VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

September 27, 2001

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

Serial No.:	01- 559
CM/RAB	R0
Docket Nos.:	50-338
	50-339
License Nos.:	NPF-4
	NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2
PROPOSED IMPROVED TECHNICAL SPECIFICATIONS
REQUEST FOR ADDITIONAL INFORMATION – SECTION 3.3.2:
BEYOND SCOPE ISSUE (TAC Nos. MB 1431 and MB 1425)

This letter transmits a response to the NRC's request for additional information (RAI) regarding the North Anna Power Station (NAPS) Units 1 and 2 proposed Improved Technical Specifications (ITS). The North Anna ITS license amendment request was submitted to the NRC in a December 11, 2000 letter (Serial No. 00-606). The NRC requested additional information about the setpoint methodology used to change the allowable values in ITS Table 3.3.2-1. This information was requested in a NRC letter dated September 6, 2001 (TAC Nos. MB1431 and MB1425).

Attached is Technical Report EE-0116, Revision 1, which provides the setpoint methodology that was used to change the allowable values. This methodology was applied to each of the subject functions, and the results are summarized in the Technical Report. Also attached for your information is page 7.3-5 of the NAPS Updated Final Safety Analysis Report, which lists the ranges that were used to determine the revised allowable values. These ranges are listed in Item 3 at the top of the page.

If you have any further questions or require additional information, please contact us.

Very truly yours,

Leslie N. Hartz
Vice President - Nuclear Engineering

Attachment

Commitments made in this letter: None

A001

cc: U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Suite 23T85
Atlanta, Georgia 30303-8931

Mr. Tommy Le
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Mail Stop 12 H4
Rockville, MD 20852-2738

Mr. M. J. Morgan
NRC Senior Resident Inspector
North Anna Power Station

Commissioner (w/o attachments)
Bureau of Radiological Health
1500 East Main Street
Suite 240
Richmond, VA 23218

Mr. J. E. Reasor, Jr. (w/o attachments)
Old Dominion Electric Cooperative
Innsbrook Corporate Center
4201 Dominion Blvd.
Suite 300
Glen Allen, Virginia 23060

SN: 01-559
Docket Nos.: 50-338/339
Subject: Proposed ITS RAI – Section 3.3.2

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Leslie N. Hartz, who is Vice President - Nuclear Engineering, of Virginia Electric and Power Company. She has affirmed before me that she is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of her knowledge and belief.

Acknowledged before me this 27th day of September, 2001.

My Commission Expires: 3-31-04.

Maggie McClure
Notary Public

(SEAL)

Attachment

Proposed Improved Technical Specifications
Response to Request for Additional Information
Section 3.3.2: Beyond Scope Issue

Technical Report EE-0116, Revision 1

Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2

TECHNICAL REPORT EE-0116
REVISION 1

ALLOWABLE VALUES
FOR SURRY AND NORTH ANNA
IMPROVED TECHNICAL SPECIFICATIONS (ITS)
TABLES 3.3.1-1 AND 3.3.2-1

Prepared by
Design Engineering - I&C/Computers
Dominion Virginia Power

Prepared by : Donald McGrath Date : 9-19-01

Reviewed by : [signature] Date : 9-19-01

Concurrence : [signature] Date : 9-24-01

Approved by : Paul Tucker Date : 9-24-01

Keywords : Allowable Values
Improved Technical Specifications
Setpoints
Reactor Trip System Instrumentation
ESFAS Instrumentation

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.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide a comprehensive and controlled reference which details the bases for the Allowable Values that appear in North Anna and Surry Improved Technical Specifications (ITS), Tables 3.3.1-1 and 3.3.2-1.

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 Protection 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 Features Actuation System (NAPS).
- This document provides the basis for the Allowable Values to be used in Surry Power Station Improved Technical Specifications, Table 3.3.1-1, Reactor Protection System Instrumentation (SPS).
- This document provides the basis for the Allowable Values to be used in Surry Power Station Improved Technical Specifications, Table 3.3.2-1, Engineered Safety Features Actuation System Instrumentation (SPS).

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 - Also known as the "Limiting Safety System Setting (LSSS)" is the threshold value used to determine channel operability during the performance of channel functional tests and channel calibrations.

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 Virginia Power Standard STD-EEN-0304 (Ref. 5.5).

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.

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 7300 PC Card or 7100 Electronic Module.

Nominal Trip Setpoint - 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.

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.

Safety Analysis Limit (SAL) - The setpoint value assumed in the Safety Analysis.

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).

2.2 The Significance of the Allowable Value

Historically, for plants that use 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 context, the Allowable Value, Limiting Safety System Setting and the T. S. Limit are the same). The difference in percent of span between the Nominal Trip Setpoint and the T. S. Limit 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 (See Section 3.1). 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 T. S. 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 Setpoint Study, the original definition of the Limiting Safety System Setting (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 (surveillance) Testing as a "flag" such that if a bistable (comparator) Trip Setpoint exceeded this value, the protection channel would be declared inoperable, the bistable trip switch would be placed in the TEST (TRIP) position 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 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.

3.0 METHODOLOGY

3.1 Westinghouse methodologies used to calculate Allowable Values

Many Westinghouse Plants continue to use Westinghouse or other AE Firms to perform some or all of their Safety Analysis Functions. In addition, Westinghouse has also performed the 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 RTS 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.

Presently, based on Surry's current Technical Specifications, this is the case for many of the RTS and ESFAS trips.

Virginia Power is unique in the fact that the UFSAR Chapter 14 (Surry) 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 RTS and ESFAS Trip Functions are performed in house by the Corporate I&C/Computers Department. Because Virginia Power performs their own Safety Analysis and CSA Calculations, the methodology used to determine Improved Technical Specifications (NUREG-1431 "ITS") Allowable Values 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. A discussion of the Westinghouse Methodology used to determine Allowable Values for RTS and ESFAS Trip Functions is provided below.

The Westinghouse Methodology used to Determine STS Allowable Values

North Anna Pressurizer High Level Reactor Trip, Protection Channel 1, Loop L-459

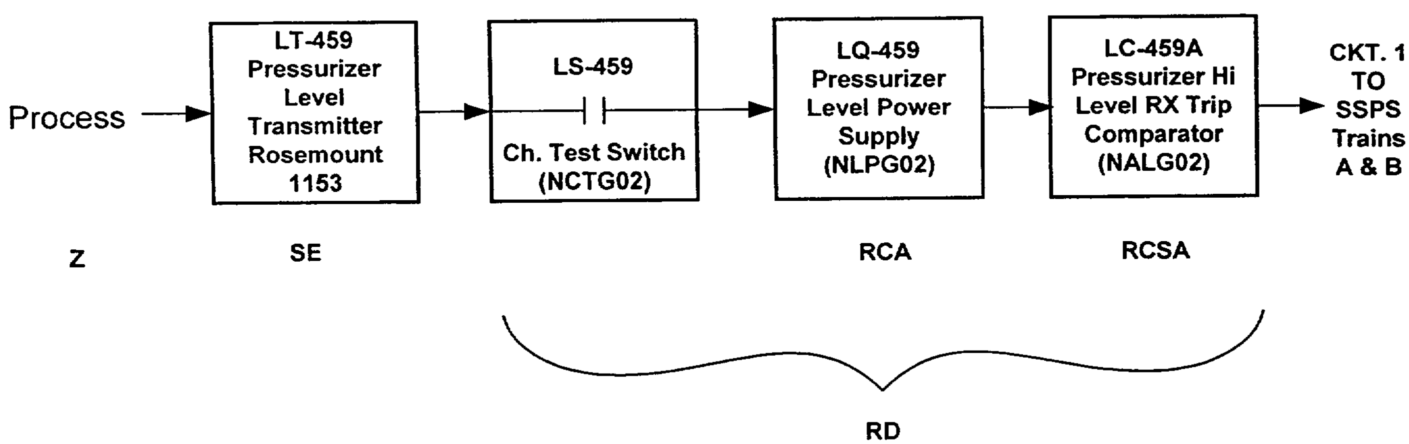


Figure 3.1-1

Early versions of STS (i.e., used by plants that are of the same vintage as D. C. Cook and North Anna) determined the Allowable Value by adding (for an increasing trip) or subtracting (for a decreasing trip) the Rack Drift (RD) Term used in the CSA Calculation to the Nominal Trip Setpoint Value for the function. These versions of STS were known as the "Two Column Approach". This methodology was used to determine North Anna's current Allowable Values for single input trip functions (Reference 5.3). The example below illustrates how the Allowable Value was determined for North Anna's Pressurizer High Water Level Reactor Trip Function (Refer to Figure 3.1-1):

Pressurizer Level Process Range =	0 to 100 % NR Level
Type of Trip =	Increasing
CSA Rack Drift Term (RD) =	1.0 % of process span
NAPS STS Nominal Trip Setpoint =	92 % of span
NAPS STS Allowable Value =	93 % of span

In the late 1970's and early 1980's, Westinghouse developed new methods to determine STS Allowable Values. The earliest version proposed for North Anna was known as a "Four Column" approach as documented in Reference 5.3. For later vintage plants and prior to implementation, the method evolved into a "Five Column" approach. The "Four Column" approach was introduced as a proposal in Reference 5.3. The five columns are discussed below :

TA = Total Allowance - the distance in percent span between the Safety Analysis Limit and the Nominal Trip Setpoint.

Z = Process, Transmitter and Rack Terms that are not quantified by testing or measurement.

$$\{(PMA)^2 + (PEA)^2 + (SPE)^2 + (STE)^2 + (RTE)^2\}^{1/2} + EA \qquad \textbf{(3.1.1)}$$

Where :

PMA = Process Measurement Accuracy
PEA = Primary Element Accuracy
SPE = Sensor Pressure Effects
STE = Sensor Temperature Effects
RTE = Rack Temperature Effects
EA = Environmental Allowance

S = Sensor errors that are quantified by testing or measurement

$$SCA + SMTE + SD \qquad \textbf{(3.1.2)}$$

Where :

SCA = Sensor Calibration Accuracy
SMTE = Sensor Measuring and Test Equipment
SD = Sensor Drift

Trip Setpoint = The Nominal Trip Setpoint that is installed in the plant for a particular RTS or ESFAS Function

Allowable Value = A calculated value above or below the Nominal Trip Setpoint that is used as a "trigger" point for the plant staff to determine operability of the instrument channel.

