time of interest (for this example use 10 seconds)
t1 = Rate Lag Derivative Time Constant = 2 or 5 Seconds
V_I = Voltage input to the Rate Lag Derivative Module before the ramp starts = 8.333 VDC
RR = Ramp Rate (VDC/Second)
B = Rate Lag Derivative Module Bias = 0.000 VDC

The currently installed settings versus the current Technical Specifications LSSS settings will be compared below for the minimum ramp of (-) 3.0 % RTP / second at a time of interest (t) of 5 seconds after the ramp begins. This is the minimum ramp rate and approximate ramp time required to achieve a trip for either condition. The Ramp Rate VDC/Second = (- 3.0 % RTP/120 % RTP) * 10 VDC = (-) 0.250 VDC / Second.

With the currently installed settings, the Negative Rate Trip will respond as shown below:

Nominal Trip Setpoint = (-) 5.0 % RTP = - 0.417 VDC
Nominal Rate Lag Derivative Time Constant = 2 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 2 * - 0.250 * 1.0000 (1 - e^{-5/2}) + 0.000$
$V_{OUT(NM311)}$ = - 0.459 VDC (Bistable Relay Driver TRIP)

With the current Technical Specifications LSSS settings, the Negative Rate Trip will respond as shown below:

Nominal Trip Setpoint = (-) 10.0 % RTP = - 0.833 VDC
Nominal Rate Lag Derivative Time Constant = 5 Seconds

$V_{OUT(NM311)} = 1.0000 * 0.000 + 5 * - 0.250 * 1.0000 (1 - e^{-5/5}) + 0.000$
$V_{OUT(NM311)}$ = - 0.790 VDC (Bistable Relay Driver RESET)

As can be seen from the examples above, from a dynamic perspective, the current Technical Specifications LSSS setting for the Rate Lag Derivative Time Constant (i.e., time constant = 5 seconds) yields the most conservative output from NM311 for both a ramp and a step. However, when the dynamics and the statics are combined for the overall function, noting that the installed static nominal trip setpoint is set conservative by 5.0 % RTP, the currently installed settings are conservative for all conditions. It should also be noted that Kewaunee's currently installed settings of (-) 5.0 % RTP with a Rate Lag Derivative Time Constant of 2 seconds are consistent with the nominal Standardized Technical Specifications (STS) values for this function and are identical to North Anna's settings for this function. Finally, Kewaunee's installed settings for this function are consistent with the requirements of WCAP-10298-A which specify nominal settings for the Power Range Negative Rate Trip of (-) 5.0 % RTP with a time constant of 2 seconds (Ref. 5.138).

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. CSA Calculation 11705 (Ref. 5.91) and Instrument Surveillance Procedure SP-48-004A (Ref. 5.104) were used to perform this analysis.

Static As Found Tolerance (AFT) = 5.0 % RTP ± 1.3 % RTP(1)
Static As Left Tolerance (ALT) = 5.0% RTP ± 0.5 % RTP(2)
Dynamic As Found Tolerance = 2.3 seconds ± 0.2 seconds(3)
Dynamic As Left Tolerance = 2.3 seconds ± 0.2 seconds(3)

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(1) $AFT = \pm (M1^2+NM311^2+NC301^2+RD^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2+1.0^2)^{1/2} = \pm 1.086$ % span = ± 1.303 % RTP
(2) $ALT = \pm (M1^2+NM311^2+NC301^2)^{1/2} = \pm (0.05^2+0.05^2+0.417^2)^{1/2} = \pm 0.424$ % span = ± 0.508 % RTP
(3) The Dynamic Tolerance is equal to ± 10 % of the desired time constant based on Reference 5.73.

Note: the calibration accuracy of NC301 is ± 0.5 % RTP = ± (0.5 % / 120 %) * 100 % span = ± 0.417 % span

4.5.5 Intermediate Range Neutron Flux High Reactor Trip

As Found Tolerance : 20.0 % RTP ± 5.0 % RTP (Refs. 5.1, 5.16, 5.29, and 5.116)

The current Custom Technical Specification (CTS) LSSS value of ≤ 40.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 20.0 % RTP. The current Custom Technical Specification (CTS) LSSS value is non-conservative based on the COT error components of the Nuclear Instrumentation System. The Intermediate Range Neutron Flux High Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); therefore no Channel Statistical Allowance (CSA) Calculation has been performed for this function. The typical COT error allowance for this function is approximately 5.0 % RTP. For example, the COT error for this function at Surry is equal to ± 5.678 % RTP, the COT error at North Anna is ± 4.403 % RTP, and the typical Standardized Technical Specifications (STS) COT allowance is 5 % RTP (Refs. 5.3, 5.16, and 5.29). The As Found Tolerance will be ≤ 25.0 % RTP. The As Found Tolerance of ≤ 25.0 % RTP is based on maintaining a Nominal Trip Setpoint Value of 20.0 % RTP.

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. Ref. 5.116 was used in the determination of the AFT and ALT below.

As Found Tolerance (AFT) = 20.0 % RTP ± 5.0 % RTP
As Left Tolerance (ALT) = 20.0% RTP ± 4.9 % RTP(1)

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(1) ALT = $\pm (CSA^2 - RD^2)^{1/2} = \pm (5.0^2 - 1.2^2)^{1/2} = \pm 4.854$ % RTP

4.5.6 Source Range Neutron Flux High Reactor Trip

As Found Tolerance: 1.0 E5 CPS + 0.466 E5 CPS, - 0.318 E5 CPS (Refs. 5.1, 5.17, 5.30, and 5.117)

The current Custom Technical Specification (CTS) LSSS for this function states “within Source Range span”. The current Nominal Trip Setpoint for this function is 1.0 E5 Counts Per Second (CPS). The Source Range Neutron Flux High Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); therefore no Channel Statistical Allowance (CSA) Calculation has been performed for this function. The typical COT error allowance for this function is approximately ± 3.0 % of linear span. For example, the COT error for this function at Surry is equal to ± 2.973 % of linear span and the COT error at North Anna is ± 3.136 % of linear span (Refs. 5.17 and 5.30). To be conservative, the North Anna COT error allowance will be used in this analysis. The As Found Tolerance will be ≤ 1.466 E5 CPS(1). The As Found Tolerance of ≤ 1.466 E5 CPS is based on maintaining a Nominal Trip Setpoint Value of 1.0 E5 CPS.

Note : This trip function is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). A CSA Calculation has not been performed for this function. References 5.17, 5.30, and 5.117 were used in the determination of the AFT and ALT below.

As Found Tolerance (AFT) = 1.0 E5 CPS + 0.466 E5 CPS, - 0.318 E5 CPS(1)
As Left Tolerance (ALT) = 1.0 E5 CPS + 0.358 E5 CPS, - 0.264 E5 CPS(2)

(1) Nominal Trip Setpoint = 1.0 * 10^5 CPS ⇒ log 1.0 * 10^5 = 5.0 (on a 0 to 5.301 Decade scale)
COT error = ± 3.136 % of linear span ⇒ (3.136 %/100 %) * 5.301 Decades = ± 0.166239 Decade
High Trip Setpoint = 5.0 + 0.166239 = 5.166239 ⇒ antilog 5.166239 = 1.466 * 10^5
Low Trip Setpoint = 5.0 - 0.166239 = 4.833761 ⇒ antilog 4.833761 = 0.682 * 10^5
(2) Nominal Trip Setpoint = 1.0 * 10^5 CPS ⇒ log 1.0 * 10^5 = 5.0 (on a 0 to 5.301 Decade scale)
COT error minus Rack Drift = ± 2.5 % of linear span ⇒ (2.5 %/100 %) * 5.301 Decades = ± 0.133 Decade
High Trip Setpoint = 5.0 + 0.133 = 5.133 ⇒ antilog 5.133 = 1.358 * 10^5
Low Trip Setpoint = 5.0 - 0.133 = 4.867 ⇒ antilog 4.867 = 0.736 * 10^5

4.5.7 Overtemperature ΔT Reactor Trip

As Found Tolerance: See below (Refs. 5.1, 5.90, 5.94, 5.105, 5.114, and 5.133)

"The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.0 % of the ΔT span" (Note that 2.0 % of the ΔT span is equal to 3.0 % ΔT Power)

The Overtemperature ΔT (OTΔT) Reactor Trip Setpoint equation in terms of process units is:

$$OT\triangle T_{SP} \leq \triangle T_0 \, [\, K_1 - K_2 * \left(\frac{1 + t_1^{\,s}}{1 + t_2^{\,s}}\right) * (T - T') + K_3 * (P - P') - f(\triangle\, I)\,]$$

(Equation 4.5.7)

Where :

ΔT_0 = Indicated ΔT at Rated Power, %
T = Average temperature, °F
T' = 573.0 °F
P = Pressurizer pressure, psig
P' = 2235 psig
K_1 = 1.195
K_2 = 0.015 / °F
K_3 = 0.00072 / psig
ΔI = $q_t - q_b$, where q_t and q_b are percent power in the top and bottom halves of the core respectively, and $q_t + q_b$ is total core power in percent of rated power.
f(ΔI) = function of ΔI, percent of rated core power as shown in the Kewaunee COLR.
τ_1 30.0 seconds
τ_2 4.0 seconds

The Overtemperature ΔT (OTΔT) Reactor Trip Setpoint is variable and is constantly calculated based on actual plant conditions. For this reason, the Allowable Value cannot be expressed as a constant. Further, the OTΔT Reactor Trip will only be analyzed for the following condition:

- OTΔT Reactor Trip with no FΔI

The two conditions listed below are also associated with the OTΔT Reactor Trip. These conditions are not credited in the USAR Chapter 14 Safety Analysis and will not be analyzed here.

- OTΔT Reactor Trip with (+) FΔI
- OTΔT Reactor Trip with (-) FΔI

Note: FΔI is the Delta Flux Penalty generated from the Upper and Lower Power Range Neutron Flux Detectors (i.e., Q_U and Q_L).

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields the following Limiting Trip Setpoints (LTSP) for the OTΔT Reactor Trip with no FΔI condition as described above:

- LTSP for OTΔT Reactor Trip with no FΔI = 130.0 % - 8.403 % = 121.597 % ΔT Power

Subtracting the NON COT error components from the Analytical Limit yields the following Allowable Value (AV) for the OTΔT Reactor Trip with no FΔI contribution as described above:

- AV for OTΔT Reactor Trip with no FΔI = 130.0 % - 5.883 % = 124.117 % ΔT Power

For the most limiting condition (i.e., OTΔT Reactor Trip with no FΔI) the Actual Nominal Trip Setpoint of 118.25 % ΔT Power (e.g., based on $T_{AVG} = 572.0\ ^oF$) is conservative with respect to the Limiting Trip Setpoint of 121.597 % ΔT Power. The As Found Tolerance Value of 121.25 % ΔT Power is conservative with respect to the Allowable Value of 124.117 % ΔT Power. This As Found Tolerance Value of $\leq$ 121.25 % ΔT Power is based on maintaining a Nominal Trip Setpoint value of 118.25 % ΔT Power. Note that this analysis is based on static conditions such that dynamic components are not considered.

The statistical combination of the COT and NON COT error components from CSA Calculation C11865 (Ref. 5.94) with the appropriate modifications described in Section 3.2 for the OTΔT Reactor Trip are given below. The COT and NON COT error components are used in Figure 4.5.7 to determine the Nominal Trip Setpoint (NTSP), Allowable Value (AV), As Found Tolerance (AFT), and As Left Tolerance (ALT) for the most limiting condition.

<u>OTΔT Reactor Trip with no FΔI</u>

$\text{NON COT}_{\text{error}} = SE_1 + SE_2 + SE_{3a} \pm [PMA_3^2 + PMA_4^2 + PMA_5^2 + PMA_6^2 + PMA_7^2 + PEA^2 + (CSA_{3\ \text{NON COT}})^2 + (CSA_{4\ \text{NON COT}})^2 + (CSA_{5\ \text{NON COT}})^2 + (CSA_{6\ \text{NON COT}})^2 + M7MTE^2 + M18MTE^2 + RTE_1^2 + RTE_2^2 + RTE_3^2]^{1/2}$

Where the following terms are taken from Calculation C11865 (Ref. 5.94):

$CSA_{3\ \text{NON COT}} = [(CSA_1\ \text{NON COT})^2 + (CSA_2\ \text{NON COT})^2 + (M3MTE)^2\ ]^{1/2}$

$CSA_{3\ \text{NON COT}} = (0.548^2 + 0.548^2 + 0.173^2)^{1/2} = 0.794$ % of ΔT span

$CSA_{4\ NON\ COT} = [(CSA_1\ NON\ COT * 0.667)^2 + (CSA_2\ NON\ COT * 0.667)^2 + (M4MTE)^2\ ]^{1/2}$

$CSA_{4\ NON\ COT} = [(0.548 * 0.667)^2 +(0.548 * 0.667)^2 + 0.245^2)^{1/2} = 0.572$ % of ΔT span

$CSA_{5\ NON\ COT} = (PEA^2 + (SCA_3 + SMTE_3)^2 + SD_3{}^2 + SPE_3{}^2 + STE_3{}^2 + SPSE_3{}^2 + M10MTE^2)^{1/2}$

$CSA_{5\ NON\ COT} = (0.0^2 + (0.096 + 0.150)^2 +0.288^2 + 0.0^2 + 0.883^2 + 0.061^2 + 0.0^2)^{1/2} = 0.963$ % of ΔT span

$CSA_{6a\ NON\ COT} = (M15MTE^2 + M16MTE^2)^{1/2}$

$CSA_{6a\ NON\ COT} = (0.346^2 + 0.200^2)^{1/2} = 0.400$ % of ΔT span

Thus, the total NON COT_{error} is equal to:

$NON\ COT_{error} = 0.267 + 0.722 + 0.867 \pm [0.0^2 + 0.0^2 + 0.0^2 + 0.0^2 + 1.133^2 + 0.0^2 + 0.794^2 + 0.572^2 + 0.963^2 + 0.400^2 + 0.374^2 + 0.224^2 + 0.5^2 + 0.5^2 + 0.5^2]^{1/2}$

$NON\ COT_{error} = \pm\ 3.922$ % of span = ± 5.883 % ΔT Power

$COT_{error} = (CSA_{3\ COT}{}^2 + CSA_{4\ COT}{}^2 + CSA_{5\ COT}{}^2 + CSA_{6a\ COT}{}^2 + M7^2 + M18^2 + RD_1{}^2 + RD_2{}^2 + RD_3{}^2)^{1/2}$

Where the following terms are taken from Calculation C11865 (Ref. 5.94):

$CSA_{3\ COT} = [(CSA_1\ COT)^2 + (CSA_2\ COT)^2 + (M3)^2\ ]^{1/2}$

$CSA_{3\ COT} = (0.417^2 + 0.417^2 + 0.707^2)^{1/2} = 0.921$ % of ΔT span

$CSA_{4\ COT} = [(CSA_1\ COT * 0.667)^2 + (CSA_2\ COT * 0.667)^2 + M4^2]^{1/2}$

$CSA_{4\ Cot} = [(0.417 * 0.667)^2 + (0.417 * 0.667)^2 + 0.707^2)^{1/2} = 0.809$ % of ΔT span

$CSA_{5\ COT} = M10$

$CSA_{5\ COT} = 0.0 = 0.0$ % of ΔT span

$CSA_{6a\ COT} = [(M15MTE)^2 + (M16MTE)^2]^{1/2}$

$CSA_{6a\ COT} = (0.500^2 + 0.500^2)^{1/2} = 0.707$% of ΔT span

Thus, the COT_{error} is equal to:

$COT_{error} = (0.921^2 + 0.809^2 + 0.0^2 + 0.707^2 + 0.5^2 + 0.5^2 + 1.0^2 + 1.0^2 + 1.0^2)^{1/2}$

$COT_{error} = \pm\ 2.346$ % of ΔT span = ± 3.519 % ΔT Power (The calculated COT error will be conservatively rounded back to ± 2.0 % of ΔT span = ± 3.0 % ΔT Power for the As Found Tolerance)

Static As Found Tolerance (AFT) = Computed Setpoint ± 3.0 % ΔT Power
Static As Left Tolerance (ALT) = Computed Setpoint ± 2.4 % ΔT Power (1)

---

(1) ALT = $\pm (\text{COTerror}^2 - RD_1^2 - RD_2^2 - RD_3^2)^{1/2} = \pm (2.346^2 - 1.0^2 - 1.0^2 - 1.0^2)^{1/2}$
ALT = ± 1.582 % of ΔT span = ± 2.373 % ΔT Power (round to ± 2.4 % ΔT Power)

KEWAUNEE'S OVERTEMPERATURE DELTA T REACTOR TRIP

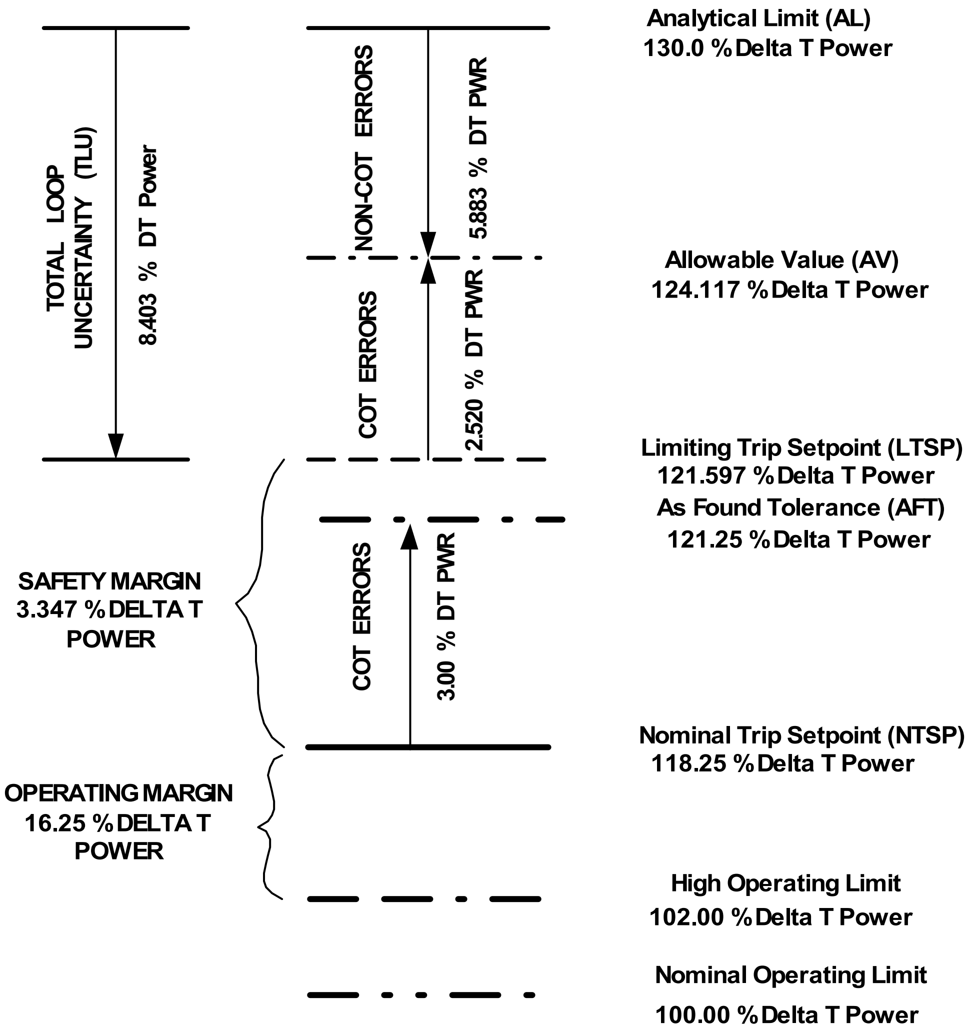

Figure 4.5.7

4.5.8 Overpower ΔT Reactor Trip

As Found Tolerance: See below (Refs. 5.1, 5.90, 5.94, and 5.105)

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 1.546 % of the ΔT span " (Note that 1.525 % of the ΔT span is equal to 2.288 % ΔT Power)

The Overpower ΔT Reactor Trip Setpoint is variable and is constantly calculated based on actual plant conditions. For this reason, the Allowable Value cannot be expressed as a constant. The Overpower ΔT Reactor Trip is a backup reactor trip function and is not credited in the USAR Chapter 14 Safety Analysis (Ref. 5.1). The As Found Tolerance of ± 1.525 % of ΔT span = ± 2.288 % ΔT Power(1) is based on the COT error components from CSA Calculation (Ref. 5.94). The As Left Tolerance is based on the As Found Tolerance minus Rack Drift.