The Four and Five Column approach was developed by Westinghouse so that a plant could evaluate whether or not the instrument channel had potentially exceeded the Safety Analysis Limit if the As Found Trip Setpoint had exceeded the Allowable Value. During the Analog Operational Test (i.e., the Monthly or Quarterly Channel Functional Test or Performance Test "PT") the following actions were taken depending on the As Found bistable trip setpoint :

1. If the As Found Setpoint was found within the calibration tolerance which is less than the Allowable Value, then the channel is considered operable and no further action is required.

2 If the As Found Setpoint is greater than the calibration tolerance but less than the Allowable Value, then the channel is operable but should be calibrated to within tolerance conditions.

3. If the As Found Setpoint is greater than the Allowable Value, then the operability is determined by satisfying the following equation :

$$\mathbf{TA \geq R + S + Z} \qquad \mathbf{(3.1.3)}$$

Where :

TA = Total Allowance - the distance in percent span between the Safety Analysis Limit and the Nominal Trip Setpoint

R = The As Found Rack deviation in percent of span

S = The As Found transmitter deviation in percent of span **OR**
S = SCA + SMTE + SD if the transmitter is not evaluated

Z = As defined in Equation 3.1.1.

In addition to using the variables above to determine operability, these variables are also used to calculate the Allowable Value in two of the three methods described below :

R or T_1

For early versions of STS, "R" is the arithmetic sum of the rack calibration and drift uncertainties used in the CSA Calculation (i.e., Westinghouse Uncertainties for the function). In later versions of STS, "R" became known as T_1 (i.e., Trigger Value 1). T_1 added another term to the equation for Rack Measuring and Test Equipment (RMTE). Both equations are based on the assumption that rack electronics found within this value are operating within the drift allowance and that the As Left condition for the rack calibration was left at the maximum value allowed by the procedure. Both equations are given below.

$$\mathbf{R = RCA + RCSA + RD} \qquad \mathbf{(3.1.4.a)}$$

For plants that use the "Five Column" approach, the equation for "R" was modified to include the Rack Measuring and Test Equipment (RMTE) and was changed to T_1 :

$$\mathbf{T_1 = RCA + RMTE + RCSA + RD} \qquad \textbf{(3.1.4.b)}$$

Where :

RCA = Rack Calibration Accuracy
RMTE = Rack Measuring and Test Equipment
RCSA = Rack Comparator Setting Accuracy
RD = Rack Drift

According to Westinghouse, these equations are only valid for single input protection functions as shown in Figure 3.1-1.

R or T_2

Reference 5.3 also introduced another method to determine the STS Allowable Value. During the proposal stage, this equation was also known a "R". Upon implementation of later versions of STS in the early 1980's, this method was known as T_2 (i.e., Trigger Value 2). R or T_2 is determined based on the Total Allowance for the particular function. This method assumes that the transmitter is calibrated to within tolerance conditions and that it drifts in a random manner. In addition, it is also assumed that the other CSA error components that are not evaluated on a periodic basis (i.e., PMA, PEA, SPE, STE and RTE) are also experiencing random variations with respect to their ideal value. Based on these assumptions, Westinghouse could determine an Allowable Value from the analytical side. The equation for T_2 is given below:

$$\mathbf{T_2 = TA - [\{ A + (S)^2\}^{1/2} + EA]} \qquad \textbf{(3.1.5)}$$

Where :

TA = As defined for equation 3.1.3
A = $(PMA)^2 + (PEA)^2 + (SPE)^2 + (STE)^2 + (RTE)^2$
S = SCA + SMTE + SD
EA = Environmental Allowance

For a multiple input protection function, T_2 is defined as :

$$\mathbf{T_2 = TA - [\{ A + (S_1)^2 + (S_2)^2 \}^{1/2} + EA]} \qquad \textbf{(3.1.6)}$$

Where :

S_1, S_2 = As defined above for S, where S_1 is for Sensor 1 and S_2 is for Sensor 2

T_3 (Trigger Value 3)

According to Westinghouse, T_3 is an Allowable Value evaluation from the operational side for a multiple input protection function. In its simplest form, T_3 is just a summation of T_1 for each input as shown below :

$$T_3 = (RCA_1 + RMTE_1 + RCSA_1 + RD_1) + (RCA_2 + RMTE_2 + RCSA_2 + RD_2) \quad (3.1.7)$$

It is possible for Equation 3.1.7 to yield an Allowable Value that is not bounded by the Total Allowance for the particular function. Additionally, determining an Allowable Value using this equation may allow one of the channel inputs to deviate into another's allowance which would be in excess of the design function for that particular input. Because of these concerns, the NRC mandated that the equation be modified to assume that the channels are independent of one another and use the SRSS of each channel as shown below :

$$T_3 = \{(RCA_1 + RMTE_1 + RCSA_1 + RD_1)^2 + (RCA_2 + RMTE_2 + RCSA_2 + RD_2)^2\}^{1/2} \quad (3.1.8)$$

For plants that use the "Five Column" approach, the intent is that the lowest calculated trigger value be used as the STS Allowable Value for the function (i.e., If $T_1 > T_2$, T_2 is to be used as the Allowable Value).

The examples below illustrate the different methods described above as they apply to the calculation of an Allowable Value for North Anna's Pressurizer High Level Reactor Trip. The CSA error terms will be based on the typical Westinghouse uncertainty values detailed in Reference 5.3 unless otherwise noted.

<u>Example 1 – North Anna's current Allowable Value</u>

Nominal Trip Setpoint + RD = Allowable Value

92.0 % + 1.0 % = 93 %

<u>Example 2 – North Anna's Allowable Value based on R or T_1</u>

Nominal Trip Setpoint + (RCA + RMTE + RCSA + RD) = Allowable Value

92 % + (0.5 % + 0.0 % + 0.25 % + 1.0 %) = 93.75 %

Note : In this case, RMTE is assumed to be 10/1 and thus is negated.

Example 3 – North Anna's Allowable Value based on T_2

Note : The values used in the equation below are taken from Calculation EE-0058 (Ref 5.20) and Technical Report EE-0101 (Ref 5.2).

$$T_2 = TA - [\{ A + (S)^2\}^{1/2} + EA]$$

Where :

TA =	Total Allowance = 8.0 (SAL – Nominal Trip Setpoint)
A =	$(PMA)^2 + (PEA)^2 + (SPE)^2 + (STE)^2 + (RTE)^2$
A =	$2.0^2 + 0.0^2 + 5.924^2 + 1.037^2 + 0.5^2 = 40.419$
S =	SCA + SMTE + SD
S =	0.5 + 0.244 + 0.789 = 1.533
EA =	Environmental Allowance = 0.0

Then T_2 is equal to :

$$8 - [\{40.419 + 1.533^2\}^{1/2} + 0.0] = 1.460$$

Yielding an Allowable Value of :

Nominal Trip Setpoint + T_2 = Allowable Value

92.0 % + 1.46 % = 93.46 %

Note that a calculation for T_3 is not applicable for a single input function.

Table 3.1-1 tabulates the results of different Westinghouse methods used to calculate the Allowable Value for North Anna's Pressurizer High Level Reactor Trip.

Table 3.1-1 – Comparison of Westinghouse Allowable Values for the Pressurizer High Level RX Trip

Method	Rack Allowance	Allowable Value
Original Method North Anna's current Allowable Value	1.0 %	93.0 %
R or T_1 Single Input Allowable Value	1.75 %	93.75 %
T_2 Single Input Allowable Value	1.46 %	93.46 %

3.2 Functional Groups for RTS and ESFAS Instrumentation.

There are three basic functional groups of Westinghouse NIS, 7100 and 7300 Protection System Instrumentation that develop all of the RTS and ESFAS trips. The three functional groups are :

1. Single input protection function
2. Dual input protection function
3. Multiple input protection function (i.e., more than two inputs)

The determination of ITS Allowable Value for a particular trip will be largely dependent on the functional group the trip falls into. Some examples are given below.

Single Input 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 Input Protection Functions

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

Multiple Input Protection Functions

- Steam Flow Feed Flow Mismatch Reactor Trip (Backup Trip)
- Surry's Overpower ΔT Reactor Trip (Backup Trip)
- Overtemperature ΔT Reactor Trip

Single Input Protection Functions

North Anna

The 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 input 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