Static As Found Tolerance (AFT) = Computed Setpoint ± 2.288 % ΔT Power(1)
Static As Left Tolerance (ALT) = Computed Setpoint ± 1.724 % ΔT Power (2)

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(1) The Overpower ΔT Reactor Trip COT error is taken from Calculation C11865 (Ref. 5.94).

$\text{AFT} = \pm (M_1{}^2 + M_2{}^2 + M_3{}^2 + M_4{}^2 + M_5{}^2 + M_6{}^2 + M_{17}{}^2 + RD_1{}^2 + RD_2{}^2)^{1/2}$
$\text{AFT} = \pm (0.417^2 + 0.417^2 + 0.707^2 + (0.707 * 0.667)^2 + 0.034^2 + 0.034^2 + 0.5^2 + 1.0^2 + (1.0 * 0.069)^2)^{1/2}$
$\text{AFT} = \pm 1.525$ % of ΔT span = ± 2.288 % ΔT Power

(2) $\text{ALT} = \pm (\text{COTerror}^2 - RD_1{}^2 - RD_2{}^2)^{1/2} = \pm (1.525^2 - 1.0^2 - 0.069^2)^{1/2}$
$\text{ALT} = \pm 1.149$ % of ΔT span = ± 1.724 % ΔT Power

4.5.9 Pressurizer Low Pressure Reactor Trip

As Found Tolerance: 1904 PSIG ± 10.0 PSIG (Refs. 5.1, 5.90, 5.93, and 5.105)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 1858.82 PSIG. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 1855.94 PSIG. The Actual Nominal Trip Setpoint of 1904 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specification (CTS) LSSS value of ≥ 1875 PSIG is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value of ≥ 1875 PSIG is non-conservative based on the calculated COT error components determined in Calculation C10818 (Ref. 5.93). The LSSS value of ≥ 1875 PSIG will be changed to an As Found Tolerance value of ≥ 1894 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. This As Found Tolerance is based on a Nominal Trip Setpoint value of 1904.0 PSIG. The Nominal Trip Setpoint value of 1904 PSIG will allow a 10.0 PSIG margin to be used for the COT error components. The As Found Tolerance value of ≥ 1894 PSIG is sufficiently close enough to the calculated value using the CSA rack error terms from Calculation C10818 (Ref. 5.93).

The calculated As Found Tolerance for this function is ≥ 1894.20 PSIG. The 0.20 PSIG offset is accommodated in the 45.18 PSIG Safety Margin for this trip as illustrated in Figure 4.5.9.

The statistical combination of the COT and NON COT error components from CSA Calculation C10818 (Ref. 5.93) are given below. The COT and NON COT error components are used in Figure 4.5.9 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{M3MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + (0.250 + 0.391)^2 + 0.75^2 + 0.0^2 + 2.300^2 + 0.158^2 + 0.0^2 + 0.200^2 + 0.283^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm\ 2.580$ % of span = ± 20.64 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{M3}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm\ 1.225$ % of span = ± 9.80 PSIG (round to ± 10 PSIG)

As Found Tolerance (AFT) = 1904 PSIG ± 10.0 PSIG
As Left Tolerance (ALT) = 1904 PSIG ± 5.7 PSIG(1)

See Figure 4.5.9 for specific details.

---

(1) $\text{ALT} = \pm (\text{COTerror}^2 - \text{RD}^2)^{1/2} = \pm (1.225^2 - 1.0^2)^{1/2} = \pm\ 0.71$ % of span = ± 5.7 PSIG

KEWAUNEE'S PRESSURIZER LOW PRESSURE REACTOR TRIP

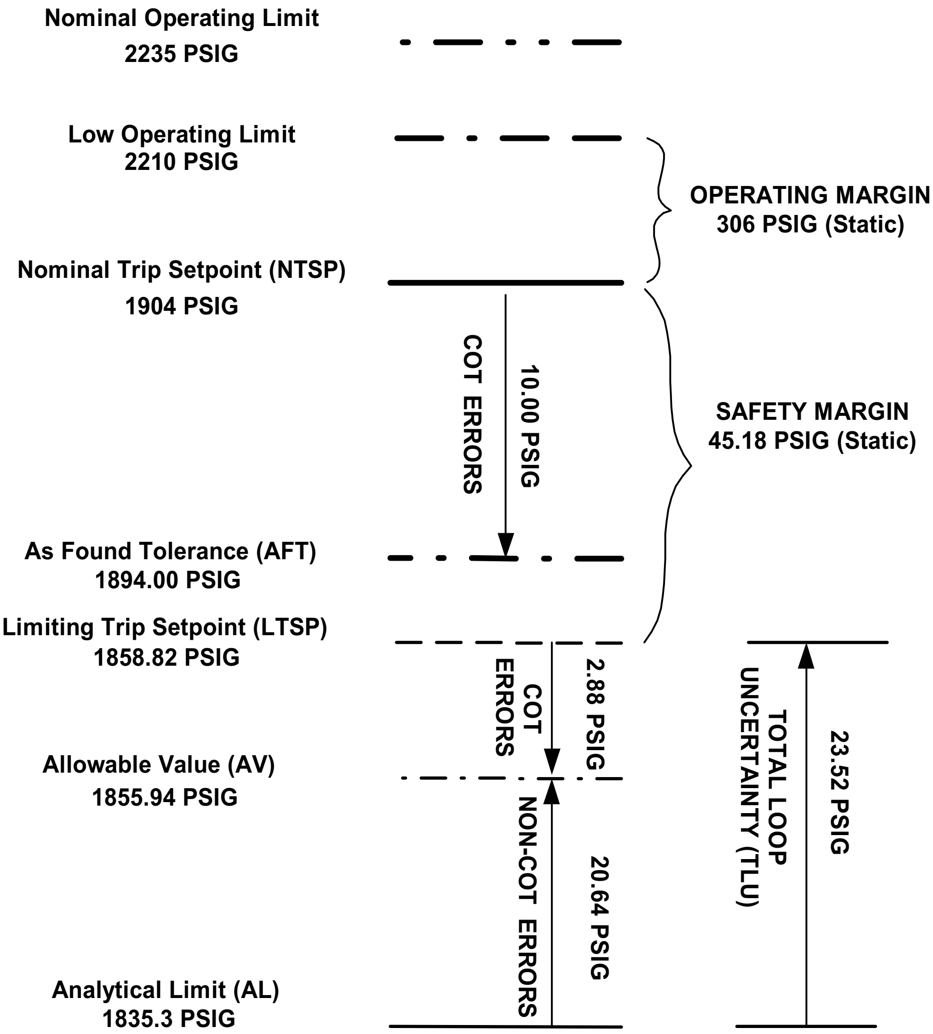

Figure 4.5.9

4.5.10 Pressurizer High Pressure Reactor Trip

As Found Tolerance: 2377 PSIG ± 9.0 PSIG (Refs. 5.1, 5.90, 5.93, and 5.105)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 2387.64 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 2389.78 PSIG. The Actual Nominal Trip Setpoint of 2377 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specification (CTS) LSSS value ≤ 2385 PSIG is conservative with respect to the Allowable Value. The CTS LSSS value ≤ 2385 PSIG will be revised to an As Found Tolerance Value of ≤ 2386 PSIG based on the COT error components calculated below. The revised As Found Tolerance Value of ≤ 2386 PSIG is also conservative with respect to the Allowable Value, however it is slightly non-conservative with respect to the calculated value using the CSA rack error components from Calculation C10818 (Ref 5.93). The calculated As Found Tolerance Value for this function is ≤ 2385.94 PSIG. The 0.06 PSIG offset from the calculated value is accommodated within the Safety Margin for this function (i.e., 10.64 PSIG). The As Found Tolerance value of ≤ 2386 PSIG is based on the Nominal Trip Setpoint value of 2377.0 PSIG.

The statistical combination of the COT and NON COT error components from CSA Calculation C10818 (Ref. 5.93) are given below. The COT and NON COT error components are used in Figure 4.5.10 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + (0.250 + 0.391)^2 + 0.75^2 + 0.0^2 + 2.300^2 + 0.158^2 + 0.0^2 + 0.200^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm 2.565$ % of span = ± 20.52 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm 1.118$ % of span = ± 8.944 PSIG (round to ± 9.0 PSIG)

As Found Tolerance (AFT) = 2377 PSIG ± 9.0 PSIG
As Left Tolerance (ALT) = 2377 PSIG ± 4.0 PSIG(1)

See Figure 4.5.10 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± 4.0 PSIG

KEWAUNEE'S PRESSURIZER HIGH PRESSURE REACTOR TRIP

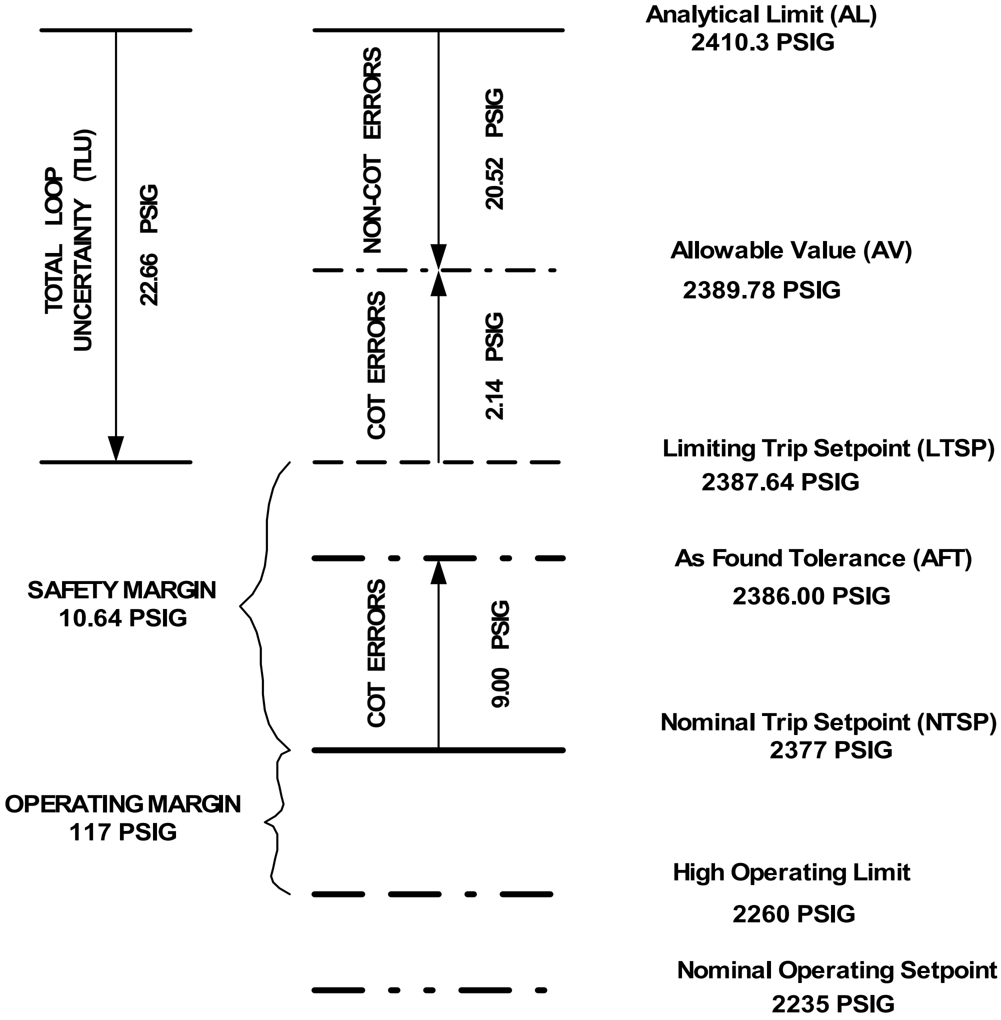

Figure 4.5.10

4.5.11 Reactor Coolant Flow Low Reactor Trip (Normalized)

Allowable Value: As Found Tolerance = 93% Flow ± 1.1% Flow
(Refs. 5.1, 5.90, 5.96, 5.106, and 5.120)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 90.52 % Flow. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 90.27 % Flow. The current Nominal Trip Setpoint of 93.0 % Flow is conservative with respect to the Limiting Trip Setpoint and the current Custom Technical Specification (CTS) LSSS value of ≥ 90.0 % Flow is non conservative with respect to the Allowable Value. The CTS LSSS value ≥ 90.0 % Flow will be changed to an As Found Tolerance value of ≥ 91.9 % Flow based on the calculated value using the CSA rack error terms from Calculation C10819 (Ref 5.96). The As Found Tolerance of ≥ 91.9 % Flow is conservative and conforms to the methodology described in TSFT-493, Rev. 4 and RIS 2006-17.

The calculated As Found Tolerance Value for this function is ≥ 91.853 % Flow. The 0.047 % Flow offset will be negated resulting in a conservative As Found Tolerance value of ≥ 91.9 % Flow for this trip as illustrated in Figure 4.5.11.

The statistical combination of the COT and NON COT error components from CSA Calculation C10819 (Ref. 5.96) are given below. The COT and NON COT error components are used in Figure 4.5.11 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

NON $\text{COT}_{\text{error}}$ (ΔP span) = $[(\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M2MTE}^2]^{1/2}$

NON $\text{COT}_{\text{error}}$ (ΔP span) = $[(0.250 + 0.110)^2 + 0.50^2 + 0.0^2 + 0.713^2 + 0.110^2 + 0.200^2]^{1/2}$

NON $\text{COT}_{\text{error}}$ (ΔP span) = ± 0.970 % of ΔP span = ± 0.574 % of Flow span @ 93 % Flow$^{(1)}$

NON $\text{COT}_{\text{error}}$ (Flow span) = SE ± $(\text{PMA}^2 + \text{PEA}^2 + \text{RTE}^2)^{1/2}$

NON $\text{COT}_{\text{error}}$ (Flow span) = 0.372 ± $(2.455^2 + 0.455^2 + 0.5^2)^{1/2}$

NON $\text{COT}_{\text{error}}$ (Flow span) = 2.918 % of Flow span

TOTAL NON $\text{COT}_{\text{error}}$ (Flow span) = $(2.918^2 + 0.574^2)^{1/2}$ = 2.974 % of Flow span = 3.271 % Flow @ 93.0 % Flow (e.g., the Nominal Trip Setpoint).

$\text{COT}_{\text{error}}$ (ΔP span) = ± M2

$\text{COT}_{\text{error}}$ (ΔP span) = ± 0.50 % of ΔP span

$\text{COT}_{\text{error}}$ (ΔP span) = ± 0.50 % of ΔP span = ± 0.296 % of Flow span @ 93 % Flow = ± 0.326 % Flow$^{(1)}$

$\text{COT}_{\text{error}}$ (Flow span) = RD = ± 1.0 % of Flow span = ± 1.10 % Flow

TOTAL COT_{error} (Flow span) = $(0.296^2 + 1.0^2)^{1/2}$ = 1.043 % of Flow span = 1.147 % Flow @ 93.0 % Flow (e.g., the Nominal Trip Setpoint) (1)

As Found Tolerance (AFT) = 93% Flow ± 1.1% Flow(1)
As Left Tolerance (ALT) = 93% Flow ± 0.55% Flow(2)

See Figure 4.5.11 for specific details.

KEWAUNEE'S REACTOR COOLANT LOW FLOW REACTOR TRIP

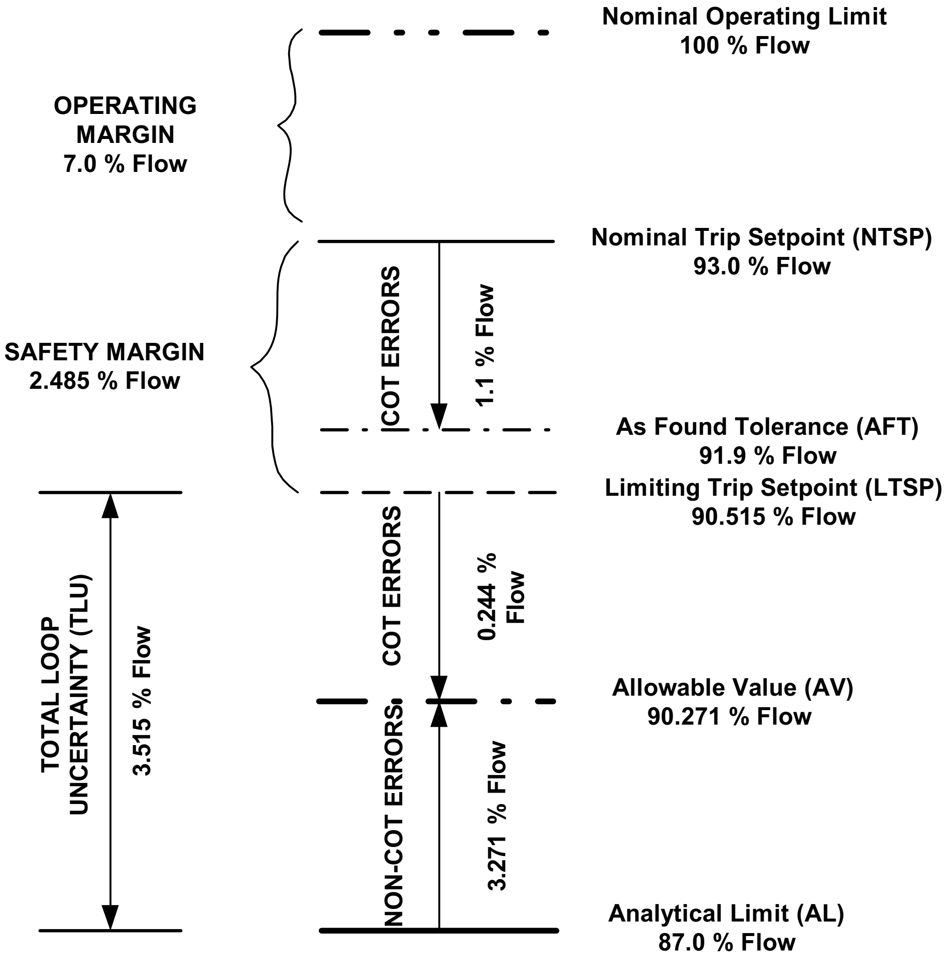

Figure 4.5.11

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(1) The equation to convert % ΔP error to % Flow error is: % flow span = (ΔP uncertainty) * 0.5 * (flow max / flow x) (Ref. 5.120)
(2) The calculated As Left Tolerance is ± 0.296 % of Flow Span. This tolerance is too restrictive and will be set at ± 0.5 % of Flow Span (i.e., like all other Bistable tolerances). The + 0.204 % of Flow Span offset is accommodated in the Safety Margin of 2.485 % Flow = 2.259 % of Flow Span.

4.5.12 Reactor Coolant Pump Undervoltage

As Found Tolerance: 76.667 ± 0.885 % of normal voltage = 92 ± 1.06 VAC
(Refs. 5.1, 5.90, 5.127, and 5.128)

The current Custom Technical Specification (CTS) LSSS for this function is ≥ 75 % of normal voltage. The current Nominal Trip Setpoint for this function is 91 to 93 VAC where 92 VAC is the centerline voltage = 76.667 % of voltage span (Ref. 5.127). This analysis assumes that 120 VAC from the potential transformer is equal to 100 % of bus voltage/normal voltage which is equal to 4160 VAC. The Reactor Coolant Pump Undervoltage Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. The calibration accuracy for this trip function is 92 ± 1.0 VAC = 76.667 ± 0.833 % of normal voltage (Ref. 5.127). The COT error from Calculation C11891 is ± 1.06 VAC = ± 0.885 % of normal voltage. Therefore, the As Found Tolerance for the Reactor Coolant Pump Undervoltage Trip is 76.667 ± 0.885 % of normal voltage = 92 ± 1.06 VAC based on device calibration accuracy and drift from Reference 5.128. The As Left Tolerance for the Reactor Coolant Pump Undervoltage Trip is 76.667 ± 0.833 % of normal voltage = 92 ± 1.0 VAC based on the device calibration accuracy from Reference 5.127. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value 92 VAC = 76.667 % of normal voltage.

As Found Tolerance (AFT) = 76.667 ± 0.885 % of normal voltage = 92 ± 1.06 VAC(1)
As Left Tolerance (ALT) = 76.667 ± 0.833 % of normal voltage = 92 ± 1.0 VAC(2)

---

(1) AFT = $\pm (SCA^2 + SD^2)^{1/2} = \pm (0.833^2 + 0.300^2)^{1/2} = \pm 0.885$ % of normal voltage = ± 1.06 VAC
(2) ALT = ± SCA = ± 0.833 % of normal voltage = ± 1.0 VAC

4.5.13 Reactor Coolant Pump Underfrequency

As Found Tolerance: 57 ± 0.3 Hz (Refs. 5.1, 5.90, 5.126, and 5.127)

The current Custom Technical Specification (CTS) LSSS for this function is ≥ 55.0 Hz. The current Nominal Trip Setpoint for this function is 57 ± 0.1 Hz (Ref. 5.127). The Reactor Coolant Pump Underfrequency Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C11890 (Ref. 5.126), the COT error allowance for this function is ± 0.3 Hz. The calibration accuracy for this trip function is ± 0.1 Hz (Ref. 5.127). The As Found Tolerance of 57 ± 0.3 Hz is based on the COT error from Calculation C11890 and the As Left Tolerance of 57 ± 0.1 Hz is conservatively based on device calibration accuracy from Reference 5.127. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 57 Hz.

As Found Tolerance (AFT) = 57 ± 0.3 Hz(1) (3)
As Left Tolerance (ALT) = 57 ± 0.1 Hz(2)

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(1) AFT = $\pm (SCA^2 + SD^2)^{1/2} = \pm (6.66^2 + 0.667^2)^{1/2} = \pm 6.69$ % of frequency span or (6.69% /100%) x 4.5 Hz(3) = ± 0.3 Hz
(2) ALT = Current Calibration Accuracy from Reference 5.127 = ± 0.1 Hz
(3) The frequency span of 4.5 Hz is taken from Calculation C11890 (Ref. 5.126).

4.5.14 Pressurizer High Level Reactor Trip

As Found Tolerance: 85.0 % Level ± 1.12 % Level (Refs. 5.1, 5.90, 5.92, and 5.109)

The current Custom Technical Specification (CTS) LSSS for this function is ≤ 90.0 % Level. The current Nominal Trip Setpoint for this function is 85.0 % Level (Ref. 5.109). The Pressurizer High Level Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C10982 (Ref. 5.92), the COT error allowance for this function is ± 1.118 % of span = ± 1.118 % Level. The calibration accuracy for this trip function is ± 0.5 % of span = ± 0.5 % Level (Ref. 5.109). The As Found Tolerance based on the COT error from Calculation C10982 is 85 ± 1.118 % Level (round to 85 ± 1.12 % Level). The As Left Tolerance is 85 ± 0.5 % Level is based on device calibration accuracy from Reference 5.109. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 85 % Level.

As Found Tolerance (AFT) = 85.0 % Level ± 1.12 % Level(1)
As Left Tolerance (ALT) = 85.0 % Level ± 0.5 % Level(2)

---

(1) AFT = ± $(M2^2 + RD^2)^{½}$ = ± $(0.5^2 + 1.0^2)^{½}$ = ± 1.118 % span = ± 1.118 % Level
(2) ALT = ± M2 = ± 0.5 % span = ± 0.5 % Level

4.5.15 Steam Generator Water Level Low Low Reactor Trip

As Found Tolerance: 17.0 % Level ± 1.12 % Level (Refs. 5.1, 5.90, 5.97, 5.112, and 5.134)

Note: The Analytical Limit for this function is 0.0 % NR Level (Ref. 5.1). The Channel Statistical Allowance (CSA) for this function has a large negative Process Measurement Accuracy (PMA) bias term which results in a negative CSA value. For conservatism, the absolute value of the larger CSA value from Reference 5.97 will be used in this analysis.

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 4.496 % NR Level. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 4.087 % NR Level. The Actual Nominal Trip Setpoint of 17.0 % NR Level (Ref. 5.112) is conservative with respect to the Limiting Trip Setpoint and the current Custom Technical Specification (CTS) LSSS value of ≥ 5.0 % NR Level is conservative with respect to the Allowable Value. The CTS LSSS value of ≥ 5.0 % NR Level is non-conservative based on the calculated COT error components determined in Calculation C11116 (Ref. 5.97). The CTS LSSS value of ≥ 5.0 % NR Level will be changed to an As Found Tolerance value of ≥ 15.88 % NR Level to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. The As Found Tolerance Value of ≥ 15.88 % NR Level is based on maintaining a Nominal Trip Setpoint value of 17.0 % NR Level.

The statistical combination of the COT and NON COT error components from CSA Calculation C11116 (Ref. 5.97) are given below. The COT and NON COT error components are used in Figure 4.5.15 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{PMA}_2 \pm (\text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE} + \text{M1MTE}^2 + \text{M3MTE}^2 + \text{RTE}^2)^{1/2}$

$\text{NON COT}_{\text{error}} = 2.518 \pm [0.0^2 + (0.250+0.217)^2 + 0.280^2 + 0.577^2 + 1.241^2 + 0.060^2 + 0^2 + 0.200^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}}$ = + 4.087 % of span = + 4.087 % NR Level (worst case).

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M3}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{½}$

$\text{COT}_{\text{error}}$ = ± 1.118 % of span = ± 1.118 % NR Level (round to ± 1.12 % NR Level)

As Found Tolerance (AFT) = 17.0 % Level ± 1.12 % Level(1)
As Left Tolerance (ALT) = 17.0 % Level ± 0.5 % Level(2)

See Figure 4.5.15 for specific details.

---

(1) AFT = $\pm (\text{M3}^2 + \text{RD}^2)^{½} = \pm (0.5^2 + 1.0^2)^{½}$ = ± 1.118 % span = ± 1.118 % Level (round to ± 1.12 % NR Level)
(2) ALT = ± M3 = ± 0.5 % span = ± 0.5 % Level

KEWAUNEE'S STEAM GENERATOR LO-LO LEVEL REACTOR TRIP

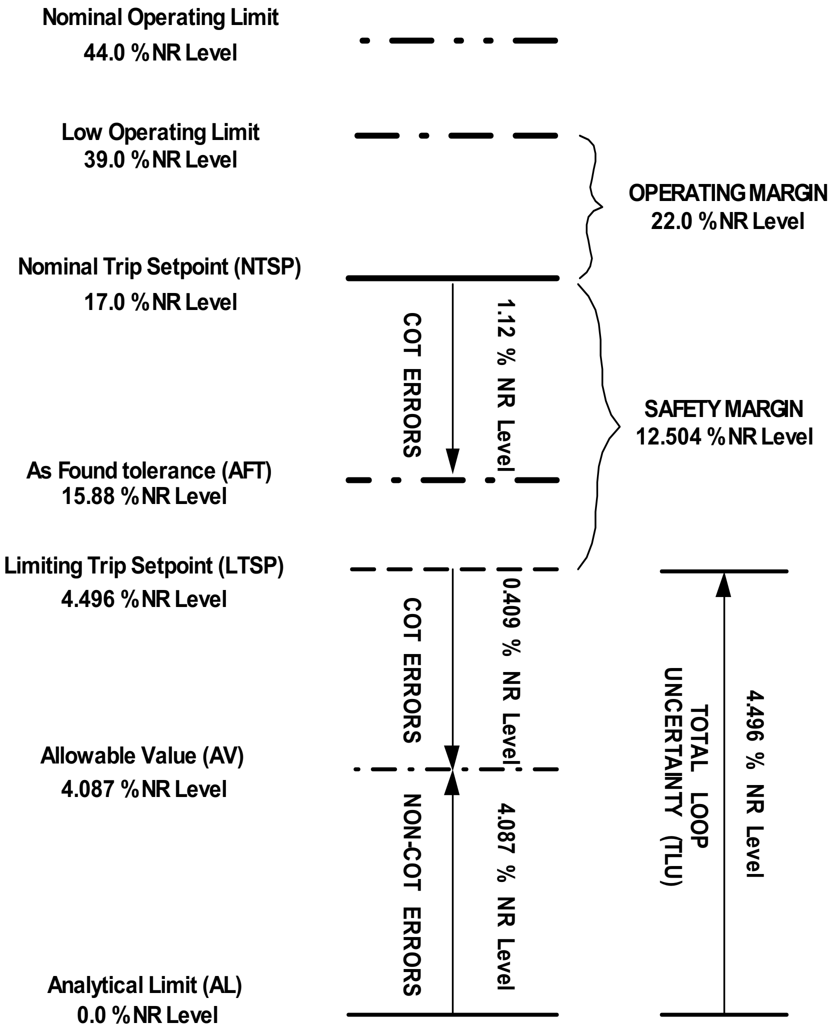

Figure 4.5.15

4.5.16 Steam Generator Water Level Low Coincident Reactor Trip

As Found Tolerance: 25.5 % Level ± 1.12 % NR Level (Refs. 5.1, 5.90, 5.97, and 5.112)

The Steam Generator Water Level Low Coincident Reactor Trip is not addressed in the current version of Kewaunee's Custom Technical Specifications (CTS). This function will now be included in the Setpoint Control Program based on the requirements of ITS Table 3.3.1-1, item 15. The current Nominal Trip Setpoint for this function is 25.5 % NR Level (Ref. 5.112). The Steam Generator Water Level Low Coincident Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C11116 (Ref. 5.97), the COT error allowance for this function is ± 1.118 % of span = ± 1.118 % NR Level. The calibration accuracy for this trip function is ± 0.5 % of span = ± 0.5 % Level (Ref. 5.112). The As Found Tolerance based on the COT error from Calculation C11116 is 25.5 ± 1.118 % NR Level (round to 25.5 ± 1.12 % NR Level). The As Left Tolerance is 25.5 ± 0.5 % NR Level is based on the device calibration accuracy from Reference 5.112. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 25.5 % NR Level.

As Found Tolerance (AFT) = 25.5 % Level ± 1.12 % NR Level(1)
As Left Tolerance (ALT) = 25.5 % Level ± 0.5 % NR Level(2)

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(1) AFT = $\pm (M2^2 + RD^2)^{1/2} = \pm (0.5^2 + 1.0^2)^{1/2} = \pm 1.118$ % span = ± 1.118 % NR Level
(2) ALT = ± M2 = ± 0.5 % span = ± 0.5 % NR Level

4.5.17 Steam Flow Feed Flow Mismatch Coincident Reactor Trip

As Found Tolerance: $0.87 * 10^6$ PPH ± $0.063 * 10^6$ PPH (Refs. 5.1, 5.90, 5.98, 5.108, and 5.130)

The Steam Flow Feed Flow Mismatch Coincident Reactor Trip is not addressed in the current version of Kewaunee's Custom Technical Specifications (CTS). This function will now be included in the Setpoint Control Program based on the requirements of ITS Table 3.3.1-1, item 15. The current Nominal Trip Setpoint for this function is $0.87 * 10^6$ Pound Per Hour (PPH) (Ref. 5.108). Based on Reference 5.108, the maximum Steam and Feedwater flowrate is $4.47 * 10^6$ PPH and the nominal flowrate at 100 % power (i.e., Flow_{nom}) is ≈ $3.82 * 10^6$ PPH (Ref. 5.98). This means that the current Nominal Trip Setpoint is set at 22.77 % of Flow_{nom}. The Steam Flow Feed Flow Mismatch Coincident Reactor Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1) and a Channel Statistical Allowance (CSA) Calculation has not been performed for this function. The COT error allowance for this function will be based on the applicable module calibration accuracies given in Reference 5.108 and the standard ± 1.0 % of span Rack Drift (RD) value from Reference 5.5. Based on References 5.108 and 5.130, there are four modules with calibration accuracies that develop this trip function. The COT error allowance based on References 5.5 and 5.108 is ± 1.414 % of Flow Span = ± $0.063 * 10^6$ PPH (1). The As Found Tolerance based on References 5.5, 5.108, and 5.130 is $0.87 * 10^6$ PPH ± $0.063 * 10^6$ PPH. The As Left Tolerance based on calibration accuracy of the four devices from Reference 5.108 is $0.87 * 10^6$ PPH ± $0.045 * 10^6$ PPH. The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of $0.87 * 10^6$ PPH.

As Found Tolerance (AFT) = $0.87 * 10^6$ PPH ± $0.063 * 10^6$ PPH (1)
As Left Tolerance (ALT) = $0.87 * 10^6$ PPH ± $0.045 * 10^6$ PPH (2)

---

(1) AFT = ± $(\text{FM-466A}^2 + \text{FC-466B/C}^2 + \text{FM-464A}^2 + \text{FM-464B}^2 + \text{RD}^2)^{1/2}$
AFT = ± $(0.5^2 + 0.5^2 + 0.5^2 + 0.5^2 + 1.0^2)^{1/2}$ = ± 1.414 % of Flow Span = ± $0.063 * 10^6$ PPH
(2) ALT = ± $(\text{FM-466A}^2 + \text{FC-466B/C}^2 + \text{FM-464A}^2 + \text{FM-464B}^2)^{1/2}$
ALT = ± $(0.5^2 + 0.5^2 + 0.5^2 + 0.5^2)^{1/2}$ = ± 1.00 % of Flow Span = ± $0.0447 * 10^6$ PPH (round to ± $0.045 * 10^6$ PPH)

4.5.18 Safety Injection (SI) Input from Engineered Safety Features Actuation System (ESFAS)

See Section 4.6.

Reactor Trip Permissives

Note : Only the limiting As Found Tolerance value will be addressed in analysis for each Reactor Trip Permissive described below.

4.5.19 Permissive P-6, Intermediate Range Neutron Flux

As Found Tolerance: Permissive P-6 unblock should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power (Refs. 5.1, 5.90, and 5.116)

The current Custom Technical Specification (CTS) LSSS for this function is > 10^{-5}% Rated Power. The current Nominal Trip Setpoint for this function is set equal to the CTS LSSS value, i.e., 1 * 10^{-5}% Rated Power. Permissive P-6 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1) and a Channel Statistical Allowance (CSA) calculation has not been performed for this function. The COT error allowance for this function will be based on a portion of the calibration accuracy for the Intermediate Range Front Panel Meter at the nominal unblock trip setpoint value of 1 * 10^{-5}% Rated Power, i.e., 7.9 * 10^{-6}% Rated Power to 1.27 * 10^{-5}% Rated Power as specified in Reference 5.116. Only the high end of the tolerance value will be used to develop the As Found Tolerance for this function such that the current CTS LSSS value of 10^{-5}% Rated Power will be the low end of the tolerance. The As Found Trip for Permissive P-6 should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power. Since this As Found Tolerance does not include a Rack Drift value, the As Left Tolerance will be equal to the As Found Tolerance.

As Found Tolerance (AFT) = Permissive P-6 unblock should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power
As Left Tolerance (ALT) = Permissive P-6 unblock should occur between 1 * 10^{-5}% Rated Power and 1.27 * 10^{-5}% Rated Power

4.5.20 Permissive P-7, Block Low Power Reactor Trips and Enable High Power Trips

P-10 As Found Tolerance (AFT) = 11.0 % RTP ± 1.2 % RTP
P-13 As Found Tolerance (AFT) = 8.8 % Turbine Load ± 1.25 % Turbine Load
(Refs. 5.1, 5.90, 5.91, 5.104, and 5.132)

The current Custom Technical Specification (CTS) LSSS for Permissive P-7 is ≤ 12.2 % of Rated Power for both inputs, i.e., P-10 and P-13. Permissive P-7 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however, a Channel Statistical Allowance (CSA) Calculation has been performed for Permissive P-10. Permissive P-7 is made up of input signals from Turbine First Stage Pressure (P-13) and NIS Power Range (P-10). Signals to the P-7 and P-10 permissives are supplied from the same bistables in the NIS Power Range drawers. P-7 and P-10 will both enable and block functions from the "trip" and "reset" points of these bistables. The calibration procedure (Ref. 5.104) for the NIS Power Range P-10 unblock input into Permissive P-7 sets the Nominal Trip Setpoint at 11.0 % RTP (increasing). The current Nominal Trip Setpoint for the Turbine First Stage Pressure input to P-7, i.e., P-13 is 8.8 % of Turbine Load (e.g., based on a nominal Turbine First Stage Pressure value of 583.5 PSIG @ 100 % Power). The COT error associated with P-10 taken from Calculation C11705 (Ref. 5.91) is ± 1.085 % of span = ± 1.3 % RTP (round back to ± 1.2 % RTP)(1). The COT error associated with P-13 is ± 1.12 % of span = ± 1.25 % Turbine Load based on the P-13 Bistable calibration accuracy from Reference 5.132 and the standard Rack Drift (RD) error value from Reference 5.5(3). The As Found Tolerance for the P-10 input to P-7 is 11.0 ± 1.2 % RTP(1). The As Left Tolerance for the P-10 input to P-7 is 11.0 ± 0.5 % RTP(2). The As Found Tolerance for the P-13 input to P-7 is 8.8 ± 1.25 % Turbine Load(3). The As Left Tolerance for the P-13 input to P-7 is 8.8 ± 0.56 % Turbine Load(4).

P-10 As Found Tolerance (AFT) = 11.0 % RTP ± 1.2 % RTP(1)
P-10 As Left Tolerance (ALT) = 11.0 % RTP ± 0.5 % RTP(2)
P-13 As Found Tolerance (AFT) = 8.8 % Turbine Load ± 1.25 % Turbine Load(3)
P-13 As Left Tolerance (ALT) = 8.8 % Turbine Load ± 0.56 % Turbine Load(4)

---

(1) AFT = $\pm (M1^2 + M5^2 + RD^2)^{½} = \pm (0.05^2 + 0.417^2 + 1.0^2)^{½} = \pm$ 1.085 % of span = ± 1.3 % RTP. This COT error will be rounded back to ± 1.2 % RTP to conform to the current CTS LSSS of ≤ 12.2 % RTP (i.e., 11 % + 1.2 % is ≤ 12.2 %)

(2) ALT = $\pm (M1^2 + M5^2)^{½} = \pm (0.05^2 + 0.417^2)^{½} = \pm$ 0.42 % of span = ± 0.5 % RTP.

(3) AFT = $\pm (PC\text{-}466A^2 + RD^2)^{½} = \pm (0.5^2 + 1.0^2)^{½} = \pm$ 1.12 % of span. The range of the Turbine First Stage Pressure Transmitters is 0 to 650 PSIG and the nominal 100 % Power pressure is 583.5 PSIG. (1.12 %/100 %)*650 PSIG = 7.28 PSIG. Then, (7.28 PSIG/583.5 PSIG) * 100 % Turbine Load = 1.25 % Turbine Load.

(4) ALT = ± 0.5 % of span = (0.5 %/100 %)*650 PSIG = 3.25 PSIG. Then, (3.25 PSIG/583.5 PSIG) * 100 % Turbine Load = 0.56 % Turbine Load.

4.5.21 Permissive P-8, Power Range Neutron Flux

As Found Tolerance (AFT) = 9.5 % RTP ± 1.3 % RTP (Refs. 5.1, 5.90, 5.91, and 5.104)

The current Custom Technical Specification (CTS) LSSS for Permissive P-8 is < 10.0 % of Rated Power. The Nominal Trip Setpoint for the unblock portion of Permissive P-8 is 9.5 % RTP (Ref. 5.104). Permissive P-8 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1) and a Channel Statistical Allowance (CSA) Calculation has not been performed for this function. However, CSA Calculation C11705 (Ref. 5.91) has identified the COT error components associated with Permissive P-10 which uses identical circuitry to that of Permissive P-8 to generate their respective functions. The COT error associated with Permissive P-10, taken from Calculation C11705 (Ref. 5.91), is ± 1.085 % of span = ± 1.3 % RTP(1). This COT error is also applicable for Permissive P-8 and will be used to develop the As Found Tolerance. Based on a Nominal Trip Setpoint of 9.5 % RTP and a COT error of ± 1.3 % RTP, the As Found Tolerance for Permissive P-8 is 9.5 ± 1.3 % RTP. Note that the high end of the As Found Tolerance (i.e., 9.5 % RTP + 1.3 % RTP = 10.8 % RTP) is non-conservative with respect to the current CTS LSSS of < 10 % RTP, however this As Found tolerance is acceptable because there is no specific Analytical Limit associated with this permissive. The As Left Tolerance will be equal to the COT error minus Rack Drift (RD)(2). The As Found and As Left Tolerance are based on maintaining a Nominal Trip Setpoint of 9.5 % RTP.

As Found Tolerance (AFT) = 9.5 % RTP ± 1.3 % RTP(1)
As Left Tolerance (ALT) = 9.5 % RTP ± 0.5 % RTP(2)

---

(1) AFT = $\pm (M1^2 + M5^2 + RD^2)^{½} = \pm (0.05^2 + 0.417^2 + 1.0^2)^{½} = \pm$ 1.085 % of span = ± 1.3 % RTP.