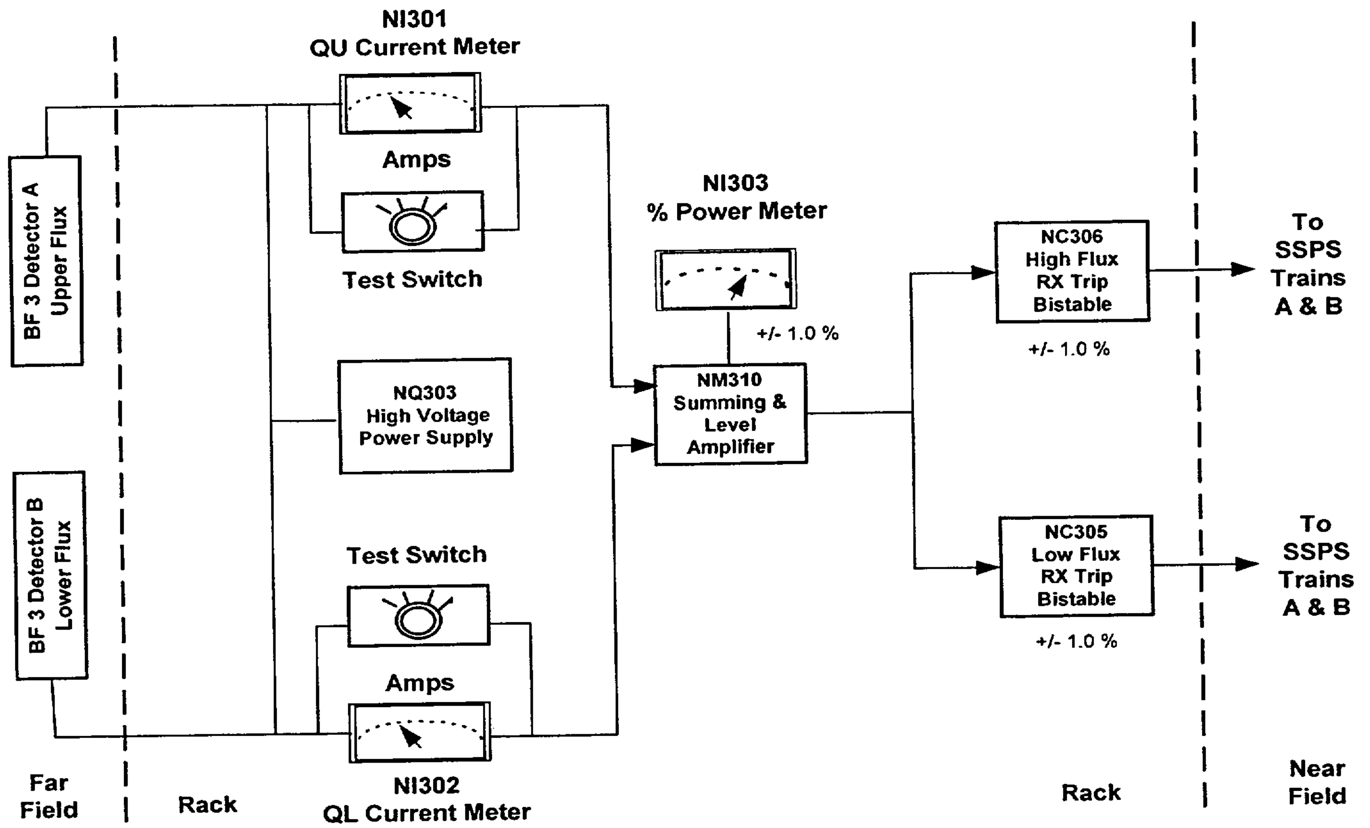


Figure 3.2-1

Westinghouse 7300 Process Control System
Low Reactor Coolant Flow Reactor Trip

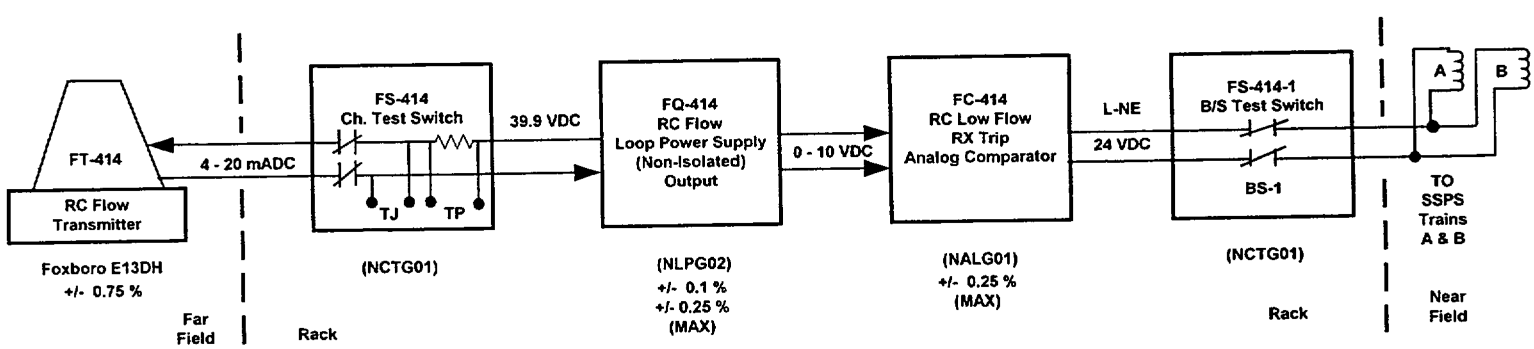


Figure 3.2-2

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. For the reactor trip portion of NIS, any accuracy's associated with signal modification up to the bistable are generally embedded in the tolerance of the bistable and the meter.

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 Calculation EE-0063 (Ref 5.15) are :

(RCSA + RMTE) + RRA + RD + RTE

Where:	RCSA	= Rack Comparator Setting Accuracy = $\pm$ 1.0 %
	RMTE	= Rack Measuring and Test Equipment = $\pm$ 0.0 % [(1)]
	RRA	= Rack Readability Allowance = $\pm$ 0.42 %
	RD	= Rack Drift = $\pm$ 1.0 %
	RTE	= Rack Temperature Effects = $\pm$ 0.5 %

Refer to Figure 3.2-2 :

CSA Calculations performed for Reactor Trips generated by the 7300 Process Control System include rack error terms associated with the modules 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 Calculation EE-0060 (Ref 5.21) are :

$(RCA + RMTE_1) + (RCSA + RMTE_2) + RD + RTE$

Where:	RCA	= Rack Calibration Accuracy = $\pm$ 0.1 %
	$RMTE_1$	= Rack Measuring and Test Equipment = $\pm$ 0.1 %
	RCSA	= Rack Comparator Setting Accuracy = $\pm$ 0.25 %
	$RMTE_2$	= Rack Measuring and Test Equipment = $\pm$ 0.05 %
	RD	= Rack Drift = $\pm$ 1.0 %
	RTE	= Rack Temperature Effects = $\pm$ 0.5 %

Some of the rack error terms described in the examples above will be used to validate the existing Tech Spec Allowable Values at North Anna for use in the ITS conversion or to calculate revised Allowable Values if necessary.

(1) The % Full Power Meter is used for the calibration and testing of the Power Range High Flux Reactor Trip Bistable.

Surry

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

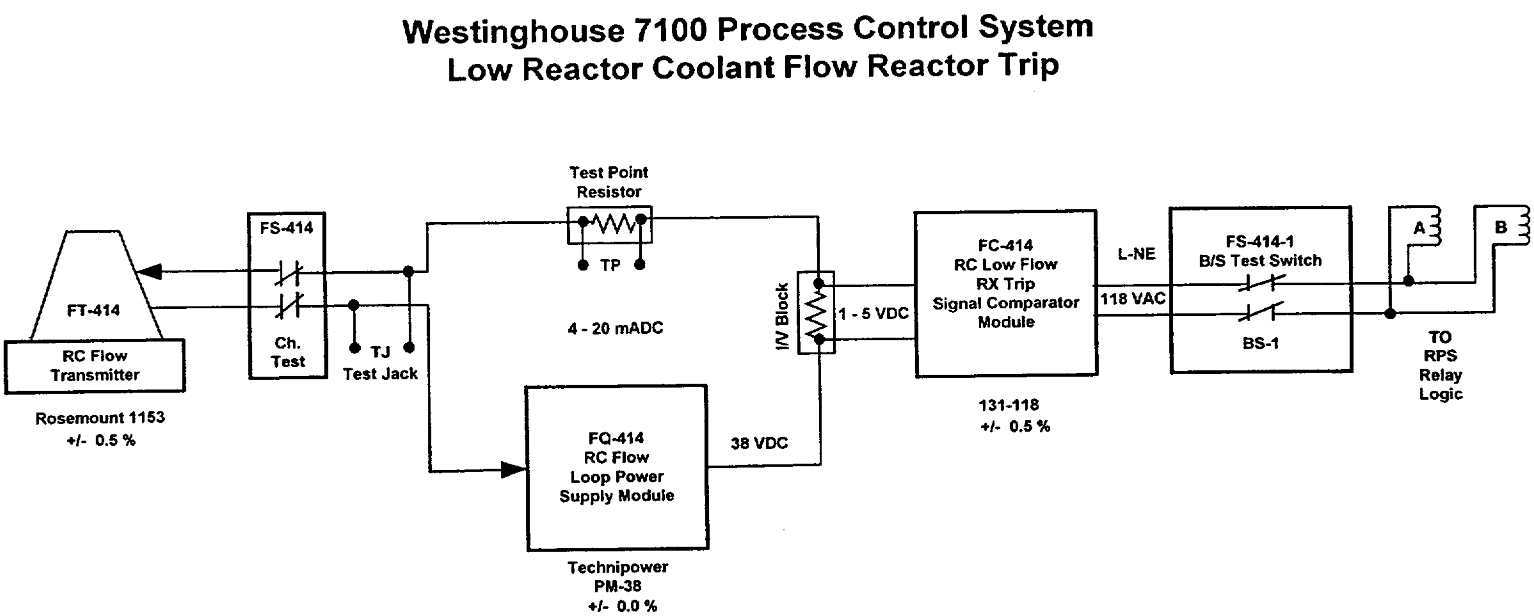


Figure 3.2-3

Refer to Figure 3.2-3 :

CSA Calculations performed for Reactor Trips generated by the 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 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 input protection function, the only rack module that will have a tolerance associated with it will be 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 as defined in Calculation EE-0183 (Ref 5.35) would be :

$$(RCSA + RMTE) + RD + RTE$$

Where: RCSA = Rack Comparator Setting Accuracy = $\pm$ 0.5 %
RMTE = Rack Measuring and Test Equipment = $\pm$ 0.15 %

RD	= Rack Drift = $\pm$ 1.0 %
RTE	= Rack Temperature Effects = $\pm$ 0.5 %

Note the difference between North Anna's rack error terms with respect to the rack error terms listed above for Surry. The RCA term and the $RMTE_1$ term are not included in Surry's CSA Calculation because the power supply is not used as a signal converter. Some of the rack error terms described in the example above will be used to validate the existing Tech Spec values at Surry for use in the ITS conversion or to calculate revised values for ITS if necessary.