(2) ALT = $\pm (M1^2 + M5^2)^{½} = \pm (0.05^2 + 0.417^2)^{½} = \pm$ 0.42 % of span = ± 0.5 % RTP.

Note: The error terms used above are from Calculation C11705 (Ref. 5.91) and they are used for Permissive P-10.

4.5.22 Permissive P-10, Power Range Neutron Flux Unblock Low Power Reactor Trips and Block High Power Trips

As Found Tolerance (AFT) = 9.0 % RTP ± 1.3 % RTP (Refs. 5.1, 5.90, 5.91, and 5.104)

The current Custom Technical Specification (CTS) LSSS for Permissive P-10 (i.e., unblock the low power trips) is ≥ 7.8 % of Rated Power. The calibration procedure (Ref. 5.104) for the NIS Power Range P-10 unblock of the low power trips sets the Nominal Trip Setpoint at 9.0 % RTP (decreasing). Permissive P-10 is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however, a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Reference 5.91, the COT error associated with P-10 is ± 1.085 % of span = ± 1.3 % RTP(1). This COT error will be used to develop the As Found Tolerance for this function. Based on a Nominal Trip Setpoint of 9.0 % RTP and a COT error of ± 1.3 % RTP, the As Found Tolerance for Permissive P-10 is 9.0 ± 1.3 % RTP. Note that the low end of the As Found Tolerance (i.e., 9.0 % RTP - 1.3 % RTP = 7.7 % RTP) is non-conservative with respect to the current CTS LSSS of ≥ 7.8 % RTP, however this As Found tolerance is acceptable because there is no specific Analytical Limit associated with this permissive. The As Left Tolerance will be equal to the COT error minus Rack Drift (RD)(2). The As Found and As Left Tolerance are based on maintaining a Nominal Trip Setpoint of 9.0 % RTP.

As Found Tolerance (AFT) = 9.0 % RTP ± 1.3 % RTP(1)
As Left Tolerance (ALT) = 9.0 % RTP ± 0.5 % RTP(2)

---

(1) AFT = $\pm (M1^2 + M5^2 + RD^2)^{1/2} = \pm (0.05^2 + 0.417^2 + 1.0^2)^{1/2} = \pm$ 1.085 % of span = ± 1.3 % RTP.

(2) ALT = $\pm (M1^2 + M5^2)^{1/2} = \pm (0.05^2 + 0.417^2)^{1/2} = \pm$ 0.42 % of span = ± 0.5 % RTP.

4.6 Limiting Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances for Kewaunee Engineered Safety Features Actuation System (ESFAS) Instrumentation to support the Setpoint Control Program

Note: Only the limiting As Found Tolerance value will be addressed in analysis for each ESFAS Trip Function described below.

4.6.1 Safety Injection, Manual Initiation

As Found Tolerance: There is no specific ESFAS Trip Setpoint associated with this function.

4.6.2 High Containment Pressure – Safety Injection

As Found Tolerance: **As Found Tolerance = 3.6 PSIG ± 0.335 PSIG**
(Refs. 5.1, 5.90, 5.95, 5.110, and 5.111)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 4.237 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 4.328 PSIG. The current CTS Setting Limit for this function is ≤ 4.0 PSIG. The CTS Setting Limit for this function of ≤ 4.0 PSIG is conservative with respect to the Allowable Value, however it is non-conservative with respect to the calculated As Found Tolerance value of 3.6 PSIG ± 0.335 PSIG (i.e., 3.935 PSIG) . The Actual Nominal Trip Setpoint of 3.6 PSIG is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of ≤ 4.0 PSIG will be changed to an As Found Tolerance value of 3.6 PSIG ± 0.335 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17.

The statistical combination of the COT and NON COT error components from CSA Calculation C11006 (Ref. 5.95) are given below. The COT and NON COT error components are used in Figure 4.6.2 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = [\text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = [0.0^2 + 0.0^2 + (0.5+0.388)^2 + 0.375^2 + 0.0^2 + 1.950^2 + 0.0^2 + 0.0^2 + 0.200^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 2.241 % of span = ± 0.672 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{½}$

$\text{COT}_{\text{error}} = \pm$ 1.118 % of span = ± 0.335 PSIG

As Found Tolerance (AFT) = 3.6 PSIG ± 0.335 PSIG
As Left Tolerance (ALT) = 3.6 PSIG ± 0.15 PSIG(1)

See Figure 4.6.2 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± (0.5 % / 100 %) * 30 PSIG = ± 0.15 PSIG

KEWAUNEE'S HIGH CONTAINMENT PRESSURE (SAFETY INJECTION)

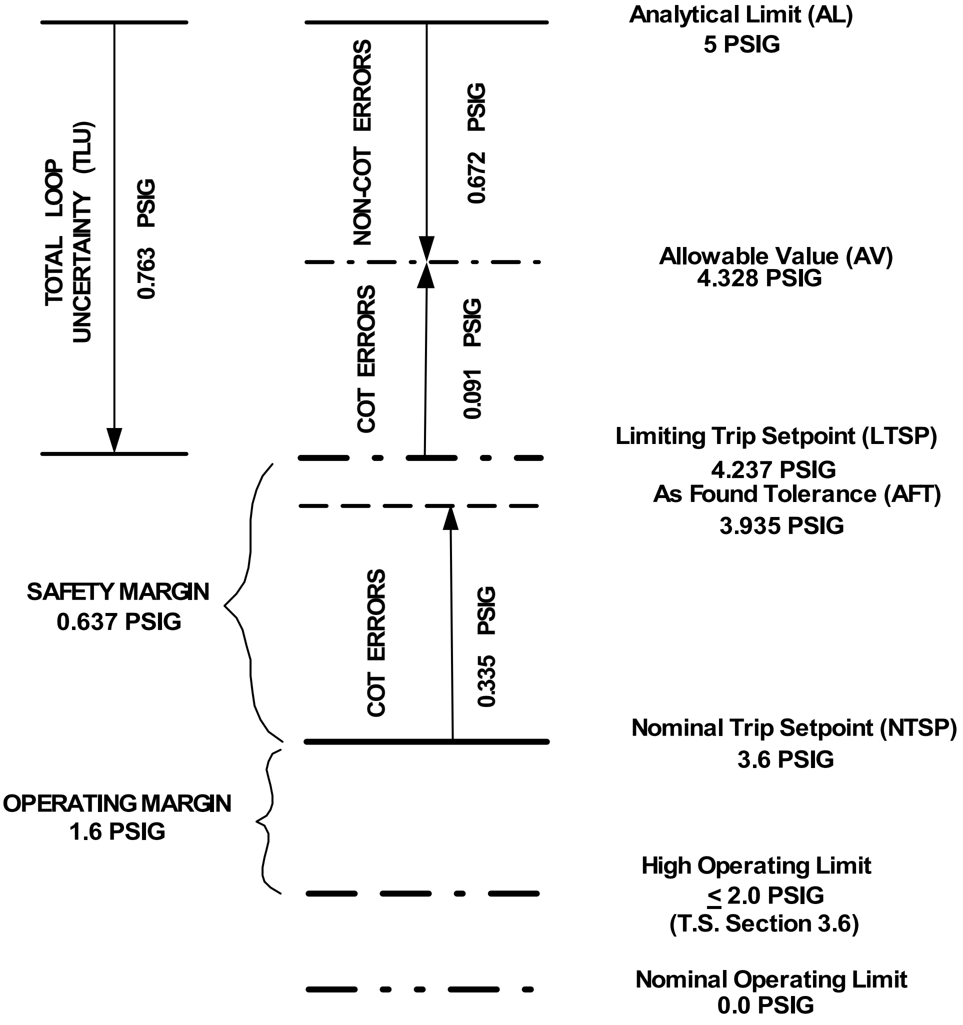

Figure 4.6.2

4.6.3 High - High Containment Pressure (Containment Spray)

As Found Tolerance: **As Found Tolerance = 21.0 PSIG ± 0.671 PSIG**
(Refs. 5.1, 5.90, 5.95, 5.110, and 5.111)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 21.622 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 21.827 PSIG. The current CTS Setting Limit for this function is ≤ 23.0 PSIG. The CTS Setting Limit for this function of ≤ 23.0 PSIG is set equal to the Analytical Limit and is non-conservative with respect to the Allowable Value. In addition, the current CTS Setting Limit is also non-conservative with respect to the calculated As Found Tolerance value of 21.0 PSIG ± 0.671 PSIG (i.e., 21.671 PSIG). The Actual Nominal Trip Setpoint of 21.0 PSIG is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of ≤ 23.0 PSIG will be changed to an As Found Tolerance value of 21.0 PSIG ± 0.671 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17.

The statistical combination of the COT and NON COT error components from CSA Calculation C11006 (Ref. 5.95) are given below. The COT and NON COT error components are used in Figure 4.6.3 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = (\text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2)^{1/2}$

$\text{NON COT}_{\text{error}} = [0.0^2 + 0.0^2 + (0.5+0.261)^2 + 0.375^2 + 0.0^2 + 1.677^2 + 0.0^2 + 0.0^2 + 0.2^2 + 0.5^2)^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 1.955 % of span = ± 1.173 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{½}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm$ 1.118 % of span = ± 0.671 PSIG

As Found Tolerance (AFT) = 21.0 PSIG ± 0.671 PSIG
As Left Tolerance (ALT) = 21.0 PSIG ± 0.300 PSIG⁽¹⁾

See Figure 4.6.3 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± (0.5 % / 100 %) * 60 PSIG = ± 0.30 PSIG

**KEWAUNEE'S HIGH HIGH CONTAINMENT PRESSURE
CONTAINMENT SPRAY INITIATION**

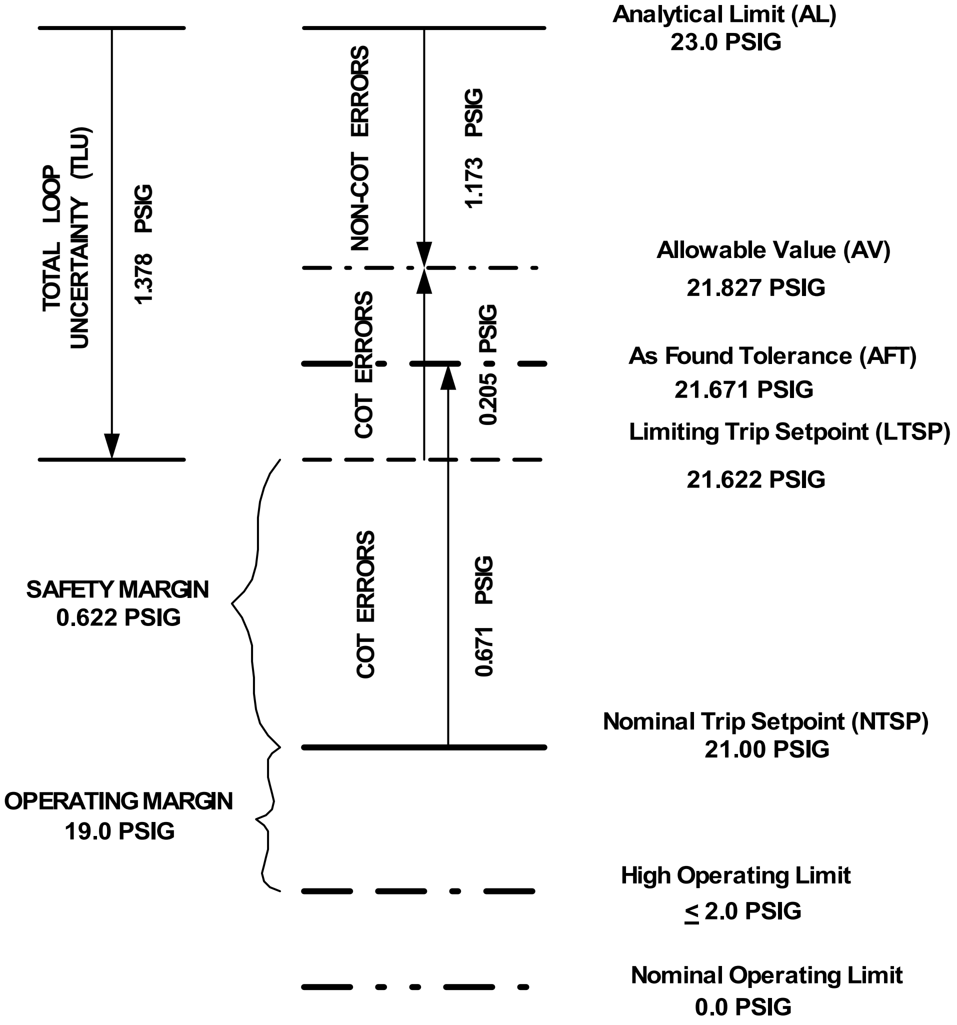

Figure 4.6.3

4.6.4 High - High Containment Pressure (Steam Line Isolation)

As Found Tolerance: **As Found Tolerance = 15.0 PSIG ± 0.671 PSIG**
(Refs. 5.1, 5.90, 5.95, 5.110, and 5.111)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 15.622 PSIG. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 15.827 PSIG. The current CTS Setting Limit for this function is ≤ 17.0 PSIG. The CTS Setting Limit for this function of ≤ 17.0 PSIG is set equal to the Analytical Limit and is non-conservative with respect to the Allowable Value. In addition, the current CTS Setting Limit is also non-conservative with respect to the calculated As Found Tolerance value of 15.0 PSIG ± 0.671 PSIG (i.e., 15.671 PSIG). The Actual Nominal Trip Setpoint of 15.0 PSIG is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of ≤ 17.0 PSIG will be changed to an As Found Tolerance value of 15.0 PSIG ± 0.671 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17.

The statistical combination of the COT and NON COT error components from CSA Calculation C11006 (Ref. 5.95) are given below. The COT and NON COT error components are used in Figure 4.6.4 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = (\text{PMA}^2 + \text{PEA}^2 + (\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2)^{1/2}$

$\text{NON COT}_{\text{error}} = [0.0^2 + 0.0^2 + (0.5+0.261)^2 + 0.375^2 + 0.0^2 + 1.677^2 + 0.0^2 + 0.0^2 + 0.2^2 + 0.5^2)^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 1.955 % of span = ± 1.173 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm$ 1.118 % of span = ± 0.671 PSIG

As Found Tolerance (AFT) = 15.0 PSIG ± 0.671 PSIG
As Left Tolerance (AFT) = 15.0 PSIG ± 0.300 PSIG(1)

See Figure 4.6.4 for specific details.

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(1) ALT = ± M2 = ± 0.5 % of span = ± (0.5 % / 100 %) * 60 PSIG = ± 0.30 PSIG

KEWAUNEE'S CONTAINMENT PRESSURE HI-HI STEAM LINE ISOLATION INITIATION

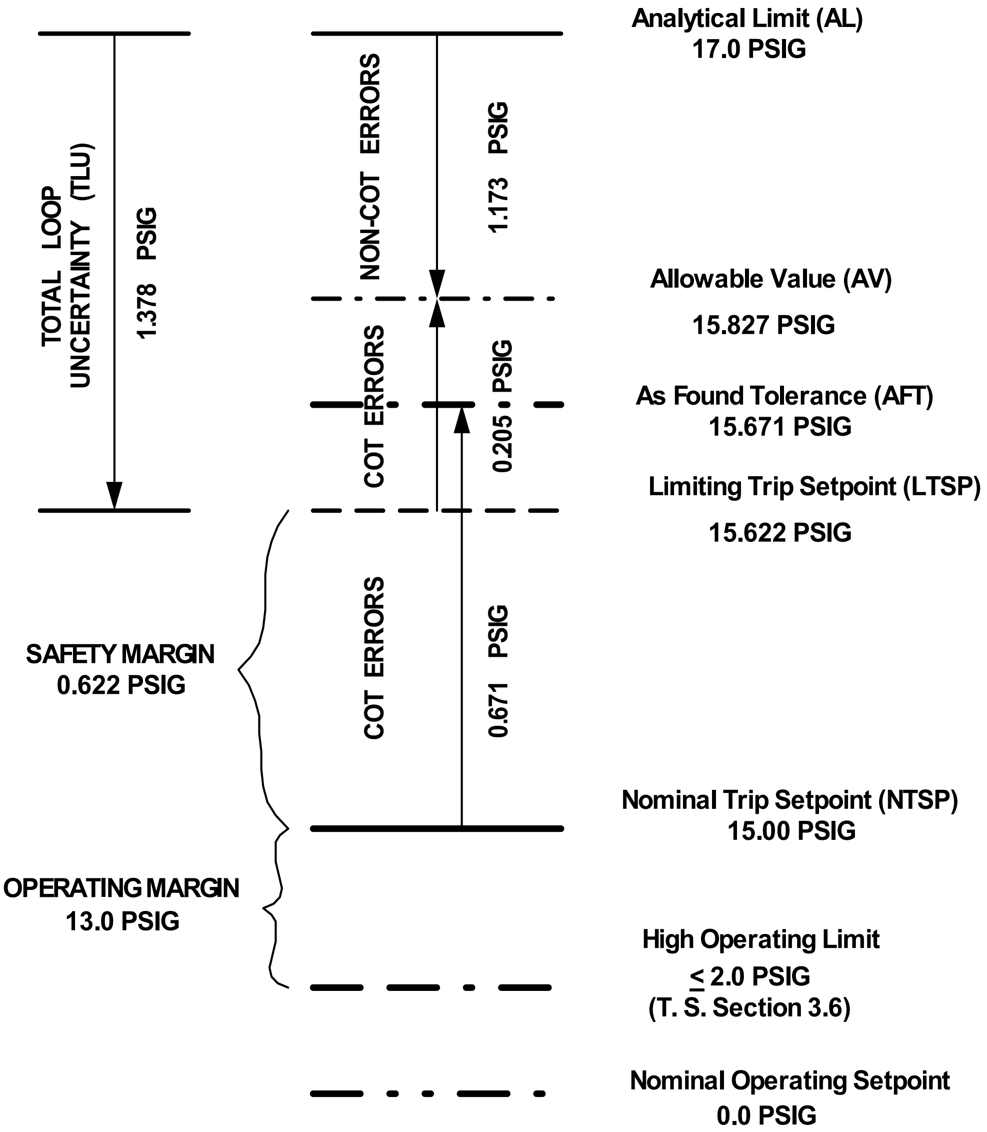

Figure 4.6.4

4.6.5 Pressurizer Low Pressure (Safety Injection)

As Found Tolerance: 1830 PSIG ± 10 PSIG (Refs. 5.1, 5.90, 5.93, and 5.105)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 1755.62 PSIG. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 1754.94 PSIG. The Actual Nominal Trip Setpoint of 1830 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specification (CTS) Setting Limit value of ≥ 1815 PSIG is conservative with respect to the Allowable Value. The current Custom Technical Specification (CTS) LSSS value ≥ 1815 PSIG is non-conservative based on the calculated COT error components determined in Calculation C10818 (Ref. 5.93). The Setting Limit value of ≥ 1815 PSIG will be changed to an As Found Tolerance value of 1830 PSIG ± 10.0 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. The revised As Found Tolerance value of ≥ 1820 PSIG will allow a 10.00 PSIG margin to be used for the COT error components. The revised As Found Tolerance value of ≥ 1820 PSIG is conservative with respect to the calculated Allowable Value but is non-conservative with respect to the calculated As Found Tolerance value using the CSA rack error terms from Calculation C10818 (Ref. 5.93).

The calculated As Found Tolerance value for this function is ≥ 1821.06 PSIG based on using the COT error components. The 1.06 PSIG offset is accommodated in the 74.38 PSIG Safety Margin for this trip as illustrated in Figure 4.6.5.

The statistical combination of the COT and NON COT error components from CSA Calculation C10818 (Ref. 5.93) are given below. The COT and NON COT error components are used in Figure 4.6.5 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} + \text{IR} \pm [\text{PMA}^2 + \text{PEA}^2 + \text{RE}_{\text{DBE}}^2 + \text{SPTE}^2 + (\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M4MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 + 0.174 \pm [0.0^2 + 0.0^2 + 1.688^2 + 8.0^2 + (0.250 + 0.391)^2 + 0.75^2 + 0.0^2 + 2.300^2 + 0.158^2 + 0.0^2 + 0.2^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = -\,8.395\ \%$ or $+\,8.743\ \%$ of span = + 69.944 PSIG (worst case)

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M4}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm\ 1.118\ \%$ of span = ± 8.944 PSIG (round to ± 10 PSIG)

As Found Tolerance (AFT) = 1830 PSIG ± 10 PSIG
As Left Tolerance (ALT) = 1830 PSIG ± 4.0 PSIG(1)

See Figure 4.6.5 for specific details.

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(1) ALT = ± M4 = ± 0.5 % of span = ± 4.0 PSIG

KEWAUNEE'S PRESSURIZER LOW PRESSURE ESFAS INITIATION

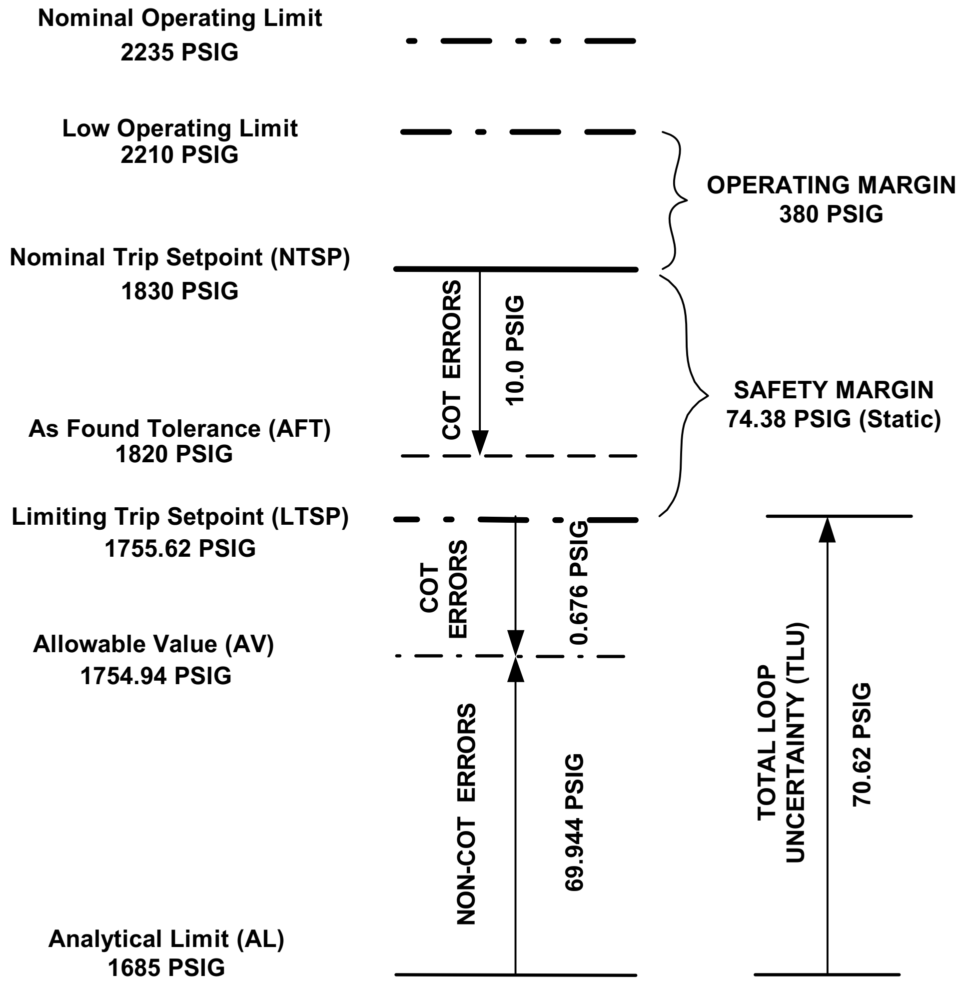

Figure 4.6.5

4.6.6 High Steam Flow Coincident with Safety Injection and Coincident with Tavg – Low Low

As Found Tolerance: **$0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr**
(Refs. 5.1, 5.90, 5.98, 5.108, and 5.120)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of $0.944 * 10^6$ lbs/hr. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of $0.981 * 10^6$ lbs/hr. The current CTS Setting Limit for this function is $0.745 * 10^6$ lbs/hr. The CTS Setting Limit for this function of $0.745 * 10^6$ lbs/hr is set conservative with respect to the Allowable Value. The current Nominal Trip Setpoint of $0.494 * 10^6$ lbs/hr is conservative with respect to the Limiting Trip Setpoint, however it is set overly conservative and at an unstable flowrate during startup. The current Nominal Trip Setpoint will be changed to $0.75 * 10^6$ lbs/hr equivalent to 19.63 % of Flow_{nom}(4). This revised Nominal Trip Setpoint will now be set at a more stable flowrate which should allow the trip to lock in without excessive relay chatter (i.e., passing through trip and reset multiple times) during the power escalation. The CTS Setting Limit of $0.745 * 10^6$ lbs/hr will be changed to an As Found Tolerance Value of $0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. This As Found Tolerance Value of $0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr is based on maintaining a Nominal Trip Setpoint value of $0.75 * 10^6$ lbs/hr.

The statistical combination of the COT and NON COT error components from CSA Calculation C10854 (Ref. 5.98) are given below. Calculation C10854 is based on a Nominal Trip Setpoint of $0.494 * 10^6$ lbs/hr versus the revised Nominal Trip Set point of $0.75 * 10^6$ lbs/hr which allows the current Channel Statistical Allowance (CSA) value to be used in this analysis since it is conservative. The COT and NON COT error components are used in Figure 4.6.6 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{EA}^2 + \text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2]^{1/2}$$

$$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.066^2 + 3.333^2 + (0.250+0.187)^2 + 0.386^2 + 0.503^2 + 1.557^2 + 0.158^2 + 0.0^2 + 0.2^2 + 0.5^2]^{1/2}$$

$$\text{NON COT}_{\text{error}} = \pm 3.801\% \text{ of } \Delta\text{P span} = \pm 17.197 \% \text{ of Flow Span} = \pm 0.769 * 10^6 \text{ lbs/hr}^{(1)}$$

$$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$$

$$\text{COT}_{\text{error}} = \pm 1.118\% \text{ of } \Delta\text{P span} = \pm 3.332 \% \text{ of Flow Span} = \pm 0.149 * 10^6 \text{ lbs/hr}^{(2)}$$

As Found Tolerance (AFT) = $0.75 * 10^6$ lbs/hr ± $0.149 * 10^6$ lbs/hr(2)
As Left Tolerance (ALT) = $0.75 * 10^6$ lbs/hr ± $0.067 * 10^6$ lbs/hr(3)

See Figure 4.6.6 for specific details.

KEWAUNEE'S HI STEAM FLOW COINCIDENT WITH SI AND LO-2 T_{AVG}

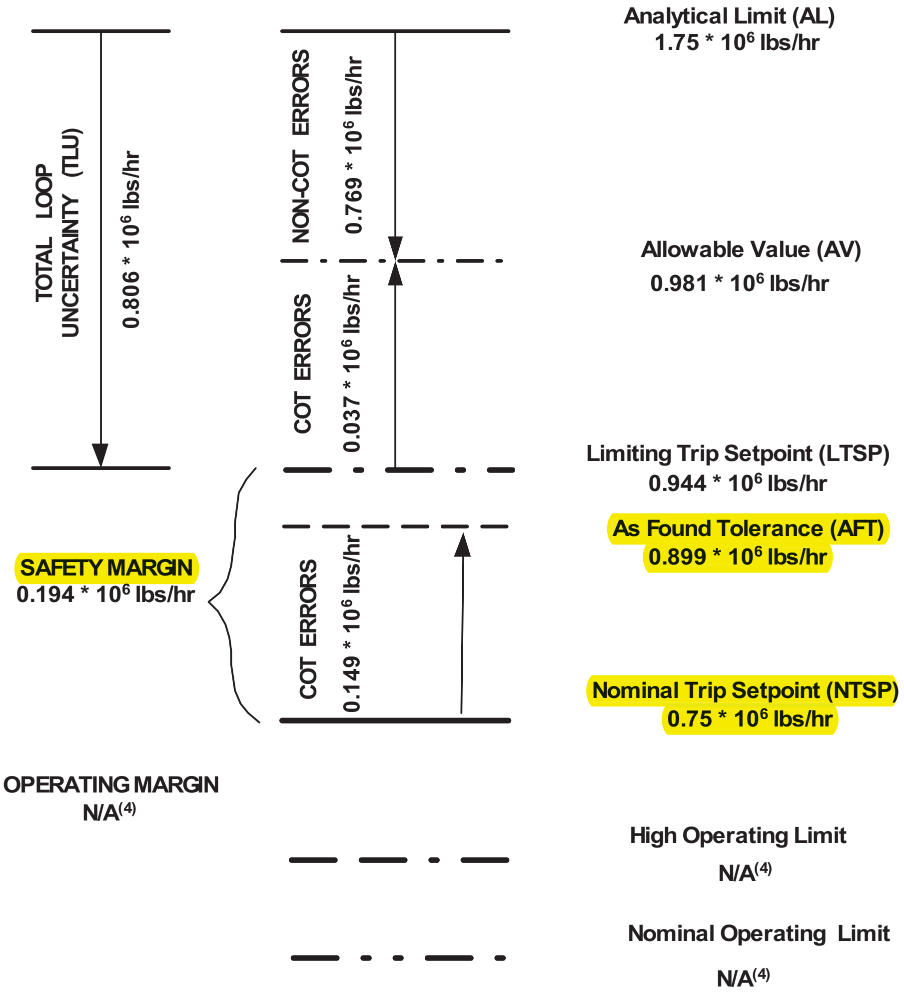

Figure 4.6.6

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(1) The equation to convert % ΔP error to % Flow error is: % flow span = (ΔP uncertainty) * 0.5 * (flow max / flow x) (Ref. 5.120). According to Reference 5.98, flow max = 4.47 * 10^6 lbs/hr and based on Reference 5.108, flow x = 0.494 * 10^6 lbs/hr. Therefore, the NON COT_{error} in terms of % Flow = $\pm$ 3.801 * 0.5 * (4.47 / 0.494) = 17.197 % Flow span = (17.197/100) * 4.47 = $\pm$ 0.769 * 10^6 lbs/hr.

(2) Using the information from Note 1 above and substituting the revised Nominal Trip Setpoint of 0.75* 10^6 lbs/hr , the AFT = COT_{error} in terms of % Flow = $\pm$ 1.118 * 0.5 * (4.47 / 0.75) = 3.332 % Flow span = (3.332/100) * 4.47 = $\pm$ 0.149 * 10^6 lbs/hr.

(3) The ALT = $\pm$ M2 = $\pm$ 0.5 % of ΔP span. Using the information from Note 1 above and substituting the revised Nominal Trip Setpoint of 0.75* 10^6 lbs/hr, the ALT in terms of % Flow = $\pm$ 0.5 * 0.5 * (4.47 / 0.75) = 1.49 % Flow span = (1.49/100) * 4.47 = $\pm$ 0.067 * 10^6 lbs/hr.

(4) The High Steam Flow portion of this ESFAS function is always active and will be locked in as a partial coincident trip at ≈ 0.75 * 10^6 lbs/hr, i.e., at ≈ 19.63 % Power where % power = (flow x / flow nom) * 100 = (0.75 / 3.82) * 100 = 19.63. Based on Reference 5.98, $Flow_{nom}$ (nominal steam flow at 100 % power) = 3.82 * 10^6 lbs/hr.

4.6.7 High High Steam Flow Coincident with Safety Injection

As Found Tolerance: 4.3439 * 10^6 lbs/hr ± 0.026 * 10^6 lbs/hr
(Refs. 5.1, 5.90, 5.98, 5.108, and 5.120)

Subtracting the Total Loop Uncertainty (TLU) from the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 7.668 * 10^6 lbs/hr. Subtracting the NON COT error components from the Analytical Limit yields an Allowable Value (AV) of 7.673 * 10^6 lbs/hr. The current CTS Setting Limit for this function is 4.4 * 10^6 lbs/hr. The CTS Setting Limit for this function of 4.4 * 10^6 lbs/hr is set conservative with respect to the Allowable Value; however, the current CTS Setting Limit is set non-conservative with respect to the calculated As Found Tolerance value of 4.3439 * 10^6 lbs/hr ± 0.026 * 10^6 lbs/hr (i.e., 4.3699 * 10^6 lbs/hr). The Actual Nominal Trip Setpoint of 4.3439 * 10^6 lbs/hr is conservative with respect to the Limiting Trip Setpoint. The CTS Setting Limit of 4.4 * 10^6 lbs/hr will be changed to an As Found Tolerance Value of 4.3439 * 10^6 lbs/hr ± 0.026 * 10^6 lbs/hr to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. This As Found Tolerance Value of 4.3439 * 10^6 lbs/hr ± 0.026 * 10^6 lbs/hr is based on maintaining a Nominal Trip Setpoint value of 4.3439 * 10^6 lbs/hr.

The statistical combination of the COT and NON COT error components from CSA Calculation C10854 (Ref. 5.98) are given below. The COT and NON COT error components are used in Figure 4.6.7 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{EA}^2 + \text{PMA}^2 + \text{PEA}^2 + (\text{SCA+SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + 3.333^2 + (0.250+0.187)^2 + 0.386^2 + 0.503^2 + 1.557^2 + 0.158^2 + 0.0^2 + 0.2^2 + 0.5^2]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 3.800% of ΔP span = ± 1.955 % of Flow Span = ± 0.087 * 10^6 lbs/hr$^{(1)}$

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{RD}^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm$ 1.118% of ΔP span = ± 0.575 % of Flow Span = ± 0.026 * 10^6 lbs/hr$^{(2)}$

As Found Tolerance (AFT) = 4.3439 * 10^6 lbs/hr ± 0.026 * 10^6 lbs/hr$^{(2)}$
As Left Tolerance (ALT) = 4.3439 * 10^6 lbs/hr ± 0.011 * 10^6 lbs/hr$^{(3)}$

See Figure 4.6.7 for specific details.

KEWAUNEE'S HI HI STEAM FLOW COINCIDENT WITH SAFETY INJECTION

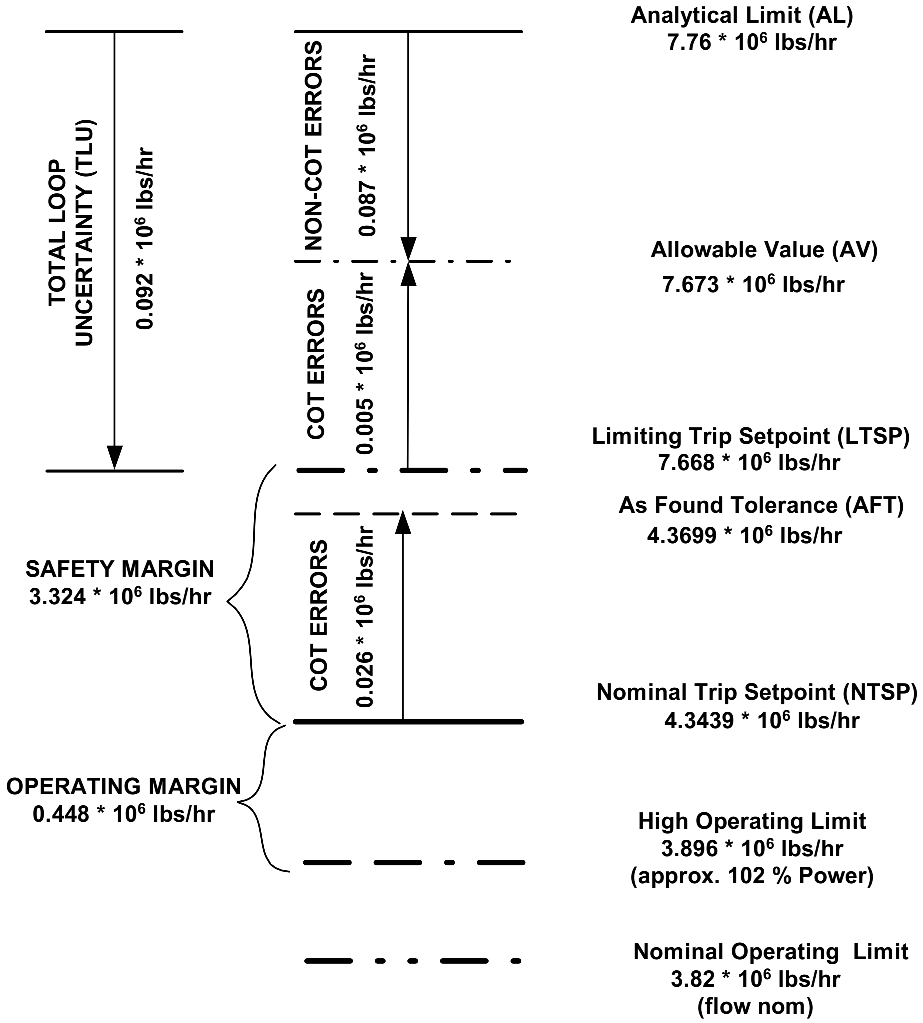

Figure 4.6.7

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(1) The equation to convert % ΔP error to % Flow error is: % flow span = (ΔP uncertainty) * 0.5 * (flow max / flow x) (Ref. 5.120). According to Reference 5.98, flow max = 4.47 * 10^6 lbs/hr and based on Reference 5.108, flow x = 4.3439 * 10^6 lbs/hr. Therefore, the NON COT_{error} in terms of % Flow = $\pm$ 3.800 * 0.5 * (4.47 / 4.3439) = 1.955 % Flow span = (1.955/100) * 4.47 = $\pm$ 0.087 * 10^6 lbs/hr.

(2) Using the information from Note 1 above, the AFT = COT_{error} in terms of % Flow = $\pm$ 1.118 * 0.5 * (4.47 / 4.3439) = 0.575 % Flow span = (0.575/100) * 4.47 = $\pm$ 0.026 * 10^6 lbs/hr.

(3) The ALT = $\pm$ M2 = $\pm$ 0.5 % of ΔP span. Using the information from Note 1 above, the ALT in terms of % Flow = $\pm$ 0.5 * 0.5 * (4.47 / 4.3439) = 0.257 % Flow span = (0.257/100) * 4.47 = $\pm$ 0.011 * 10^6 lbs/hr.

4.6.8 Low-Low T_{AVG} Coincidence input to Steam Line Isolation

As Found Tolerance Value: 541.0 °F ± 1.38 °F (Refs. 5.1, 5.90, 5.94, and 5.105)

The current Custom Technical Specification (CTS) Setting Limit for this function is ≥ 540.0 °F. The current Nominal Trip Setpoint for this function is ≥ 541.0 °F (Ref. 5.105). The Low T_{AVG} Coincidence input to the Steam Line Isolation ESFAS function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) Calculation has been performed for this function. Based on Calculation C11865 (Ref. 5.94), the COT error allowance for this function is ± 1.38 % of span = ± 1.38 °F. The As Found Tolerance based on the COT error from Calculation C11865 is 541 °F ± 1.38 °F. The CTS Setting Limit for this function of ≥ 540.0 °F is set slightly conservative with respect to the calculated As Found Tolerance value of 541 °F ± 1.38 °F (i.e. 539.62 °F). The As Found Tolerance being slightly non-conservative with respect to the current CTS Setting Limit is acceptable because there is no Analytical Limit associated with this function. The As Left Tolerance will be based on the COT error allowance minus Rack Drift (i.e., RD_2 from Ref. 5.94). The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint Value of 541 °F.

As Found Tolerance (AFT) = 541.0 °F ± 1.38 °F(1)
As Left Tolerance (ALT) = 541 °F ± 0.95 °F (2)

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(1) AFT = $\pm((M1 * 0.667)^2 + (M2 * 0.667)^2 + M4^2 + M8^2 + RD_2^2)^{½} = \pm((0.417 * 0.667)^2 + (0.417 * 0.667)^2 + 0.707^2 + 0.5^2 + 1.0^2)^{½} = \pm 1.38$ % of T_{AVG} span

(2) (2) ALT = $\pm((M1 * 0.667)^2 + (M2 * 0.667)^2 + M4^2 + M8^2)^{½} = \pm((0.417 * 0.667)^2 + (0.417 * 0.667)^2 + 0.707^2 + 0.5^2)^{½} = \pm 0.95$ % of T_{AVG} span

(3) The effective gain of the T_{AVG} summing junction is set by the relationship of the T_{AVG} span versus the span of T_{HOT} and T_{COLD} (i.e., 520 to 620 °F versus 500 to 650 °F, span equal to 150 °F). For Kewaunee, the effective gain is 0.6667 V/V, therefore % T_{AVG} span is equal to % T_{HOT} span or T_{COLD} span * 0.6667.