Dual Input Protection Functions

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

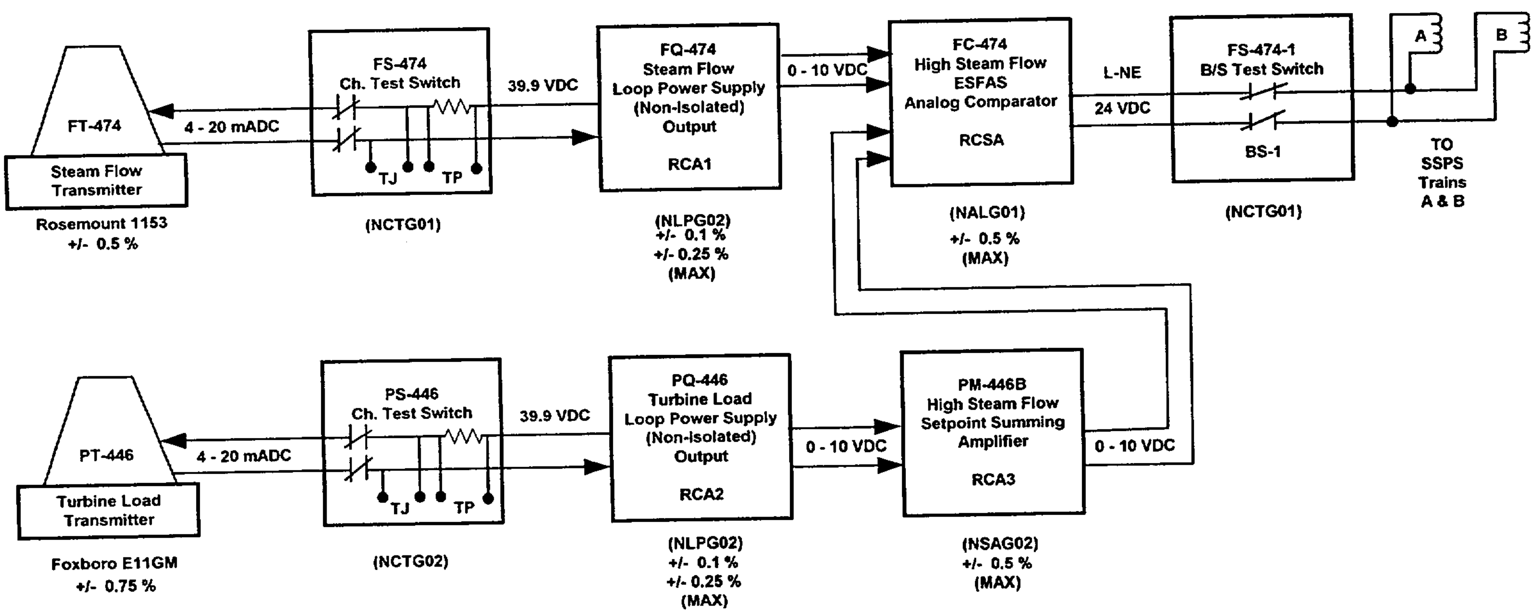


Figure 3.2-4

Figure 3.2-4 illustrates a typical dual input protection function for North Anna. Channel Statistical Allowance Calculations for dual input protection functions are different than single input functions. For example, there are more rack error terms associated with the development of the trip than a single input function. The rack error terms associated with the High Steam Flow in 2/3 Lines ESFAS trip based on Calculation EE-0736 (Ref. 5.23) are given below :

$$(RCA_1 + RMTE_1) + (RCA_2 + RMTE_2) + (RCA_3 + RMTE_3) + (RCSA + RMTE_4) + RD + RTE$$

Where:	RCA_1	= Steam Flow Rack Calibration Accuracy = $\pm$ 0.1 %
	$RMTE_1$	= Rack Measuring and Test Equipment = $\pm$ 0.153 %
	RCA_2	= Turbine Load Power Supply Calibration Accuracy = $\pm$ 0.1 %

$RMTE_2$	= Rack Measuring and Test Equipment = + 0.153 %
RCA_3	= High Steam Flow Setpoint Summator Calibration Accuracy = + 0.5 %
$RMTE_3$	= Rack Measuring and Test Equipment = + 0.042 %
RCSA	= Rack Comparator Setting Accuracy = + 0.5 %
$RMTE_4$	= Rack Measuring and Test Equipment = + 0.042 %
RD	= Rack Drift = + 1.0 %
RTE	= Rack Temperature Effects = + 0.5 %

Some of the rack error terms described in the example above will be used to validate the existing Tech Spec values at North Anna for use in the ITS conversion or to calculate revised values for ITS if necessary. The configuration of dual input 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 Input Protection Functions

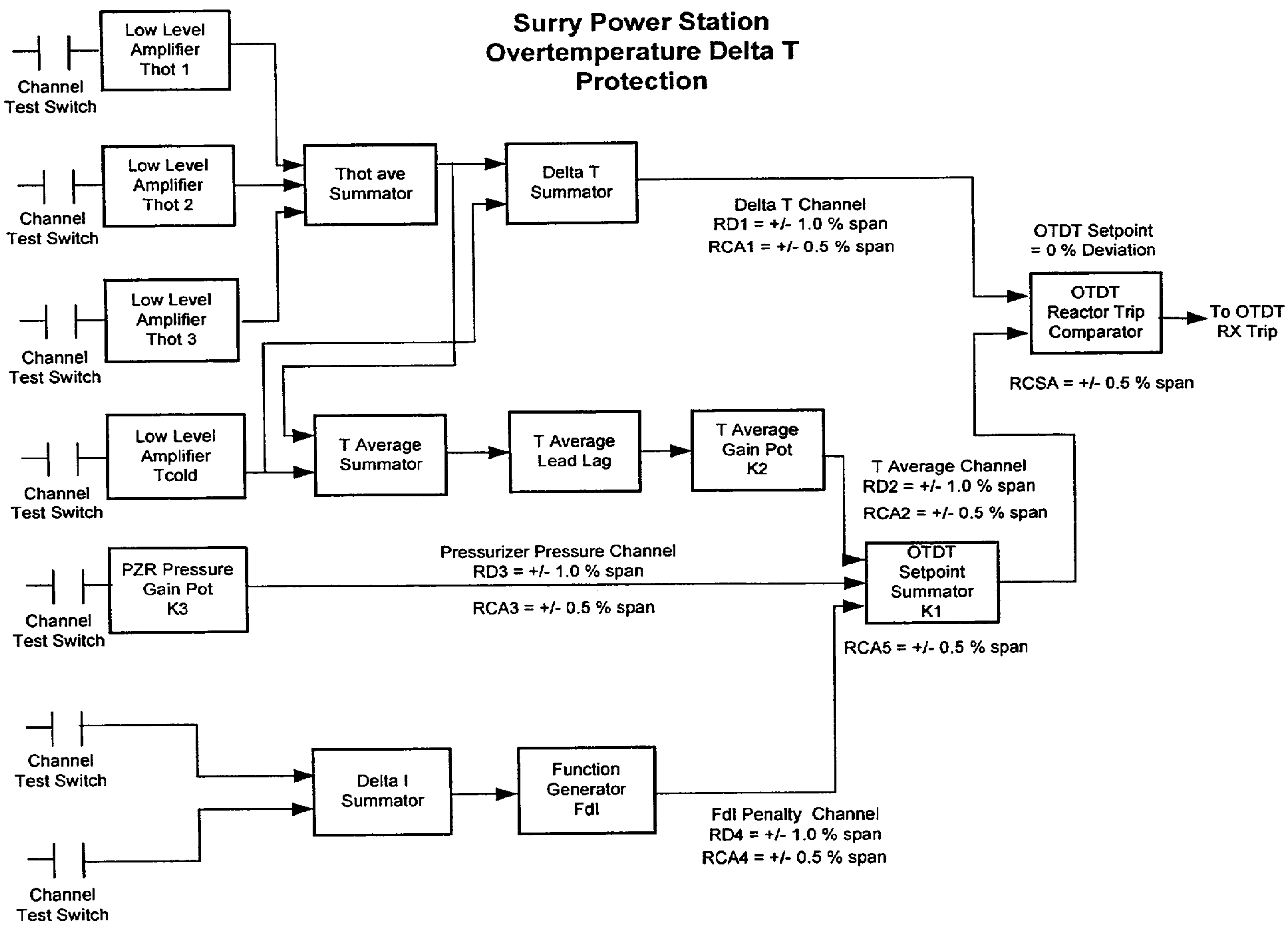


Figure 3.2-5

There are two multiple input protection functions at North Anna and three multiple input functions at Surry. Figure 3.2-5 is a block diagram that illustrates Surry's Overtemperature ΔT Reactor Trip configuration. The configuration of North Anna's Overtemperature ΔT Reactor Trip is similar to Surry's noting that the process control equipment is different.

As can be seen from Figure 3.2-5, there are five inputs to the Overtemperature ΔT Reactor Trip function, they are :

- $T_{HOT\ AVE}$
- T_{COLD}
- Pressurizer Pressure
- Power Range Upper Flux (Q_U)
- Power Range Lower Flux (Q_L)

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

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

The rack error components listed below for Surry's Overtemperature ΔT function are based on Calculation EE-0415 (Ref. 5.32).

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

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

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

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

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

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

Where:

RCA_1	= ΔT Channel Calibration Accuracy = $\pm$ 0.5 %
$RMTE_1$	= ΔT Channel Rack Measuring and Test Equipment = $\pm$ 0.26 %
RD_1	= ΔT Channel Rack Drift = $\pm$ 1.0 %
RTE_1	= ΔT Channel Rack Temperature Effect = $\pm$ 0.5 %
RCA_2	= T_{AVG} Channel Calibration Accuracy = $\pm$ 0.5 %
$RMTE_2$	= T_{AVG} Channel Rack Measuring and Test Equipment = $\pm$ 0.26 %
RD_2	= T_{AVG} Channel Rack Drift = $\pm$ 1.0 %

RTE_2	= T_{AVG} Channel Rack Temperature Effect = $\pm$ 0.5 %
RCA_3	= Pressurizer Pressure Channel Calibration Accuracy = $\pm$ 0.5 %
$RMTE_3$	= Pressurizer Pressure Channel Rack Measuring and Test Equipment = $\pm$ 0.21 %
RD_3	= Pressurizer Pressure Channel Rack Drift = $\pm$ 1.0 %
RTE_3	= Pressurizer Pressure Channel Rack Temperature Effect = $\pm$ 0.5 %
RCA_4	= FΔI Channel Calibration Accuracy = $\pm$ 0.5 %
$RMTE_4$	= FΔI Channel Rack Measuring and Test Equipment = $\pm$ 0.21 %
RD_4	= FΔI Pressure Channel Rack Drift = $\pm$ 1.0 %
RTE_4	= FΔI Pressure Channel Rack Temperature Effect = $\pm$ 0.5 %
RCA_5	= OTΔT Setpoint Summator Calibration Accuracy = $\pm$ 0.5 %
$RMTE_5$	= OTΔT Setpoint Summator Rack Measuring and Test Equipment = $\pm$ 0.21 %
RCSA	= OTΔT Reactor Trip Bistable = $\pm$ 0.5 %
$RMTE_5$	= OTΔT Reactor Trip Bistable Rack Measuring and Test Equipment = $\pm$ 0.21 %

Some of the error terms listed above will be used to determine the ITS Allowable Value for Surry's Overtemperature ΔT Reactor Trip. Similar error terms will be used throughout this document to evaluate the other multiple input protection functions at both plants.