4.6.9 Steam Line Pressure - Low

As Found Tolerance: 514.0 PSIG ± 17.15 PSIG (Refs. 5.1, 5.90, 5.98, and 5.108)

Adding the Total Loop Uncertainty (TLU) to the Analytical Limit (AL) yields a Limiting Trip Setpoint (LTSP) of 511.066 PSIG. Adding the NON COT error components to the Analytical Limit yields an Allowable Value (AV) of 504.01 PSIG. The Actual Nominal Trip Setpoint of 514.0 PSIG is conservative with respect to the Limiting Trip Setpoint. The current Custom Technical Specifications (CTS) Setting Limit of ≥ 500 PSIG is non-conservative with respect to the calculated Allowable Value and is conservative with respect to the calculated As Found Tolerance. The As Found Tolerance of 514 PSIG ± 17.15 PSIG is based on the calculated COT error allowance from Calculation C10854 (Ref. 5.98). The Custom Technical Specifications (CTS) Setting Limit of ≥ 500 PSIG will be changed to an As Found Tolerance of 514 PSIG ± 17.15 PSIG to conform to the requirements of TSFT-493, Rev. 4 and RIS 2006-17. The calculated As Left Tolerance will be based on the COT error allowance from Calculation C10854 minus Rack Drift (RD). The As Found and As Left Tolerances are based on maintaining a Nominal Trip Setpoint of 514.0 PSIG.

The statistical combination of the COT and NON COT error components from CSA Calculation C10854 (Ref. 5.98) are given below. The COT and NON COT error components are used in Figure 4.6.9 to determine the Limiting Trip Setpoint (LTSP) and the Allowable Value (AV).

$\text{NON COT}_{\text{error}} = \text{SE} \pm [\text{EA}^2 + \text{PMA}^2 + \text{PEA}^2 + (\text{SCA}+\text{SMTE})^2 + \text{SD}^2 + \text{SPE}^2 + \text{STE}^2 + \text{SPSE}^2 + \text{M1MTE}^2 + \text{M2MTE}^2 + \text{M3MTE}^2 + \text{RTE}^2]^{1/2}$

$\text{NON COT}_{\text{error}} = 0.0 \pm [0.0^2 + 0.0^2 + 0.0^2 + (0.250 + 0.180)^2 + 0.429^2 + 0.0^2 + 1.475^2 + 0.158^2 + 0.0^2 + 0.283^2 + 0.2^2 + 0.5^2\ ]^{1/2}$

$\text{NON COT}_{\text{error}} = \pm$ 1.715 % of span = ± 24.01 PSIG

$\text{COT}_{\text{error}} = \pm (\text{M1}^2 + \text{M2}^2 + \text{M3}^2 + \text{RD}^2)^{½}$

$\text{COT}_{\text{error}} = \pm (0.0^2 + 0.5^2 + 0.5^2 + 1.0^2)^{1/2}$

$\text{COT}_{\text{error}} = \pm$ 1.225 % of span = ± 17.15 PSIG

As Found Tolerance (AFT) = 514.0 PSIG ± 17.15 PSIG
As Left Tolerance (ALT) = 514 PSIG ± 10.0 PSIG(1)

See Figure 4.6.9 for specific details.

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(1) $\text{ALT} = (\text{M1}^2 + \text{M2}^2 + \text{M3}^2)^{½} = \pm (0.0^2 + 0.5^2 + 0.5^2)^{½} = \pm$ 0.707 % of span = ± 9.898 PSIG (round to ± 10. PSIG)

KEWAUNEE'S STEAM LINE PRESSURE LOW ESFAS INITIATION

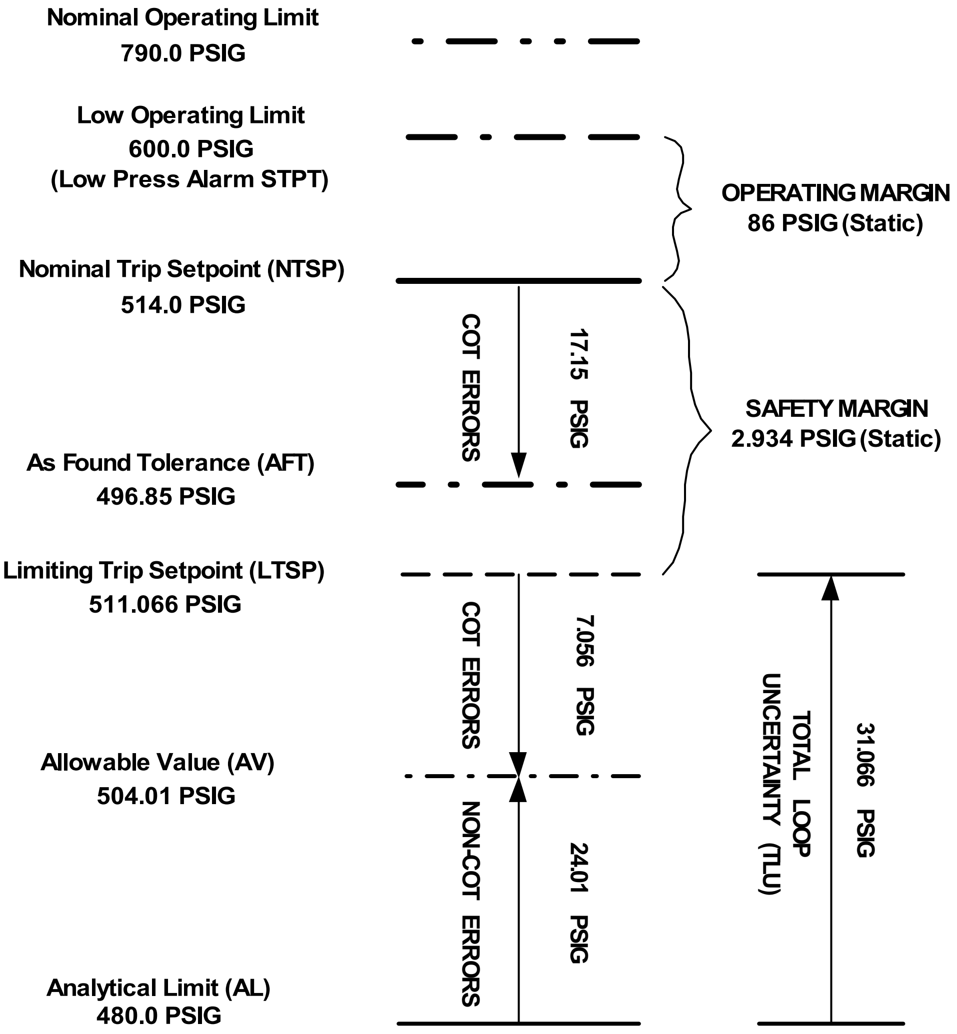

Figure 4.6.9

4.6.10 Steam Generator Water Level Low Low Reactor Trip/SI

See item 4.5.15.

4.6.11 SG Water Level - High High

See Section 3.5.3.

4.7 Limiting Trip Setpoints, Allowable Values, As Found Tolerances, and As Left Tolerances for Kewaunee Instrumentation associated with LCO's 3.3.5, 3.3.6, and 3.3.7 to support the Setpoint Control Program

4.7.1 Safeguards Bus Undervoltage (Loss of Voltage)

As Found Tolerance: **84.47 ± 0.200 % of Bus Voltage = 101.69 ± 0.241 VAC with a time delay of 1.75 seconds ± 0.25 seconds**
(Refs. 5.1, 5.90, 5.102, & 5.129)

The current Custom Technical Specification (CTS) Setting Limit for this function is 85 % ± 2 % of bus voltage in ≤ 2.5 secs. The current Nominal Trip Setpoint for this function is 101.49 to 101.89 VAC where 101.69 VAC is the centerline voltage = 84.47 % of bus voltage(1) (Ref. 5.102 & 5.129). This analysis assumes that 120.39 VAC from the potential transformer is equal to 100 % of bus voltage which is equal to 4160 VAC per the conversion factor as noted in footnote 1. The Safeguards Bus Undervoltage Loss of Power Trip is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) calculation has been performed for this function. The calibration accuracy for this trip is 101.69 ± 0.2 VAC = 84.47 ± 0.166 % of bus voltage (1) (Ref. 5.129). The COT error from Calculation C11709 is ± 0.200 % of bus voltage = ± 0.241 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.47 ± 0.200 % of bus voltage = 101.69 ± 0.241 VAC(1) based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.47 ± 0.166 % of bus voltage = 101.69 ± 0.200 VAC based on the device calibration accuracy from Reference 5.129. The As Found Tolerance and As Left Tolerance are based on maintaining a Nominal Trip Setpoint Value of 101.69 VAC = 84.47 % of bus voltage.

The time delay associated with this trip is based on a setpoint of 1.75 seconds ± 0.01 seconds (Ref. 5.129). Calculation C11709 (Ref. 5.102) gives a total error associated with the relays as 14.14 % of the settings. Utilizing the total error of 14.14 % of the setting provides a range of 1.50 seconds to 2.00 seconds based on a setpoint of 1.75 seconds. Therefore, the Time Delay As Found Tolerance is 1.75 seconds ± 0.25 seconds. The Time Delay As Left Tolerance is 1.75 ± 0.10(5) second based on the device calibration accuracy from Reference 5.129.

As Found Tolerance (AFT) = 84.47 ± 0.200 % of bus voltage = 101.69 ± 0.241 VAC(2)
As Left Tolerance (ALT) = 84.47 ± 0.166 % of bus voltage = 101.69 ± 0.200 VAC(3)
Time Delay As Found Tolerance = 1.75 Seconds ± 0.25 seconds
Time Delay As Left Tolerance = 1.75 Seconds ± 0.10 seconds(5)

As Found Tolerance (AFT) = 84.15 ± 0.200 % of bus voltage = 101.31 ± 0.241 VAC(4)
As Left Tolerance (ALT) = 84.15 ± 0.166 % of bus voltage = 101.31 ± 0.200 VAC(4)

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(1) Convert % bus Voltage to VAC as follows:
4160*(% bus Volts / 100) / (sqrt (3) * 20 * 0.9975) = VAC
Where 20 is the PT turn down ratio and 0.9775 is the Ratio Correction Factor (Ref. 5.102).

(2) AFT = ± SCA = ± 0.200 % bus voltage (From Reference 5.102).

(3) ALT = Current Calibration Accuracy from Reference 5.129 = ± 0.166 % bus voltage.

(4) Calculation C11709 (Ref. 5.102) recommends a setpoint change for the Safeguards Bus Undervoltage Loss of Voltage Trip. The recommended setpoint will be 101.31 ± 0.200 VAC = 84.15 ± 0.166 % of bus voltage for the relay Dropout.

The COT error from Calculation C11709 is ± 0.200 % of bus voltage = ± 0.241 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.15 ± 0.200 % of bus voltage = 101.31 ± 0.241 VAC based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Undervoltage Loss of Power Trip is 84.15 ± 0.166 % of bus voltage = 101.31 ± 0.200 VAC based on the recommendation from Reference 5.102. The As Found Tolerance and As Left Tolerance are based on implementing the recommendations of Calculation C11709 and setting the Nominal Trip Setpoint to a value of 101.31 VAC = 84.15 % of bus voltage. The same Time Delay Tolerances apply for the new setpoints.

(5) Undervoltage relays 27A/B5, 27C/B5, 26A/B6, 27C/B6 have an As Left time delay of 0.01 seconds listed in the Electrical Preventive Maintenance Procedures with an As Found time delay of 0.1 seconds. The procedure value of 0.01 seconds is conservative to the As Left Tolerance of 0.1 seconds as described above.

4.7.2 Safeguards Bus Second Level Undervoltage (Degraded Voltage)

As Found Tolerance: **93.80 ± 0.179 % of bus voltage = 112.93 ± 0.215 VAC with a time delay of 6.72 seconds ± 0.68 seconds**
(Refs. 5.1, 5.90, 5.102, & 5.129)

The current Custom Technical Specification (CTS) Setting Limit for this function is 93.6 % ± 0.9 % of bus voltage in ≤ 7.4 secs. The current Nominal Trip Setpoint for this function is 112.73 to 113.13 VAC where 112.93 VAC is the centerline voltage = 93.80 % of bus voltage(1) (Ref. 5.102 & 5.129). This analysis assumes that 120.39 VAC from the potential transformer is equal to 100 % of bus voltage which is equal to 4160 VAC per the conversion factor as noted in footnote 1. The Safeguards Bus Second Level Undervoltage Degraded Voltage Trip is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1); however a Channel Statistical Allowance (CSA) calculation has been performed for this function. The calibration accuracy for this trip is 112.93 ± 0.2 VAC = 93.80 ± 0.166 % of bus voltage (1) (Ref. 5.129). The COT error from Calculation C11709 is ± 0.179 % of bus voltage = ± 0.215 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Second Level Undervoltage Degraded Voltage Trip is 93.80 ± 0.179 % of bus voltage = 112.93 ± 0.215 VAC based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Second Level Undervoltage Degraded Voltage Trip is 93.80 ± 0.166 % of bus voltage = 112.93 ± 0.200 VAC based on the device calibration accuracy from Reference 5.129. The As Found Tolerance and As Left Tolerance are based on maintaining a Nominal Trip Setpoint Value of 112.93 VAC = 93.80 % of bus voltage.

The time delay associated with this trip is based on a setpoint of 6.72 seconds ± 0.01 seconds (Ref. 5.129). Calculation C11709 (Ref. 5.102) gives a total error associated with the relays as 10.1 % of the settings. Utilizing the total error of 10.1 % of the setting provides a range of 6.04 seconds to 7.40 seconds based on a setpoint of 6.72 seconds. Therefore, the Time Delay As Found Tolerance is 6.72 seconds ± 0.68 seconds. The Time Delay As Left Tolerance is 6.72 ± 0.10(5) second based on the device calibration accuracy from Reference 5.129.

As Found Tolerance (AFT) = 93.80 ± 0.179 % of bus voltage = 112.93 ± 0.215 VAC(2)
As Left Tolerance (ALT) = 93.80 ± 0.166 % of bus voltage = 112.93 ± 0.200 VAC (3)
Time Delay As Found Tolerance = 6.72 Seconds ± 0.68 seconds
Time Delay As Left Tolerance = 6.72 Seconds ± 0.10 seconds(5)

As Found Tolerance (AFT) = 93.50 ± 0.200 % of bus voltage = 112.57 ± 0.215 VAC(4)
As Left Tolerance (ALT) = 93.50 ± 0.166 % of bus voltage = 112.57 ± 0.200 VAC(4)

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(1) Convert % bus Voltage to VAC as follows:
4160*(% bus Volts / 100) / (sqrt (3) * 20 * 0.9975) = VAC
Where 20 is the PT turn down ratio and 0.9775 is the Ratio Correction Factor (Ref. 5.102).
(2) AFT = ± SCA = ± 0.179 % bus voltage (From Reference 5.102).
(3) ALT = Current Calibration Accuracy from Reference 5.129 = ± 0.166 % bus voltage.
(4) Calculation C11709 (Ref. 5.102) recommends a setpoint change for the Safeguards Bus Undervoltage Degraded Voltage Trip. The recommended setpoint will be 112.57 ± 0.200 VAC = 93.50 ± 0.166 % of bus voltage for the relay Dropout. The COT error from Calculation C11709 is ± 0.179 % of bus voltage = ± 0.215 VAC. Therefore, the As Found Tolerance for the Safeguards Bus Undervoltage Degraded Voltage Trip is 93.50 ± 0.179 % of bus voltage = 112.57 ± 0.215 VAC based on the device calibration accuracy from Reference 5.102. The As Left Tolerance for the Safeguards Bus Undervoltage Degraded Voltage Trip is 93.50 ± 0.166 % of bus voltage = 112.57 ± 0.200 VAC based on the recommendation from Reference 5.102. The As Found Tolerance and As Left Tolerance are based on implementing the recommendations of Calculation C11709 and setting the Nominal Trip Setpoint to a value of 112.57 VAC = 93.50 % of bus voltage. The same Time Delay Tolerances apply for the new setpoints.
(5) Undervoltage (Degraded Voltage) relays 27AY/B5, 27CY/B5, 26AY/B6, 27CY/B6 have an As Left time delay of 0.01 seconds listed in the Electrical Preventive Maintenance Procedures with an As Found time delay of 0.1 seconds. The procedure value of 0.01 seconds is conservative to the As Left Tolerance of 0.1 seconds as described above.

4.7.3 Forebay Level

As Found Tolerance: 162" H2O ± 9" H2O (Refs. 5.1, 5.90, 5.101 & 5.121)

The current Custom Technical Specifications (CTS) do not list a Setting Limit value associated with the Forebay Level Trip. The Forebay Level Trip function is not credited in the Kewaunee USAR Chapter 14 Safety Analysis (Ref. 5.1). The current As Found Nominal Trip Setpoint for this function is 162 Inches H2O Decreasing ± 9.0 Inches H2O per Reference 5.121. The current As Left Nominal Trip Setpoint is 162 Inches H2O Decreasing ± 4.5 Inches H2O per Reference 5.121. Per Calculation C11220 (Ref. 5.101) testing concluded that at a water level of 565' 3", acceptable conditions exist for continued operation of the SW pumps. The setpoint of 162" H2O is equivalent to 566' Forebay water level per Reference 5.101, which yields a difference of 9" H2O to be used for the As Found Tolerance.

As Found Tolerance (AFT) = 162" H2O ± 9" H2O(1)
As Left Tolerance (ALT) = 162" H2O ± 4.5" H2O(2)

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(1) AFT = Margin from minimum level for SW Pump operation – Existing Setpoint Equivalent (Ref. 5.101) = 566' – 565'3" = 9"
(2) ALT = Current As Left Calibration Accuracy from Reference 5.121 = 4.5"

4.7.4 Containment Purge and Vent System Radiation Particulate Detector and Radioactive Gas Detector Containment Ventilation Isolation

Containment Gas Radiation Monitors (R12 and R21)

As Found Tolerance: **2.2 E+05 CPM + BKG**
(Refs. 5.1, 5.90, 5.113, 5.114, 5.115, 5.123, 5.124, 5.131, & 5.143)

The current Custom Technical Specifications (CTS) Setting Limit for this function states "≤ radiation levels in exhaust duct as defined in footnote(3)". The current Nominal Trip Setpoint (4) for the Containment Gas Radiation Monitors are 8.00 E +04 CPM for the High Alarm Setpoint per References 5.123 and 5.143. The Containment Gas Radiation monitors are not credited in the Chapter 14 Safety Analysis (Ref. 5.1). The Alert and Alarm setpoints are determined IAW the methodology outlined in the Kewaunee Power Station Offsite Dose Calculation Manual (ODCM) and documented in Calculation C10690 (Ref. 5.115). The High Alarm Setpoint provides the Containment Isolation signal. The calculated High Alarm Setpoint per the ODCM and Calculation C10690 (Refs. 5.113 & 5.115) is currently 2.2 E +05 CPM + Background (BKG). The Setpoints listed in Reference 5.123 are set conservative to the values determined in the ODCM and Calculation C10690 (Refs. 5.113 & 5.115). There are currently no Analytical Limits or Allowable Values associated with this function (Ref. 5.1). The determination of the setpoints is not within the scope of the Setpoint Control Program and the current High Alarm Nominal Trip Setting of 8.00E +04 CPM is conservative with respect to the calculated value listed in the ODCM and Calculation C10690. Based on Reference 5.113 & 5.115 the As Found Tolerance will be 2.2 E +05 CPM + Background. The As Left Tolerance will be based on the existing High Alarm Setpoint listed in Reference 5.123.

As Found Tolerance (AFT) = 2.2 E+05 CPM + BKG (1)
As Left Tolerance (ALT) = 8.00 E+04 CPM (2)

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(1) AFT = Setpoint taken from Reference 5.113 & 5.115
(2) ALT = Calibration Procedure Setpoint = 8.0 E+04 CPM (Reference 5.123 & 5.124)
(3) Footnote three from Technical Specification Table 3.5-1 page 2 of 2 states "The setting limits for max radiation levels are derived from ODCM Specification 3.4.1 and Table 2.2, and USAR Section 6.5."
(4) The Alert Setpoint is determined IAW References 5.113 and 5.115 and is set at 2.00 E +04 CPM per Reference 5.123. The Alert Setpoint provides an alarm function only and the Containment Isolation signal is provided by the High Alarm Setpoint.