3.3 Calculating Allowable Values for Surry and North Anna

The existing Allowable Values for North Anna and T. S. Setpoint values for Surry will evaluated to determine if they are acceptable for use in the ITS conversion. The methodology used for the evaluation will be described below.

North Anna

The Allowable Values that appear in North Anna's current version(s) of Technical Specifications (Refs 5.8 and 5.9) will be evaluated to ensure that they are bounded by the CSA Calculation of record and by the Safety Analysis assumptions documented in Technical Report NE-0994 (Ref. 5.1). Based on this evaluation, the existing Allowable Value will either be retained or revised for use in the North Anna ITS conversion. In a generic sense, the evaluation methodology will take into account the following attributes as they relate to each particular protection function:

- The functional group that characterizes the function
- Whether or not the existing Allowable Value is conservative with respect to the calculated Allowable Value or sufficiently close to the calculated Allowable Value
- Whether or not the existing Allowable Value is overly conservative from an operational aspect where it could adversely impact the results of Monthly/Quarterly Functional Testing.

Single Input Protection Functions

For a single input protection function, the Allowable Value will be determined based on the following rack error components :

- Rack Calibration Accuracy (RCA)
- Rack Comparator Setting Accuracy (RCSA)
- Rack Drift (RD)

Note : **The RCA and RCSA terms used above are typically defined in Virginia Power CSA Calculations as Module Tolerances and are designated as M_1, M_2 ... M_n. For the purposes of this report, the Terms RCA_1, RCA_2, RCA_n and RCSA are the same as M_1, M_2 and M_n as used in the CSA Calculations.**

As described in Section 3.2, there are two other rack error terms that are not included in the calculation of the Allowable Value, they are Rack Measuring and Test Equipment (RMTE) and Rack Temperature Effect (RTE). These rack error terms are not included because they cannot be evaluated/quantified during the performance of a Monthly/Quarterly Functional Test. Normally, M&TE is checked on a periodic basis (i.e., every quarter, six months or year). Rack Temperature Effects are not really ever checked or quantified. The Emergency Switchgear Room at both plants is designed to maintain a relatively constant temperature. If the temperature changes by more than a nominal amount, the effects on the process instrumentation are normally not evaluated unless a loop or loops are deviating from their

nominal process value(s) as indicated in the control room. In addition, by not using these error components, the calculated Allowable Value will be more conservative and easily quantified during or immediately subsequent to functional testing.

The methodology used to calculate the Rack Allowance used to determine the Allowable Value will be based on the Square Root Sum of the Squares (SRSS) of the three rack error terms listed above, noting that each rack error term will be treated as an independent variable . This method will yield a Rack Allowance and thus an Allowable Value that will be more conservative than the methods described in Section 3.1. Note the example below for the Pressurizer High Level Reactor Trip as shown in Figure 3.1-1.

<u>Pressurizer High Level Reactor Trip Allowable Value using RMTE and RTE</u>

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

$$\text{Rack Allowance} = \{ (0.1 + 0.15)^2 + (0.25 + 0.03)^2 + 1.0^2 + 0.5^2 \}^{1/2}$$

Rack Allowance = 1.179 % of span

Allowable Value = Nominal Trip Setpoint + Rack Allowance

Allowable Value = 92.0 + 1.179 = 93.179 %

<u>Pressurizer High Level Reactor Trip Allowable Value without RMTE and RTE</u>

$$\text{Rack Allowance} = \{ RCA^2 + RCSA^2 + RD^2 \}^{1/2}$$

$$\text{Rack Allowance} = \{ 0.1^2 + 0.25^2 + 1.0^2 \}^{1/2}$$

Rack Allowance = 1.036 % of span

Allowable Value = Nominal Trip Setpoint + Rack Allowance

Allowable Value = 92.0 + 1.036 = 93.036 %

In the case of North Anna, the Allowable Value in the current version of Technical Specifications is 93.0 % Level. In this specific case for the Pressurizer High Level Reactor Trip, the current value of 93.0 % Level will be retained. Table 3.3-1 provides a comparison of the Allowable Values based on all the different methodologies presented in Table 3.1-1 along with those calculated above. It can be seen that the chosen methodology provides the most conservative result while still allowing for acceptable operation. In many cases the calculated Allowable Value for North Anna's single input protection functions will be very close to the current Allowable Value for that function as shown in Table 3.3-1.

Table 3.3-1 – Comparison of Allowable Values for North Anna's Pressurizer High Level RX Trip

Method	Rack Allowance	Allowable Value
Original Method North Anna's current Allowable Value	1.0 %	93.0 %
R or T_1 Single Input Allowable Value	1.75 %	93.75 %
T_2 Single Input Allowable Value	1.46 %	93.46 %
Allowable Value with RMTE and RTE	1.179 %	93.179 %
Allowable Value without RMTE and RTE	1.036 %	93.036 %

As can be seen from Table 3.3-1, calculating the Rack Allowance without RMTE and RTE yields an Allowable Value that is very conservative and close the current Allowable Value for this function. All of the Allowable Values for single input protection functions at North Anna will be calculated in a manner similar to that illustrated above.

For single input protection functions that use more than one module to condition or modify the input signal to the bistable, multiple RCA error terms will used in the equation to determine the Allowable Value. The Pressurizer Low Pressure Reactor Trip function as illustrated in Figure 3.3-1 will be used as an example of the methodology used to calculate the Allowable Value for single input protection functions that use more than one module to modify the input signal to the bistable.

Westinghouse 7300 Process Control System
Low Pressurizer Pressure Reactor Trip

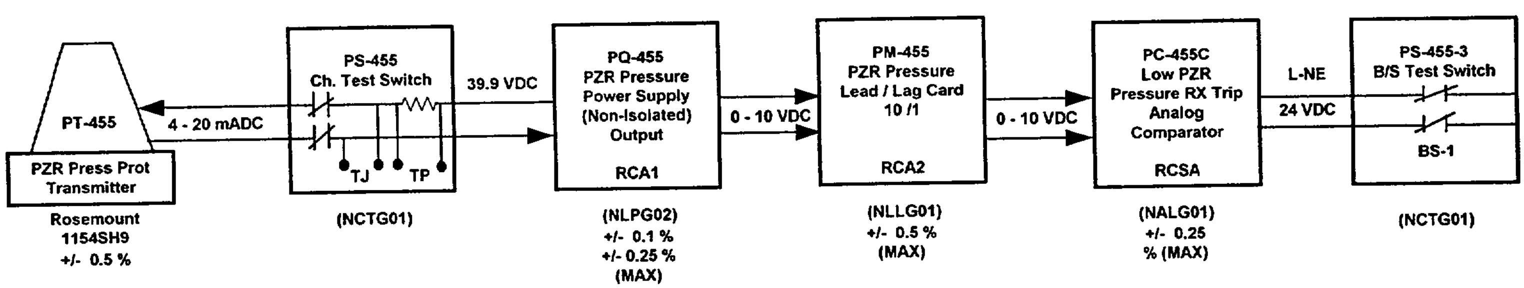


Figure 3.3-1

The calculated Allowable Value for the Pressurizer Low Pressure Reactor Trip based on Figure 3.3-1 is given below :

Low Pressurizer Pressure Reactor Trip Allowable Value

$$\text{Rack Allowance} = (RCA_1^2 + RCA_2^2 + RCSA^2 + RD^2)^{1/2}$$

$$\text{Rack Allowance} = (0.1^2 + 0.5^2 + 0.25^2 + 1.0^2)^{1/2}$$

Rack Allowance = 1.15 % of span = 9.2 PSIG (1)

Allowable Value = Nominal Trip Setpoint – Rack Allowance

Allowable Value = 1870 PSIG – 9.2 PSIG

Allowable Value = 1860.8 PSIG

The Allowable Value for the Low Pressurizer Pressure Reactor Trip in the current version(s) of Technical Specifications is $\geq$ 1860 PSIG. In this case, the current value of $\geq$ 1860 PSIG will be retained because it is sufficiently close enough to the calculated value.

Dual Input Protection Functions

For a dual input protection function, the Allowable Value will be determined based on the following rack error components for each input:

- Rack Calibration Accuracy (RCA)
- Rack Comparator Setting Accuracy (RCSA)
- Rack Drift (RD)

For a simple dual input function, the Allowable Value for North Anna will be calculated using the following generic equations, noting that all of the rack error terms are treated as independent variables :

$$\text{Rack Allowance} = \{ RCA_1^{\ 2} + RCA_2^{\ 2} + RCA_3^{\ 2} + RCA_n^{\ 2} + RCSA^{\ 2} + RD^{\ 2} \}^{1/2}$$

Depending on the methodology used in the CSA Calculation, a Rack Drift (RD) term may have been included in the calculation for each input to the trip. In this case, the generic equation used to calculate the Rack Allowance will be :

$$\text{Rack Allowance} = \{ RCA_1^{\ 2} + RCA_2^{\ 2} + RCA_3^{\ 2} + RCA_n^{\ 2} + RCSA^{\ 2} + RD_1^{\ 2} + RD_2^{\ 2} \}^{1/2}$$

---

(1) (1.15 / 100) * 800 PSIG span = 9.2 PSIG

In all cases the Allowable Value is calculated using the following equation :

Allowable Value = Nominal Trip Setpoint +/- Rack Allowance

Using the North Anna High Steam Flow in 2/3 Lines ESFAS trip as an example (Refer to Figure 3.2-4), the calculated Allowable Value for this function is :

$$\text{Rack Allowance} = \{ RCA_1{}^2 + RCA_2{}^2 + RCA_3{}^2 + RCSA^2 + RD^2 \}^{1/2}$$

$$\text{Rack Allowance} = \{ 0.1^2 + 0.1^2 + 0.5^2 + 0.5^2 + 1.0^2 \}^{1/2}$$

$$\text{Rack Allowance} = 1.233 \text{ \% of } \Delta P \text{ span}$$

Allowable Value = Nominal Trip Setpoint + Rack Allowance

Calculated Value $_{(20\ \%\ \text{Power})}$ = 40 % F_{nom} + 2.08 % F_{nom} = 42.08 % F_{nom} (1)(2)

Round to : Allowable Value $_{(20\ \%\ \text{Power})}$ = 40 % F_{nom} + 2.0 % F_{nom} = 42.0 % F_{nom}

Calculated Value $_{(100\ \%\ \text{Power})}$ = 110 % F_{nom} + 1.0 % F_{nom} = 110.77 % F_{nom} (3)(4)

Round to : Allowable Value $_{(100\ \%\ \text{Power})}$ = 110 % F_{nom} + 1.0 % F_{nom} = 111.0 % F_{nom}

Note: F_{nom} is the nominal design flow at 100 % power for North Anna. F_{nom} is equal to $4.247 * 10^6$ Pounds Per Hour (PPH) at 100 % power.

---

(1) $\% \Delta P = (((0.4*4.247E6)/5E6)^2 + (1.233/100)) / 1.2298) * 100\ \% = 10.39\ \%\ \Delta P$

(2) $\% F_{nom} = ((((10.39\ \% / 100\ \%) * 1.2298)^{1/2} * 5E6) / 4.247\ E6) * 100\ \% = 42.08\ \%$

(3) $\% \Delta P = ((((4.247E6 * 1.1)/5E6)^2 + (1.233/100)) / 1.0000) * 100\ \% = 88.53\ \%\ \Delta P$

(4) $\% F_{nom} = ((((88.53\ \% / 100\ \%) * 1.0000)^{1/2} * 5E6) / 4.247\ E6) * 100\ \% = 110.77\ \%$

Note : The constant 1.2298 is equal to the specific weight of steam at P_{SAT} (1005.3 PSIG) divided by the specific weight of steam at P_{REF} (830.3 PSIG); 2.29252 (lbm/ft^3) / 1.86418 (lbm/ft^3) = 1.2298.
The Allowable Value for the North Anna High Steam Flow in 2/3 Lines ESFAS trip in the current version(s) of Technical Specifications is ≤ 44.0 % of F_{nom} from 0 to 20 % Power increasing linearly to ≤ 111.5 % of F_{nom} at 100 % Power. Based on the rack allowance calculated above and its conversion to % ΔP and % of F_{nom}, the current Allowable Values will be changed to ≤ 42.0 % of F_{nom} from 0 to 20 % Power increasing linearly to ≤ 111.0 % of F_{nom} at 100 % Power.

Multiple Input Protection Functions

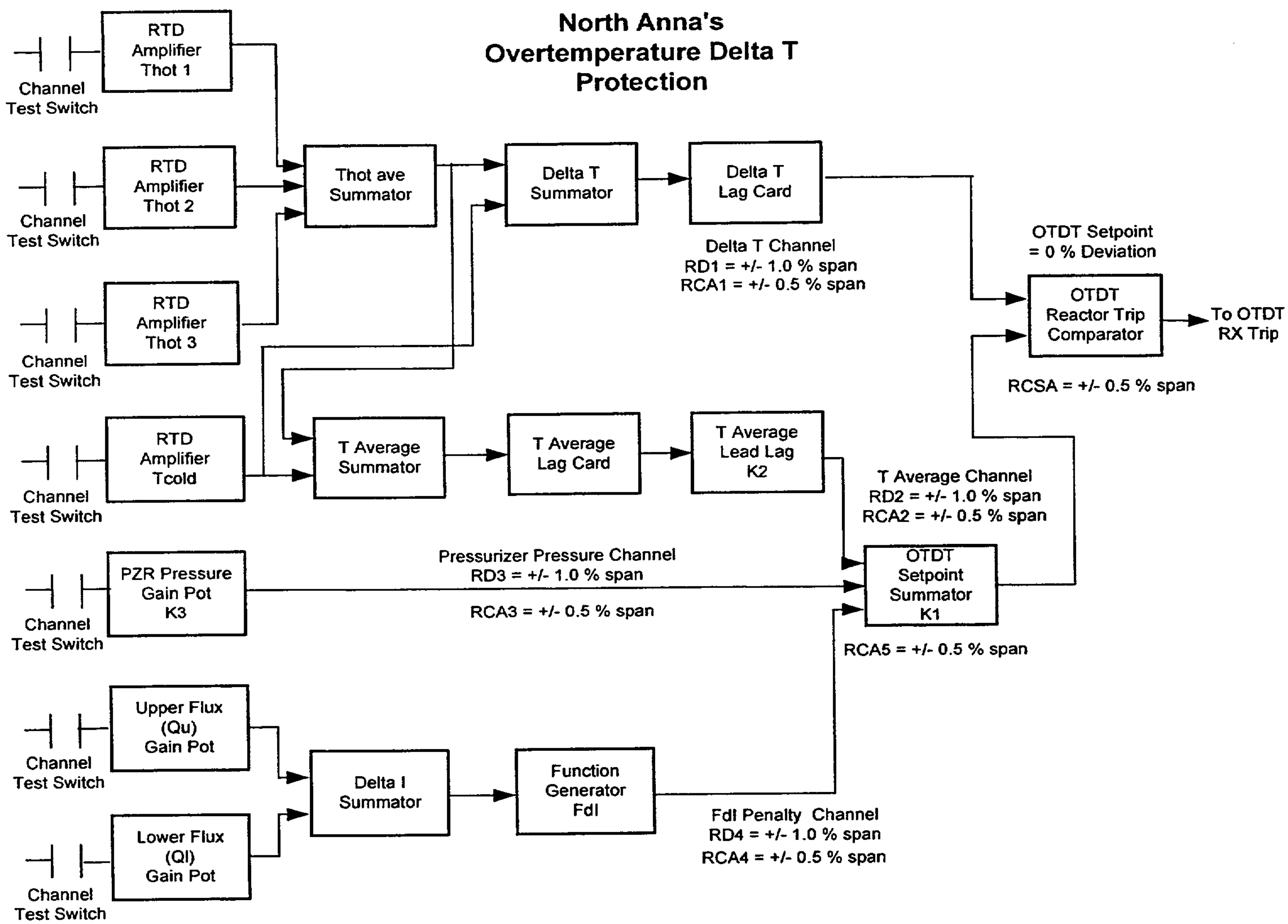


Figure 3.3-2

The Allowable Value for multiple input protection functions will be determined based on the following rack error components :

- Rack Calibration Accuracy (RCA) – This will be based on a string calibration accuracy of $\pm$ 0.5 % of span
- Rack Comparator Setting Accuracy (RCSA)
- Rack Drift (RD)

For multiple input functions, the Allowable Value for North Anna will be calculated using the following generic equations, noting that all of the rack error terms will be treated as independent variables :

$$\text{Rack Allowance} = \{RCA_1^2 + RCA_2^{\,2} + RCA_3^{\,2} + RCA_n^{\,2} + RCSA^2 + RD^2\}^{1/2}$$

Depending on the methodology used in the CSA Calculation, a Rack Drift (RD) term may have been included in the calculation for each input to the trip. In this case, the generic equation used to calculate the Rack Allowance will be :

$$\text{Rack Allowance} = \{(RCA_1^{\,2} + RCA_2^{\,2} + RCA_3^{\,2} + RCA_n^{\,2} + RD_1^{\,2} + RD_2^{\,2} + + RD_3^{\,2} + RD_n^{\,2} + RCSA^2\}^{1/2}$$

In all cases the Allowable Value is calculated using the following equation :

Allowable Value = Nominal Trip Setpoint +/- Rack Allowance

Using the North Anna Overtemperature ΔT Reactor Trip as an example (Refer to Figure 3.3-2), the Rack Calibration Accuracy (RCA), Rack Comparator Setting Accuracy (RCSA) and Rack Drift (RD) error components for the OTΔT Reactor Trip are conservatively made up of :

ΔT Channel (RCA_1)	$\pm$ 0.5 % of ΔT span
T_{AVG} Channel (RCA_2)	$\pm$ 0.5 % of span = 1.10 % ΔT power = 0.73 % of ΔT span
PZR Pressure Channel (RCA_3)	$\pm$ 0.5 % of span = 0.46 % ΔT power = 0.31 % of ΔT span
FΔI Channel (RCA_4)	$\pm$ 0.5 % of span = 1.60 % ΔT power = 1.07 % of ΔT span
OTΔT Setpoint (RCA_5)	$\pm$ 0.5 % of ΔT span
OTΔT Comparator (RCSA)	$\pm$ 0.5 % of ΔT span
ΔT Channel Rack Drift (RD_1)	$\pm$ 1.0 % of ΔT span
T_{AVG} Channel Rack Drift (RD_2)	$\pm$ 1.0 % of span = 2.20 % ΔT power = 1.46 % of ΔT span
PZR Channel Rack Drift (RD_3)	$\pm$ 1.0 % of span = 0.92 % ΔT power = 0.62 % of ΔT span
FΔI Channel Rack Drift (RD_4)	$\pm$ 1.0 % of span = 3.20 % ΔT power = 2.14 % of ΔT span (1)

(1) Calculation EE-0434 (Reference 5.18) estimates $\pm$ 3.0 % ΔI (i.e., $\pm$ 2.5 % of ΔI span) for this function. In order to calculate the Allowable Value, 1.0 % of span will be used for FΔI Channel Rack Drift.

The Rack Allowance for the OTΔT Reactor Trip function can be calculated statistically by combining the error terms above in two different ways using SRSS as shown below.