4.7.5 Containment Particulate Radiation Monitor (R11)

As Found Tolerance: 8.00 E+04 CPM
(Refs. 5.1, 5.90, 5.113, 5.114, 5.115, 5.122, 5.124, & 5.131)

The current Custom Technical Specifications (CTS) Setting Limit for this function states "$\leq$ radiation levels in exhaust duct as defined in footnote(3)". The current Nominal Trip Setpoint for the Containment Particulate Radiation Monitor is 5.00 E +04 CPM for the alert setpoint and 8.00 E +04 CPM for the High Alarm per Reference 5.122. The Containment Particulate Radiation monitor is not credited in the Chapter 14 Safety Analysis (Ref. 5.1). Per USAR Table 11.2.7 the Setpoint is set "Statistically significant level above background". The Design Change Process which is controlled by the 50.59/72.48 process is utilized to determine any setpoint changes associated with the Containment Particulate Radiation Monitors. The existing setpoints are shown on drawing E-2021 (Ref. 5.124) and were derived utilizing this process and will be maintained as the As Found Tolerance and the As Left Tolerance.

As Found Tolerance (AFT) = 8.00 E+04 CPM (1)
As Left Tolerance (ALT) = 8.00 E+04 CPM (2)

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(1) AFT = Calibration Procedure Setpoint = 8.0 E+04 CPM (Reference 5.122, & 5.124)
(2) ALT = Calibration Procedure Setpoint = 8.0 E+04 CPM (Reference 5.122 & 5.124)
(3) Footnote three from Technical Specification Table 3.5-1 page 2 of 2 states "The setting limits for max radiation levels are derived from ODCM Specification 3.4.1 and Table 2.2, and USAR Section 6.5."

4.7.6 Control Room Ventilation Radiation Monitor (R23)

As Found Tolerance: 1.00 E+04 CPM (Refs. 5.1, 5.114, 5.124, & 5.125)

The current Custom Technical Specifications (CTS) Setting Limit does not specify a Setting Limit for this Radiation Monitor. The Improved Technical Specifications have added this monitor. The current Nominal Trip Setpoint for the Control Room Ventilation Radiation Monitor is 5.00 E +03 CPM for the alert setpoint and 1.00 E +04 CPM for the High Alarm per References 5.124 and 5.125. The Control Room Ventilation Radiation Monitor is not credited in the Chapter 14 Safety Analysis (Ref. 5.1). Per USAR Table 11.2.7 the Setpoint is set "Statistically significant level above background". The Design Change Process which is controlled by the 50.59/72.48 process is utilized to determine any setpoint changes associated with the Control Room Radiation Monitor. The existing setpoints are shown in drawing E-2021 (Ref. 5.124) and were derived utilizing this process and will be maintained as the As Found Tolerance and the As Left Tolerance.

As Found Tolerance (AFT) = 1.00 E+04 CPM (1)
As Left Tolerance (ALT) = 1.00 E+04 CPM (2)

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(1) AFT = Calibration Procedure Setpoint = 1.0 E+04 CPM (Reference 5.124, & 5.125)
(2) ALT = Calibration Procedure Setpoint = 1.0 E+04 CPM (Reference 5.124, & 5.125)

4.7.7 Turbine Building Service Water Header Isolation

As Found Tolerance: **82.5 PSIG ± 1.0 PSIG** **(Refs. 5.1, 5.114, 5.140, & 5.141)**

The current Custom Technical Specifications (CTS) does not address the Turbine Building Service Water Header Isolation function. Improved Technical Specifications (ITS) has added this function to ITS Table 3.3.2-1. Based on References 5.140 and 5.141, the current Nominal Trip Setpoint for Turbine Building Service Water Low Pressure Isolation is 82.5 PSIG (decreasing). The Turbine Building Service Water Header Isolation function is not credited in the Chapter 14 Safety Analysis (Ref. 5.1). Based on Reference 5.140, the calibration accuracy for the pressure switch is ± 1.0 PSIG. For this application, the As Found Tolerance and As Left Tolerance will be set at the same value, i.e., ± 1.0 PSIG.

As Found Tolerance (AFT) = 82.5 PSIG ± 1.0 PSIG
As Left Tolerance (ALT) = 82.5 PSIG ± 1.0 PSIG

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(3) AFT = Calibration Procedure Setpoint = ± 1.0 PSIG (Reference 5.140)
(4) ALT = Calibration Procedure Setpoint = ± 1.0 PSIG (Reference 5.140)

5.0 REFERENCES

5.1 Technical Report NE-0994, Revision 17, Safety Analysis Limits for Technical Specification Instrumentation - Companion to EE-0101, September 2009.

5.2 Technical Report EE-0101, Revision 10, Setpoint Basis Document – Analytical Limits, Setpoints and Calculations for Technical Specification Instrumentation At North Anna and Surry Power Stations, Dated 12-11-07.

5.3 Westinghouse - NAPS Reactor Protection System/Engineered Safety Features Actuation System Setpoint Methodology (NRC Letter - S/N 541, Dated 09-28-78).

5.4 Engineering Transmittal CEE 99-0028, Revision 0, Response to Open Items ITS LCO 3.3.1, Surry Power Station Units 1 and 2, Dated 10-29-99.

5.5 Dominion Virginia Power STD-EEN-0304, Revision 6, Calculating Instrumentation Uncertainties By the Square Root of the Sum of the Squares Method.

5.6 Dominion Virginia Power STD-GN-0030, Revision 8, Nuclear Plant Setpoints.

5.7 Surry Power Station Technical Specifications.

5.8 North Anna Power Station Technical Specifications.

5.9 USNRC Regulatory Guide 1.105, Revision 3 (December 1999), Setpoints for Safety-Related Instrumentation.

5.10 Improved Thermal Design Procedure, Instrument Uncertainties for North Anna Units 1 & 2 Core Uprating C. R. Tuley July 1986, Westinghouse Electric Corporation.

5.11 Dominion Virginia Power Technical Report EE-0099, Revision 0 (AR), North Anna Instrument Tolerance Document.

5.12 Dominion Virginia Power Technical Report EE-0100, Revision 2 with Appendices 5, 12, and 18.

5.13 Dominion Virginia Power Technical Report EE-0085, Revision 2 with Appendices 5, 12, and 18.

5.14 Engineering Transmittal CEE 95-037, Revision 2, Transmittal of Surveillance Limits for RPS and ESFAS Primary Trip Functions at Surry Power Station Units 1 and 2, Dated 03-20-02.

5.15 Dominion Virginia Power Calculation EE-0063, Revision 2, Setpoint Accuracy for Power Range Neutron Flux High Setpoint Reactor Trip, North Anna Power Station, Units 1 and 2.

5.16 Dominion Virginia Power Calculation EE-0738, Revision 1, Add. 00A, NIS Intermediate Range Channel Statistical Allowance Calculation.

5.17 Dominion Virginia Power Calculation EE-0710, Revision 0, North Anna Nuclear Instrumentation Source Range Uncertainty.

5.18 Dominion Virginia Power Calculation EE-0434, Revision 2, Delta T and T AVG Protection Loops, T-412, T-422 and T-432, North Anna Power Station, Units 1 and 2.

5.19 Dominion Virginia Power Calculation EE-0069, Revision 3, with Add 00A, Setpoint and Indication Accuracy for Pressurizer Pressure Loops.

5.20 Dominion Virginia Power Calculation EE-0058, Revision 2, CSA for North Anna Pressurizer Level Protection & Indication CSA.

5.21 Dominion Virginia Power Calculation EE-0060, Revision 3, CSA for North Anna Power Station Units 1 & 2 Reactor Coolant Flow Protection.

5.22 Dominion Virginia Power Calculation EE-0492, Revision 2, with Add. 00A, CSA Calculation for North Anna Power Station, Steam Generator Narrow Range Level, Units 1 & 2, Loops L-1474, L-1475, L-1476, L-1484, L-1485, L-1486, L-1494, L-1495, L-1496, L-2474, L-2475, L-2476, L-2484, L-2485, L-2486, L-2494, L-2495, & L-2496.

5.23 Dominion Virginia Power Calculation EE-0736, Revision 5, Channel Uncertainty for North Anna Units 1&2 Feedwater Flow and Steam Flow Channels Including Channel Check Criteria for Feedwater and Steam Flow Indication.

5.24 Dominion Virginia Power Calculation EE-0524, Revision 0 with Add. 0A and 0B, Reactor Coolant Pump Undervoltage and Underfrequency Trip Setpoints.

5.25 Dominion Virginia Power Calculation EE-0052, Revision 2, with Add. 00A, North Anna Containment Narrow Range Pressure Uncertainty.

5.26 Dominion Virginia Power Calculation EE-0121, Revision 3, with Add. 00A North Anna Main Steam Pressure Protection Channel Uncertainty.

5.27 Dominion Virginia Power Calculation EE-0092, Revision 4, North Anna Refueling Water Storage Tank Level Uncertainty – Wide Range.

5.28 Dominion Virginia Power Calculation EE-0198, Revision 1 with Add. 1A, Setpoint Accuracy for Power Range Neutron Flux High Setpoint Reactor Trip.

5.29 Dominion Virginia Power Calculation EE-0722, Revision 1, NIS Intermediate Range Channel Statistical Allowance Calculation.

5.30 Dominion Virginia Power Calculation EE-0719, Revision 0, Surry Nuclear Instrumentation Source Range Uncertainty.

5.31 Dominion Virginia Power Calculation EE-0415, Revision 2, Delta T and T Average Protection Loops, T-412, T-422 and T-432, Surry Power Station, Units 1 and 2.

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5.33 Dominion Virginia Power Calculation EE-0458, Revision 1, with Add. 00A and 00B, Channel Statistical Allowance (CSA) Calculation for Surry Pressurizer Level Protection, Surry Units 1 and 2.

5.34 Dominion Virginia Power Calculation EE-0183, Revision 3, with Add. 00A, CSA Calculation for Surry Power Station Units 1 and 2 Reactor Coolant Flow.

5.35 Dominion Virginia Power Calculation EE-0432, Revision 4 with Add. 00A, CSA Calculation for Surry Power Station, Steam Generator Narrow Range Level, Units 1&2, Loops L-1474, L-1475, L-1476, L-1484, L-1485, L-1486, L-1494, L-1495, L-1496, L-2474, L-2475, L-2476, L-2484, L-2485, L-2486, L-2494, L-2495, L-2496.

5.36 Dominion Virginia Power Calculation EE-0355, Revision 3, with Add. 03A, 00B, 00C, and 00D, Channel Uncertainty Calculation for Surry, Units 1&2 Feedwater Flow, Steam Flow, Steam Pressure and Steam Header Pressure Protection and Control Including Channel Check Criteria for Feedwater and Steam Flow Indication.

5.37 Dominion Virginia Power Calculation EE-0412, Revision 0, with Add. 0A and 0B, Reactor Coolant Pump Undervoltage and Underfrequency Trip Setpoints.

5.38 Dominion Virginia Power Calculation EE-0457, Revision 1, CSA Calculation for Turbine First Stage Pressure, Steam Break Protection and High Steam Flow SI Actuation, Surry Power Station Units 1 and 2.

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5.40 Dominion Virginia Power Calculation EE-0141, Revision 1, Insulation Resistance (IR) Effects for Environmentally Qualified (EQ) Instrumentation.

5.41 Dominion Virginia Power Calculation EE-0112, Revision 2, with Add. 00A, Refueling Water Storage Tank Level Uncertainty.

5.42 Dominion Virginia Power Calculation EE-0724, Revision 0, Canal Level Probe Channel Statistical Accuracy Calculation Channel Numbers: 1-CW-LS-102. 1-CW-LS-103. 2-CW-LS-202. 2-CW-LS-203.

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5.44 North Anna Instrument Calibration Procedure 1-ICP-RC-P-1455, Revision 4, Pressurizer Pressure Protection Channel 1 (1-RC-P-1455) Calibration.

5.45 North Anna Instrument Calibration Procedure 1-ICP-LO-PS-609-4, Revision 11, Reactor Trip From Turbine Trip Auto Stop Oil Pressure Switch (LO-PS-609-4) Calibration.

5.46 North Anna Instrument Calibration Procedure ICP-NI-1-N-41, Revision 36, Power Range Channel N-41 Protection Channel I.

5.47 North Anna Instrument Calibration Procedure ICP-RC-1-T-1412, Revision 33, Reactor Coolant Delta T/ TAVG Protection Channel I (1-RC-T-1412) Calibration.

5.48 North Anna Instrument Calibration Procedure 1-ICP-FW-L-1474, Revision 15, Steam Generator A Narrow Range Level Protection Channel I (1-FW-L-1474) Calibration.

5.49 North Anna Instrument Calibration Procedure 1-ICP-MS-F-1474, Revision 24, Steam Generator A Steam Flow and Feed Flow Protection Channel III (1-MS-F-1474 and 1-FW-F-1477) Calibration.

5.50 North Anna Instrument Calibration Procedure 1-ICP-MS-P-1474, Revision 6, Steam Line A Steam Pressure Protection Channel II (1-MS-P-1474) Calibration.

5.51 North Anna Instrument Calibration Procedure 1-ICP-NI-N-31, Revision 8, NIS Source Range Channel I (N-31) Calibration.

5.52 North Anna Instrument Calibration Procedure 1-ICP-QS-L-100A, Revision 10, Refueling Water Storage Tank Level Channel III (1-QS-L-100A) Calibration.

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5.54 North Anna Instrument Calibration Procedure 1-ICP-RC-L-1459, Revision 4, Pressurizer Level Protection Channel 1 (1-RC-L-1459) Calibration.

5.55 orth Anna Instrument Calibration Procedure 1-ICP-LM-P-100B, Revision 2, Reactor Containment Pressure Protection Channel II (1-LM-P-100B) Calibration.

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5.57 North Anna Instrument Calibration Procedure ICP-NI-1-N-35, Revision 22, Intermediate Range Channel N-35.

5.58 Surry Instrument Periodic Test Procedure 1-IPT-CC-CS-L-100A, Revision 7, Refueling Water Storage Tank Level Loop L-100A Channel Calibration.

5.59 Surry Instrument Periodic Test Procedure 1-IPT-CC-FW-F-476, Revision 13, Feedwater Flow Loop F-1-476 Channel Calibration.

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5.61 Surry Instrument Periodic Test Procedure 1-IPT-CC-LM-P-100A, Revision 11, Containment Pressure Loop P-LM-100A Channel Calibration.

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5.63 Surry Instrument Periodic Test Procedure 1-IPT-CC-MS-P-446, Revision 13, Turbine Load Loop P-1-446 Channel Calibration.

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5.65 Surry Instrument Periodic Test Procedure 1-IPT-CC-MS-P-474, Revision 8, Steam Line Pressure Loop P-1-474 Channel Calibration.

5.66 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-F-414, Revision 10, Reactor Coolant Flow Loop F-1-414 Channel Calibration.

5.67 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-L-459, Revision 17, Pressurizer Level Protection Loop L-1-459 Channel Calibration.

5.68 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-P-455, Revision 12, Pressurizer Pressure Protection Loop P-1-455 Channel Calibration.

5.69 Surry Instrument Periodic Test Procedure 1-IPT-CC-RC-T-412, Revision 29, Delta T and TAVG Protection Set I Loop T-1-412 Channel Calibration.

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5.71 Engineering Transmittal ET-NAF-970142, Revision 0, Surry Technical Specification 3.2 Limiting Safety Settings, Protective Instrumentation Modification to Surveillance Procedures Surry Power Station Units 1 and 2.

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5.75 Calculation SM-0933, Revision 0, Generation of OTΔT, OPΔT and F(ΔI) Function Constants for Surry Core Uprating.

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5.92 Dominion Calculation C10982, Revision 0, Pressurizer High Level Reactor Trip CSA.

5.93 Dominion Calculation C10818, Revision 0, Kewaunee Unit 1 Pressurizer Pressure Protection Channel Statistical Allowance (CSA) Calculation.

5.94 Dominion Calculation C11865, Revision 0, Kewaunee Unit 1 Channel Statistical Allowance (CSA) Calculation for the Overtemperature Delta T Reactor Trip, Overpower Delta T Reactor Trip, Low-Low T Average Input to Steam Line Isolation, and Low T Average Feedwater Regulator Valve Closure.

5.95 Dominion Calculation C11006, Revision 0, Containment Pressure Channel Statistical Allowance (CSA) for Safety Injection, Main Steam Isolation, and Containment Spray Initiation.

5.96 Dominion Calculation C10819, Revision 0, Kewaunee Unit 1 Reactor Coolant Low Flow Reactor Trip Channel Statistical Allowance (CSA) Calculation.

5.97 Dominion Calculation C11116, Revision 0, Kewaunee Unit 1 Steam Generator Narrow Range Level Protection Channel Statistical Allowance (CSA) Calculation.

5.98 Dominion Calculation C10854, Revision 0, Hi & Hi-Hi Steam Flow and Low Steam Line Pressure ESF Actuation CSA.

5.99 Technical Specification Task Force Improved Standard Technical Specifications Traveler, TSTF-493, Clarify Application of Setpoint Methodology for LSSS Functions, Revision 4.

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

5.101 Kewaunee Calculation C11220, Revision ORIG, Determination of Forebay Low-Low- Level Trip Instrument Accuracy.

5.102 Dominion Calculation C11709, Revision 1, Addendum A, Degraded and Loss of Voltage Relay Settings, Kewaunee Power Station.

5.103 Kewaunee Surveillance Procedure SP-48-003E, Revision 17, Nuclear Power Range Channel 1 (Red) N-41 Monthly Test.

5.104 Kewaunee Surveillance Procedure SP-48-004A, Revision 27, Nuclear Power Range Channel 1 (Red) N-41 Calibration.

5.105 Kewaunee Surveillance Procedure SP-47-011A, Revision 20, Reactor Coolant Temperature and Pressurizer Pressure Instrument Channel 1 (Red) Calibration.

5.106 Kewaunee Surveillance Procedure SP-36-014B-1, Revision D, Reactor Coolant Flow Channel 411 (Red) Instrument Calibration.

5.107 Kewaunee Surveillance Procedure SP-06-031A-1, Revision 3, Steam Generator Steam Pressure Loop 468 Transmitter Channel 1 (Red) Calibration.

5.108 Kewaunee Surveillance Procedure SP-06-034B-1, Revision 13, Steam Generator Flow Mismatch and Steam Pressure Instrument Channel 1 (Red) Calibration.

5.109 Kewaunee Surveillance Procedure SP-36-017B-1, Revision 2, Pressurizer Level Instrument Channel 426 (Red) Calibration.

5.110 Kewaunee Surveillance Procedure SP-18-043, Revision 27, Containment Pressure Instrument Channels Test.

5.111 Kewaunee Surveillance Procedure SP-18-044B, Revision 23, Containment Pressure Instrument Calibration.

5.112 Kewaunee Surveillance Procedure SP-05A-028B-3, Revision 3, Steam Generator Level Instrument Channel 463 (Yellow) Calibration.

5.113 Kewaunee Power Station Offsite Dose Calculation Manual (ODCM), Revision 11, February 22, 2007.

5.114 Kewaunee Power Station Updated Safety Analysis Report, Revision 21.3, dated 6/30/09.

5.115 Kewaunee Calculation C10690, Revision A, ODCM Setpoint Calculations.

5.116 Kewaunee Surveillance Procedure SP-48-287A-4, Revision 13, Intermediate Range N-35 Drawer Calibration.

5.117 Kewaunee Surveillance Procedure SP-48-287A-1, Revision G, Source Range N-31 Drawer Calibration.

5.118 ISA-RP67.04-Part II-1994, Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation.

5.119 Surry Technical Specification Change Request No. 318 (Revised Setting Limits and Overtemperature & Overpower ΔT Time Constants) Licensing Amendments DPR-32 Amendment No. 261 and DPR-37 Amendment No. 261.

5.120 Technical Report No. EE-0039 Revision 0, Flow Channel Uncertainties, North Anna and Surry Power Stations.

5.121 Kewaunee Surveillance Procedure SP-04-135, Revision 20, Forebay Area Water Level Instruments Calibration.

5.122 Kewaunee Surveillance Procedure SP-45-049.11, Revision 21, RMS Channel R-11 Containment Particulate Radiation Monitor Quarterly Functional Test.

5.123 Kewaunee Surveillance Procedure SP-45-049.12, Revision Z, RMS Channel R-12 Containment Gas Radiation Monitor Quarterly Functional Test.