Method 1a - Rack Allowance combining independent error terms using SRSS

Note: For a conservative estimate, the rack error terms are not all converted to % of ΔT span.

$$\text{Rack Allowance} = \pm (RCA_1^2 + RCA_2^2 + RCA_3^2 + RCA_4^2 + RCA_5^2 + RCSA^2 + RD_1^2 + RD_2^2 + RD_3^2 + RD_4^2)^{1/2}$$

$$\text{Rack Allowance} = \pm (0.5^2 + 0.5^2 + 0.5^2 + 0.5^2 + 0.5^2 + 0.5^2 + 1.0^2 + 1.0^2 + 1.0^2 + 1.0^2)^{1/2}$$

Rack Allowance = $\pm$ 2.35 % of span = $\pm$ 3.53 % ΔT Power

Method 1b - Rack Allowance combining independent error terms using SRSS

Note: All rack error terms are converted to % of ΔT span.

$$\text{Rack Allowance} = \pm (RCA_1^2 + RCA_2^2 + RCA_3^2 + RCA_4^2 + RCA_5^2 + RCSA^2 + RD_1^2 + RD_2^2 + RD_3^2 + RD_4^2)^{1/2}$$

$$\text{Rack Allowance} = \pm (0.5^2 + 0.73^2 + 0.31^2 + 1.07^2 + 0.5^2 + 0.5^2 + 1.0^2 + 1.46^2 + 0.62^2 + 2.14^2)^{1/2}$$

Rack Allowance = $\pm$ 3.26 % of span = $\pm$ 4.89 % ΔT Power

Method 2a - Rack Allowance grouping channel error terms and combining using SRSS

Note: For a conservative estimate, the rack error terms are not all converted to % of ΔT span.

$$\text{Rack Allowance} = \pm \{(RCA_1 + RD_1)^2 + (RCA_2 + RD_2)^2 + (RCA_3 + RD_3)^2 + (RCA_4 + RD_4)^2 + RCA_5^2 + RCSA^2\}^{1/2}$$

$$\text{Rack Allowance} = \pm \{(0.5 + 1.0)^2 + (0.5 + 1.0)^2 + (0.5 + 1.0)^2 + (0.5 + 1.0)^2 + 0.5^2 + 0.5^2\}^{1/2}$$

Rack Allowance = $\pm$ 3.082 % of span = $\pm$ 4.623 % ΔT Power

Method 2b - Rack Allowance grouping channel error terms and combining using SRSS

Note: All rack error terms are converted to % of ΔT span.

$$\text{Rack Allowance} = \pm \{(RCA_1 + RD_1)^2 + (RCA_2 + RD_2)^2 + (RCA_3 + RD_3)^2 + (RCA_4 + RD_4)^2 + RCA_5^2 + RCSA^2\}^{1/2}$$

$$\text{Rack Allowance} = \pm \{(0.5 + 1.0)^2 + (0.73 + 1.46)^2 + (0.31 + 0.62)^2 + (1.07 + 2.14)^2 + 0.5^2 + 0.5^2\}^{1/2}$$

Rack Allowance = $\pm$ 4.33 % of span = $\pm$ 6.495 % ΔT Power

The OTΔT Reactor Trip Rack Allowance Value of $\pm$ 2.35 % of the ΔT span or $\pm$ 3.53 % ΔT Power calculated in Method 1a is slightly greater than the current Allowable Value of $\pm$ 2.0 % of the ΔT span or $\pm$ 3.0 % ΔT Power. As can be seen from the examples above, Method 1a is a very conservative way of calculating the Rack Allowance for this function. Many of the Allowable Values for the OTΔT and OPΔT Reactor Trips that appear in later versions of STS are calculated using a method similar to Method 2a or 2b which yields a much larger Rack Allowance Value than Method 1a or 1b. In the case of North Anna, the current Allowable Value of 2.0 % of the ΔT span will be changed to 2.3 % of the ΔT span to reflect the calculated value illustrated in Method 1a above. It is recommended that the Allowable Value for the OTΔT Reactor Trip function be expressed in ITS as a NOTE. It is further recommended that the NOTE be written as follows for the North Anna ITS :

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.3 % of the ΔT span "

Surry

The setpoint values that appear in Surry's current version of Technical Specifications will also be evaluated to ensure that they are bounded by the CSA Calculation of record and by the Safety Analysis assumptions documented in Technical Report NE-0994 (Ref 5.1). Based on this evaluation, the existing setpoint values will either be retained or revised for use in the Surry ITS conversion. The evaluation methodology used for Surry will be same as that used for North Anna taking into account the differences in hardware and functional testing as required.

Single Input Protection Functions

Like North Anna, there will be two rack error terms that are not included in the calculation of the Allowable Values for Surry, they are Rack Measuring and Test Equipment (RMTE) and Rack Temperature Effect (RTE).

The methodology used to calculate the Rack Allowance for Surry is based on the Square Root Sum of the Squares (SRSS) of the three rack error terms listed below. Like the example illustrated above for North Anna, Surry's rack error terms will also be treated as independent variables.

- Rack Calibration Accuracy (RCA)
- Rack Comparator Setting Accuracy (RCSA)
- Rack Drift (RD)

The methodology used to calculate the Rack Allowance and thus an Allowable Value that will also be more conservative than the methods described in Section 3.1. Note the example below for Surry's Pressurizer High Level Reactor Trip.

Pressurizer High Level Reactor Trip Allowable Value using RMTE and RTE

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

$$\text{Rack Allowance} = \{ (0.0 + 0.0)^2 + (0.5 + 0.15)^2 + 1.0^2 + 0.5^2 \}^{1/2}$$

$$\text{Rack Allowance} = 1.29\ \%\ \text{of span}$$

$$\text{Allowable Value} = \text{Nominal Trip Setpoint} + \text{Rack Allowance}$$

Allowable Value = 88.0 + 1.29 = 89.29 %

Pressurizer High Level Reactor Trip Allowable Value without RMTE and RTE

$$\text{Rack Allowance} = \{ \text{RCA}^2 + \text{RCSA}^2 + \text{RD}^2 \}^{1/2}$$

$$\text{Rack Allowance} = \{ 0.0^2 + 0.5^2 + 1.0^2 \}^{1/2}$$

$$\text{Rack Allowance} = 1.12\ \%\ \text{of span}$$

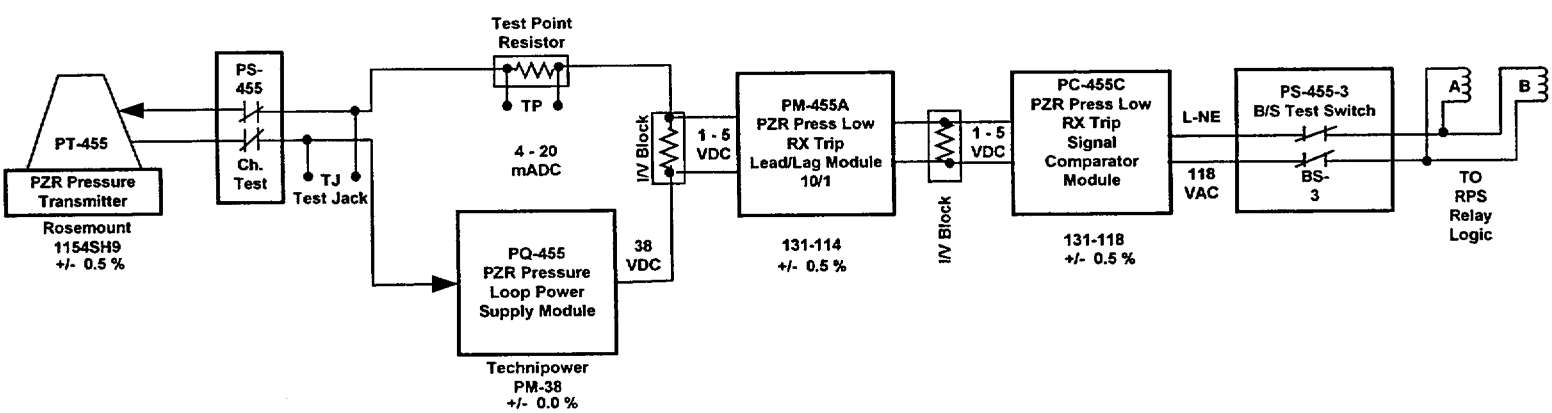
Allowable Value = Nominal Trip Setpoint + Rack Allowance

Allowable Value = 88.0 + 1.12 = 89.12 %

In the case of Surry, the Setpoint Value in the current version of Technical Specifications is 92.0 % Level. In this specific case for the Pressurizer High Level Reactor Trip, the current value of 92.0 % will be changed to a conservative value of 89.1 % Level.

All of the Allowable Values for single input protection functions at Surry will be calculated in a manner similar to that illustrated above. For single input protection functions that use more than one module to condition or modify the input signal to the bistable, multiple RCA error terms will used in the equation to determine the Allowable Value. The Pressurizer Low Pressure Reactor Trip function as illustrated in Figure 3.3-3 will be used as an example of the methodology used to calculate the Allowable Value for single input protection functions that use more than one module to modify the input signal to the bistable.

Westinghouse 7100 Process Control System
Low Pressurizer Pressure Reactor Trip



<u>**Figure 3.3-3**</u>

The calculated Rack Allowance for the Pressurizer Low Pressure Reactor Trip based on Figure 3.3-3 is given below :

<u>**Low Pressurizer Pressure Reactor Trip Allowable Value**</u>

$$\text{Rack Allowance} = (RCA_1^2 + RCA_2^2 + RCSA^2 + RD^2)^{1/2}$$

$$\text{Rack Allowance} = (0.0^2 + 0.5^2 + 0.5^2 + 1.0^2)^{1/2}$$

Rack Allowance = 1.22 % of span = 9.76 PSIG [(1)]

(1) (1.22 / 100) * 800 PSIG span = 9.76 PSIG

Allowable Value = Nominal Trip Setpoint – Rack Allowance

Allowable Value = 1875 PSIG – 9.76 PSIG

Allowable Value = 1865.24 PSIG

The Allowable Value for the Low Pressurizer Pressure Reactor Trip in the current version of Technical Specifications (Ref 5.7) is ≥ 1860 PSIG. In this case, the current value of ≥ 1860 PSIG will be changed to ≥ 1865 PSIG to conform to the calculated Allowable Value.

Allowable Values for other single input protection functions that use multiple modules to develop the trip will be calculated in a manner similar to that illustrated above.