5.124 Kewaunee Integrated Logic Diagram Radiation Monitoring E-2021, Revision AG.

5.125 Kewaunee Instrument Calibration Procedure MA-KW-ISP-RM-001-23, Revision 1, RMS Channel R-23 Control Room Ventilation Radiation Monitor Quarterly Functional Test.

5.126 Dominion Calculation C11890, Revision 0, Kewaunee Unit 1 Reactor Coolant Pump Underfrequency Trip Channel Statistical Allowance (CSA) Calculation.

5.127 Kewaunee Electrical Surveillance Procedure MA-KW-ESP-EHV-001A, Revision 3, BUS 1-1 4KV Voltage and Frequency Test and Calibration.

5.128 Dominion Calculation C11891, Revision 0, Kewaunee Unit 1 Reactor Coolant Pump Undervoltage Reactor Trip Channel Statistical Allowance (CSA) Calculation.

5.129 Kewaunee Electrical Preventive Maintenance Procedure MA-KW-EPM-EHV-015, Revision 0, BUS 1-5 Loss of Voltage Relay Calibration.

5.130 Kewaunee Drawing XK-100-621, Revision 3N, Interconnection Wiring Diagram.

5.131 Kewaunee DCR 2172, Provide Overall System Upgrade of Process and Area Rad Monitoring Systems.

5.132 Kewaunee Surveillance Procedure SP-54-059, Revision 29, Turbine First Stage Pressure Loop Calibration.

5.133 Kewaunee Power Station Technical Requirements Manual, Core Operating Limits Report (COLR) Cycle 29, Revision 2.

5.134 Kewaunee Alarm Response Procedure OP-KW-ARP-47062-A, Revision 0, S/G A Program Level Deviation.

5.135 Kewaunee Drawing E-2006, Revision T, Integrated Logic Diagram Feedwater System.

5.136 7300 Process Instrumentation Scaling, I&C Training Manual, Westinghouse Nuclear Training Services, Copyright 1981, Westinghouse Electric Corporation.

5.137 WCAP-8773, Calculation Manual Westinghouse 7100 Series Process Control Systems, Dated April 1976.

5.138 WCAP-10298-A, Dropped Rod Methodology for Negative Rate Trip Plants, June 1983.

5.139 Surry Power Station Design Change DCP 07-047, Implement Requirments of TSCR 318 / Surry / Units 1 & 2.

5.140 Kewaunee Instrument Surveillance Procedure MA-KW-ISP-SW-001A, Revision 2, Service Water Header A Pressure Switch Calibration.

5.141 Kewaunee Calculation C11345, Revision A, Addendum B, Re-evaulation of Turbine Building SW Header Isolation Set point.

5.142 Kewaunee Condition Report CR361418, Improved Technical Specifications Change to Nuclear Instrumentation System Rate Trips.

5.143 Kewaunee Surveillance Procedure SP-45-049.21, Revision 23, RMS Channel R-21 Containment Stack Radiation Monitor Quarterly Functional Test.

Licensee Response/NRC Response/NRC Question Closure

Id	**2621**
NRC Question Number	**KAB-071**
Select Application	**NRC Question Closure**
Response Date/Time	
Closure Statement	**This question is closed and no further information is required at this time to draft the Safety Evaluation.**
Response Statement	
Question Closure Date	**3/18/2010**
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**3/18/2010 8:46 AM**
Modified By	
Date Modified	

ITS NRC Questions

Id	**1821**
NRC Question Number	**KAB-072**
Category	**Technical**
ITS Section	**3.3**
ITS Number	**3.3.6**
DOC Number	
JFD Number	
JFD Bases Number	
Page Number (s)	**421**
NRC Reviewer Supervisor	**Carl Schulten**
Technical Branch POC	**Add Name**
Conf Call Requested	**N**
NRC Question	**On page 421 of Attachment 1, volume 8, Table 3.3.6-1 shows one monitor available for function 2.c, "Containment Radiation Iodine." However, USAR sections 6.5.1.2.3 and 11.2.3.4 identify that R-21 is a gaseous monitor not an iodine monitor. Please correct the discrepancy or provide an explanation.**
Attach File 1	
Attach File 2	
Issue Date	**2/25/2010**
Added By	**Kristy Bucholtz**
Date Modified	
Modified By	
Date Added	**2/25/2010 3:44 PM**
Notification	**NRC/LICENSEE Supervision**

Licensee Response/NRC Response/NRC Question Closure

Id	**2401**
NRC Question Number	**KAB-072**
Select Application	**Licensee Response**
Response Date/Time	**3/3/2010 7:45 AM**
Closure Statement	
Response Statement	**Kewaunee Power Station was attempting to be consistent with the ISTS terminology when the R-21 monitor was called an Iodine monitor. The R-21 skid has a cartridge to sample iodine. However, the actual trip comes from the R-21 monitor itself, which is a gaseous monitor. Therefore, the submittal will be modified to state in ITS Table 3.3.6-1 that there are 2 gaseous monitor channels, and not include any iodine channels. That is, Function 2.c will be deleted and Function 2.a will specify 2 channels in lieu of 1 channel. A draft markup regarding these changes is attached. These changes will be reflected in the supplement to this section of the ITS conversion amendment.**
Question Closure Date	
Attachment 1	**KAB-072 Markup.pdf** (1MB)
Attachment 2	
Notification	**NRC/LICENSEE Supervision** **Kristy Bucholtz** **Robert Hanley** **Jerry Jones** **Bryan Kays**
Added By	**David Mielke**
Date Added	**3/3/2010 7:47 AM**
Modified By	
Date Modified	

Table 3.3.6-1, Functions 2.a~~,~~ ~~2.b,~~ and ~~2.c~~

2.b

A01

TABLE TS 3.5-1

ENGINEERED SAFETY FEATURES INITIATION INSTRUMENT SETTING LIMITS

LA02

NO.	FUNCTIONAL UNIT	CHANNEL	~~SETTING LIMIT~~
8	Containment Purge and Vent System Radiation Particulate Detector Radioactive Gas Detector	Containment ventilation isolation	~~≤ value of radiation levels in exhaust duct as defined in footnote (3)~~
9	Safeguards Bus Undervoltage (4)	Loss of power	85.0% ± 2% nominal bus voltage ≤ 2.5 seconds time delay
10	Safeguards Bus Second Level Undervoltage (5)	Degraded grid voltage	93.6% ± 0.9% of nominal bus voltage ≤ 7.4 seconds time delay

See ITS 3.3.5

See ITS 3.3.5

---

(3) ~~The setting limits for max radiation levels are derived from ODCM Specification 3.4.1 and Table 2.2, and USAR Section 6.5.~~

LA02

(4) This undervoltage protection channel ensures ESF equipment will perform as assumed in the USAR.

(5) This undervoltage protection channel protects ESF equipment from long-term low voltage operation.

ITS

ITS 3.3.6

A01

Table 3.3.6-1 Function 5

2.b

Table 3.3.6-1 Function 2.a, ~~2.b,~~ and ~~2.c~~

TABLE TS 3.5-4

INSTRUMENT OPERATING CONDITIONS FOR ISOLATION FUNCTIONS

		1	2	3	4	5	6
NO.	**FUNCTIONAL UNIT**	**NO. OF CHANNELS**	**NO. OF CHANNELS TO TRIP**	**~~MINIMUM~~ OPERABLE CHANNELS** REQUIRED	**MINIMUM DEGREE OF REDUNDANCY**	**~~PERMISSIBLE BYPASS CONDITIONS~~**	**OPERATOR ACTION IF CONDITIONS OF COLUMN 3 OR 4 CANNOT BE MET**
3	Containment Ventilation Isolation		LA03	A05			
	a. High Containment Radiation	~~2~~	1 LA03	1	-	-	ACTION B These channels are not required to activate containment ventilation isolation when the containment purge and ventilation system isolation valves are maintained closed.(2)
	b. Safety Injection	Refer to Item 1 of Table TS 3.5-3					
	c. Containment Spray	Refer to Item 3 of Table TS 3.5-3					
4	Main Feedwater Isolation						
	a. Hi-Hi Steam Generator Level	3	2	2	1		HOT SHUTDOWN

Table 3.3.6-1 Function 4

See ITS 3.3.2

~~(2) The detectors are required for Reactor Coolant System leak detection as referenced in TS 3.1.d.5.~~ A06

Page 2 of 2

Amendment No. 102
10/18/93

A01

TABLE TS 4.1-1

MINIMUM FREQUENCIES FOR CHECKS, CALIBRATIONS AND TEST OF INSTRUMENT CHANNELS

A04 COT

Table 3.3.6-1, Functions 2.a, ~~2.b,~~ and ~~2.c~~

2.b

CHANNEL DESCRIPTION	CHECK SR 3.3.6.1	CALIBRATE SR 3.3.6.4	~~TEST~~ SR 3.3.6.3	REMARKS
18. a. Containment Pressure (SIS signal)	Each shift	Each refueling cycle	Monthly(a)	(a) Isolation Valve Signal
b. Containment Pressure (Steamline Isolation)	Each shift(a)	Each refueling cycle(a)	Monthly(a)	(a) Narrow range containment pressure (-3.0, +3.0 psig excluded)
c. Containment Pressure (Containment Spray Act)	Each shift	Each refueling cycle	Monthly	
d. Annulus Pressure (Vacuum Breaker)	Not applicable	Each refueling cycle	Each refueling cycle	
19. Radiation Monitoring System	~~Daily~~ ~~(a,b)~~ A03 12 hours	Each refueling cycle ~~(a)~~	Quarterly ~~(a)~~	~~(a) Includes only channels R11 thru R15, R19, R21, and R23~~ ~~(b) Channel check required in all plant modes~~
~~20. Deleted~~				
21. Containment Sump Level	Not applicable	Not applicable	Each refueling cycle	
22. Accumulator Level and Pressure	Each shift	Deleted	Not applicable	
23. Steam Generator Pressure	Each shift	Each refueling cycle	Monthly	

See ITS 3.3.2

See ITS 3.6.9

LA01

A03

M03

See ITS 3.4.15

See ITS 3.5.1

See ITS 3.3.2

Discussion of Change LA01 is for channel R11, R12, and 21. For other channels, see ITS 3.3.2, 3.3.7, 3.4.15, and CTS 3.8.a.9.

M02 Add proposed SR 3.3.6.2

CTS

Table 3.3.6-1 (page 1 of 1)
Containment Purge and ~~Exhaust~~ Vent Isolation Instrumentation ①

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	~~TRIP SETPOINT~~ ⑤	
	~~1. Manual Initiation~~	~~1,2,3,4, (a)~~	~~2~~	~~SR 3.3.6.6~~	~~NA~~	⑥
DOC M02	1 ~~2~~. Automatic Actuation Logic and Actuation Relays	1,2,3,4, ~~(a)~~	2 trains	SR 3.3.6.2 ~~SR 3.3.6.3~~ ~~SR 3.3.6.5~~	~~NA~~	⑥ ③
Table TS 3.5-1 Functional Unit 8, Table TS 3.5-4 Functional Unit 3a, Table TS 4.1-1 Channel Description 19	2 ~~3~~. ~~[~~ Containment Radiation					⑥ ②
	a. Gaseous	1,2,3,4, ~~(a)~~	~~[1]~~ 2	SR 3.3.6.1 SR 3.3.6.~~4~~ 3 SR 3.3.6.~~7~~ 4	~~≤ [2 x background]~~	② ③
	b. Particulate	1,2,3,4, ~~(a)~~	~~[~~1~~]~~	SR 3.3.6.1 SR 3.3.6.~~4~~ 3 SR 3.3.6.~~7~~ 4	~~≤ [2 x background]~~	② ③
	~~c. Iodine~~	~~1,2,3,4, (a)~~	~~[1]~~	~~SR 3.3.6.1~~ ~~SR 3.3.6.4 3~~ ~~SR 3.3.6.7 4~~	~~≤ [2 x background]~~	~~② ③~~ ①
	~~d. Area Radiation~~	~~1,2,3,4, (a)~~	~~[1]~~	~~SR 3.3.6.1~~ ~~SR 3.3.6.4~~ ~~SR 3.3.6.7~~	~~≤ [2 x background]]~~	①
Table TS 3.5-4 Functional Unit 1.b	3 ~~4~~. Containment Isolation - ~~Phase A~~ Manual Initiation	Refer to LCO 3.3.2, "ESFAS Instrumentation," Function 3.a., for all initiation functions and requirements.				⑥
	INSERT 1					①

~~(a) During movement of [recently] irradiated fuel assemblies within containment.~~ ③

For information only. No changes to this page.

All changes are ① unless otherwise noted

B 3.3 INSTRUMENTATION

B 3.3.6 Containment Purge and ~~Exhaust~~ Isolation Instrumentation

Vent

Containment Vessel Air Handling System, consisting of the Containment Air Cooling and Containment Purge and Vent Systems

BASES

BACKGROUND

vent

Containment purge and ~~exhaust~~ isolation instrumentation closes the containment isolation valves in the ~~Mini Purge System and the Shutdown Purge System~~. This action isolates the containment atmosphere from the environment to minimize releases of radioactivity in the event of an accident. The ~~Mini Purge~~ System may be in use during reactor operation and the ~~Shutdown Purge~~ System will be in use with the reactor shutdown.

Containment Air Cooling

Containment Purge and Vent

vent n ②

Containment purge and ~~exhaust~~ isolation initiates on a automatic safety injection (SI) signal ~~through the Containment Isolation - Phase A Function, or by manual actuation of Phase A Isolation~~. The Bases for LCO 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," discuss these modes of initiation.

INSERT 1

Three vent three

~~Four~~ radiation monitoring channels are also provided as input to the containment purge and ~~exhaust~~ isolation. The ~~four~~ channels measure containment radiation at two locations. One channel ~~is a containment area gamma monitor, and the other three measure radiation in a sample of the containment purge exhaust. The three purge exhaust radiation detectors are of three different types: gaseous, particulate, and iodine monitors~~. All ~~four~~ detectors will respond to most events that release radiation to containment. ~~However, analyses have not been conducted to demonstrate that all credible events will be detected by more than one monitor. Therefore, for the purposes of this LCO the~~ ~~four~~ channels are not considered redundant. ~~Instead, they are treated as four one-out-of-one Functions.~~ Since the ~~purge exhaust~~ monitors constitute a sampling system, various components such as sample line valves, sample line heaters, sample pumps, and filter motors are required to support monitor OPERABILITY.

INSERT 2

three

radiation

Each of the purge systems has inner and outer containment isolation valves in its supply and exhaust ducts. A high radiation signal from any one of the ~~four~~ channels initiates containment purge isolation, which closes both inner and outer containment isolation valves in the ~~Mini Purge System and the Shutdown Purge~~ System. These ~~systems~~ are described in the Bases for LCO 3.6.3, "Containment Isolation Valves."

three

valves

Containment Purge and Vent

and the 2 inch containment vent isolation valves

APPLICABLE SAFETY ANALYSES

The safety analyses assume that the containment remains intact with penetrations unnecessary for core cooling isolated early in the event ~~within approximately 60 seconds~~. The isolation of the purge valves has not been analyzed mechanistically in the dose calculations, although its

①

INSERT 1

; a manual SI signal; a manual containment vent isolation signal; or a manual containment spray signal (of both trains)

①

INSERT 2

also a radioactive gas

is a particulate monitor (R-11), the second channel is a radioactive gas monitor (R-12), and the third channel is ~~an activity~~ monitor (R-21) ~~that monitors for iodine, particulate, and gas activity~~. The three channels are separated into two trains with channel R-21 designated as Train A and channels R-11 and R-12 designated as Train B

For information only. No changes to this page.

All changes are ① unless otherwise noted

BASES

LCO (continued)

Automatic Actuation Logic and Actuation Relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b, SI, and ESFAS Function 3.~~a~~, Containment ~~Phase A~~ Isolation. The applicable MODES and specified conditions for the containment purge and vent isolation portion of these Functions are different ~~and less restrictive~~ than those for their ~~Phase A~~ Containment isolation and SI roles. If one or more of the SI or ~~Phase A~~ Containment isolation Functions becomes inoperable in such a manner that only the Containment Purge and Vent Isolation Function is affected, the Conditions applicable to their SI and ~~Phase A~~ Containment isolation Functions need not be entered. The less restrictive Actions specified for inoperability of the Containment Purge and Vent Isolation Functions specify sufficient compensatory measures for this case.

2 ~~3~~. Containment Radiation ④

The LCO specifies ~~four~~ three required channels of radiation monitors to ensure that the radiation monitoring instrumentation necessary to initiate Containment Purge and Vent Isolation remains OPERABLE.

For sampling systems, channel OPERABILITY involves more than OPERABILITY of the channel electronics. OPERABILITY ~~may~~ will also require correct valve lineups, sample pump operation, and filter motor operation, as well as detector OPERABILITY, ~~if~~ since these supporting features are necessary for trip to occur under the conditions assumed by the safety analyses.

INSERT 3

INSERT 4

~~4. Containment Isolation - Phase A~~ ④

~~Refer to LCO 3.3.2, Function 3.a., for all initiating Functions and requirements.~~

APPLICABILITY

The ~~Manual Initiation,~~ Automatic Actuation Logic and Actuation Relays, ~~Containment Isolation - Phase A,~~ and Containment Radiation Functions are required OPERABLE in MODES 1, 2, 3, and 4~~, and during movement of [recently] irradiated fuel assemblies [(i.e., fuel that has occupied part of a critical reactor core within the previous [X] days)] within containment~~. ④ Under these conditions, the potential exists for an accident that could release significant fission product radioactivity into containment. Therefore, the containment purge and ~~exhaust~~ vent isolation instrumentation must be OPERABLE in these MODES.

① **INSERT 3**

radioactive gas

The ~~activity~~ monitor (R-21) has two flow path alignments; it can be aligned to the 36 inch containment purge exhaust line or to the containment atmosphere via the same penetration used by particulate monitor R-11 and radioactive gas monitor R-12. However, since the 36 inch containment purge exhaust line is isolated and sealed in MODES 1, 2, 3, and 4, for the ~~activity~~ monitor R-21 to be OPERABLE, it must be aligned to the containment atmosphere via the same containment penetration as the R-11 and R-12 radiation monitors.

④ **INSERT 4**

3. Containment Isolation – Manual Initiation

Refer to LCO 3.3.2, Function 3.a, for all initiating Functions and requirements. This Function provides the manual initiation capability for containment ventilation isolation.

4. Containment Spray – Manual Initiation

Refer to LCO 3.3.2, Function 2.a, for all initiating Functions and requirements. This Function provides the manual initiation capability for containment ventilation isolation.

5. Safety Injection

Refer to LCO 3.3.2, Function 1, for all initiating Functions and requirements. This Function provides both manual and automatic initiation capability for containment ventilation isolation.

APPLICABILITY (continued)

While in MODES 5 and 6 ~~without fuel handling in progress~~, the containment purge and exhaust isolation instrumentation need not be OPERABLE since the potential for radioactive releases is minimized and operator action is sufficient to ensure post accident offsite doses are maintained within the limits of Reference 1. ④ ①

vent

vent

Containment Isolation – Manual Initiation, Containment Spray – Manual Initiation, and Safety Injection

The Applicability for the containment purge and exhaust isolation on the ESFAS Containment Isolation-Phase A Functions are specified in LCO 3.3.2. Refer to the Bases for LCO 3.3.2 for discussion of the Containment Isolation-Phases A Function Applicability. ①

ACTIONS

The most common cause of channel inoperability is outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by unit specific calibration procedures. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a COT, when the process instrumentation is set up for adjustment to bring it within specification. If the Trip Setpoint is less conservative than the tolerance specified by the calibration procedure, the channel must be declared inoperable immediately and the appropriate Condition entered.

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.6-1. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

three

Condition A applies to the failure of one containment purge isolation radiation monitor channel. Since the four containment radiation monitors measure different parameters, failure of a single channel may result in loss of the radiation monitoring Function for certain events. Consequently, the failed channel must be restored to OPERABLE status. The 4 hours allowed to restore the affected channel is justified by the low likelihood of events occurring during this interval, and recognition that one or more of the remaining channels will respond to most events. ①

Licensee Response/NRC Response/NRC Question Closure

Id	**2451**
NRC Question Number	**KAB-072**
Select Application	**NRC Question Closure**
Response Date/Time	
Closure Statement	**This question is closed and no further information is required at this time to draft the Safety Evaluation.**
Response Statement	
Question Closure Date	**3/5/2010**
Attachment 1	
Attachment 2	
Notification	**NRC/LICENSEE Supervision**
Added By	**Kristy Bucholtz**
Date Added	**3/5/2010 1:45 PM**
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