Dual Input Protection Functions

The methodology used to determine the ITS Allowable Value for Dual Input Protection Functions will be the same as that used for North Anna. For a simple dual input function, the Allowable Value for Surry will be calculated using the following generic equations :

For a simple dual input function, the Allowable Value for Surry will be calculated using the same generic equations as those used for North Anna.

$$\text{Rack Allowance} = \{ RCA_1{}^2 + RCA_2{}^2 + RCA_3{}^2 + RCA_n{}^2 + RCSA^2 + RD^2 \}^{1/2}$$

Depending on the methodology used in the CSA Calculation, a Rack Drift (RD) term may have been included in the calculation for each input to the trip. In this case, the generic equation used to calculate the Rack Allowance will be :

$$\text{Rack Allowance} = \{ RCA_1{}^2 + RCA_2{}^2 + RCA_3{}^2 + RCA_n{}^2 + RCSA^2 + RD_1{}^2 + RD_2{}^2 \}^{1/2}$$

Note : **The RCA and RCSA terms used above are typically defined in Virginia Power CSA Calculations as Module Tolerances and are designated as M_1, M_2 ... M_n. For the purposes of this report, the Terms RCA_1, RCA_2, RCA_n and RCSA are the same as M_1, M_2 and M_n as used in the CSA Calculations.**

In all cases the Allowable Value is calculated using the following equation :

Allowable Value = Nominal Trip Setpoint +/- Rack Allowance

Using the Surry High Steam Flow in 2/3 Lines ESFAS trip as an example, the calculated Allowable Value for this function is :

$$\text{Rack Allowance} = \{ RCA_1{}^2 + RCA_2{}^2 + RCSA^2 + RD^2 \}^{1/2}$$

$$\text{Rack Allowance} = \{ 0.5^2 + 0.5^2 + 0.5^2 + 1.0^2 \}^{½}$$

Rack Allowance = 1.323 % of ΔP span

Where:
RCA_1 = Steam Flow Isolator tolerance = $\pm$ 0.5 % of span
RCA_2 = High Steam Flow Setpoint Summator tolerance = $\pm$ 0.5 % of span
RCSA = High Steam Flow Bistable tolerance = $\pm$ 0.5 %
RD = Rack Drift = $\pm$ 1.0 % of span

Allowable Value = Nominal Trip Setpoint + Rack Allowance

Allowable Value $_{(20\ \%\ Power)}$ = 38 % F_{nom} + 2.32 % F_{nom} = 40.32 % F_{nom} (1)(2)

Allowable Value $_{(100\ \%\ Power)}$ = 109 % F_{nom} + 0.83 % F_{nom} = 109.83 (3)(4)

Note: F_{nom} is the nominal design flow at 100 % power for Surry. F_{nom} is equal to 3.7533 * 10^6 Pounds Per Hour (PPH) at 100 % power.

The Allowable Value for the Surry High Steam Flow in 2/3 Lines ESFAS trip in the current version of Technical Specifications is $\leq$ 40.0 % of F_{nom} from 0 to 20 % Power increasing linearly to $\leq$ 110.0 % of F_{nom} at 100 % Power. Based on the rack allowance calculated above and its conversion to % ΔP and % of F_{nom}, the current Allowable Values will be changed to reflect the values calculated above. The ITS Allowable Values for the Surry High Steam Flow in 2/3 Lines ESFAS Trip are :

Allowable Value $_{(0\ to\ 20\ \%\ Power)}$ = $\leq$ 40.0 % of F_{nom}

Increasing linearly from 20 % Power to 100 % Power

Allowable Value $_{(Power \geq 100\ \%)}$ = $\leq$ 110.0 % of F_{nom}

Note : The ITS Allowable Values calculated above are based on Nominal Trip Setpoint Values of 38 % of F_{nom} from 0 to 20 % Power and 109 % of F_{nom} at power levels $\geq$ 100 %.

---

(1) % ΔP = $(((0.38*3.7533E6)/4.4E6)^2 + (1.323/100)) / 1.25935) * 100\ \% = 9.394\ \%\ \Delta P$
(2) % F_{nom} = $((((9.394\ \% / 100\ \%) * 1.25935)^{1/2} * 4.4E6) / 3.7533\ E6) * 100\ \% = 40.32\ \%$
(3) % ΔP = $((((3.7533E6 * 1.09)/4.4E6)^2 + (1.323/100)) / 1.0000) * 100\ \% = 87.77\ \%\ \Delta P$
(4) % F_{nom} = $((((87.77\ \% / 100\ \%) * 1.0000)^{1/2} * 4.4E6) / 3.7533\ E6) * 100\ \% = 109.83\ \%$

Note : The constant 1.25935 is equal to the specific weight of steam at P_{SAT} (1020 PSIA) divided by the specific weight of steam at the average P_{REF} for both units (825.33 PSIA); 2.292698 (lbm/ft^3) / 1.820542 (lbm/ft^3) = 1.25935.

Multiple Input Protection Functions

The Allowable Value for multiple input protection functions at Surry will be determined in the same manner as that used for North Anna. The Rack Allowance will be conservatively based on the following rack error components :

- Rack Calibration Accuracy (RCA) – This will be based on a string calibration accuracy of ± 0.5 % of span
- Rack Comparator Setting Accuracy (RCSA)
- Rack Drift (RD)

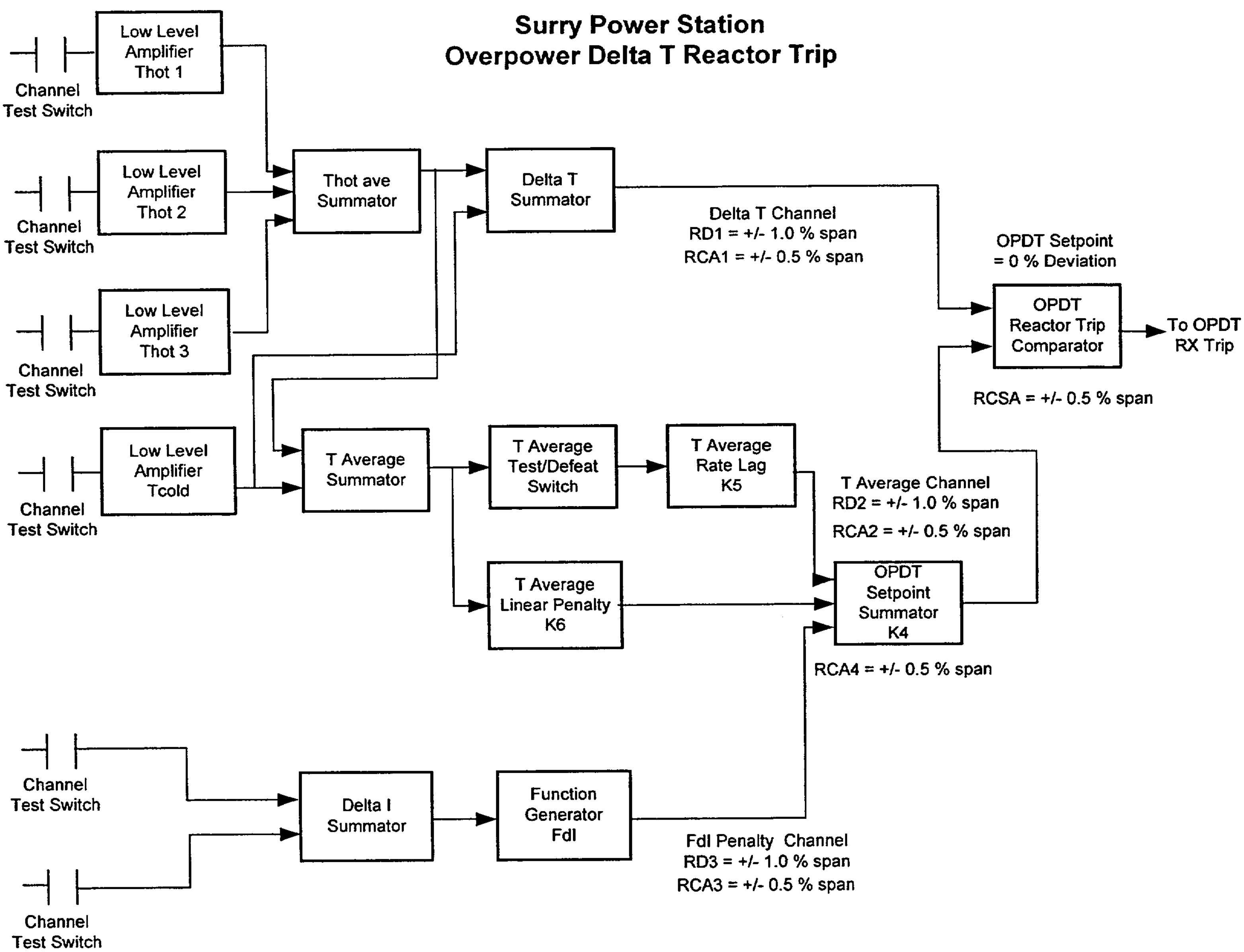


Figure 3.3-4

Using the Surry Overpower ΔT Reactor Trip as an example (Refer to Figure 3.3-4), the Rack Calibration Accuracy (RCA), Rack Comparator Setting Accuracy (RCSA) and Rack Drift (RD) error components for the OPΔT Reactor Trip are conservatively made up of :

ΔT Channel (RCA_1)	± 0.5 % of ΔT span
T_{AVG} Channel (RCA_2)	± 0.5 % of span = 1.055 % ΔT power = 0.703 % of ΔT span
FΔI Channel (RCA_3)	± 0.5 % of span = 1.350 % ΔT power = 0.900 % of ΔT span
OPΔT Setpoint (RCA_4)	± 0.5 % of ΔT span
OPΔT Comparator (RCSA)	± 0.5 % of ΔT span
ΔT Channel Rack Drift (RD_1)	± 1.0 % of ΔT span
T_{AVG} Channel Rack Drift (RD_2)	± 1.0 % of span = 2.11 % ΔT power = 1.41 % of ΔT span
FΔI Channel Rack Drift (RD_3)	± 1.0 % of span = 2.70 % ΔT power = 1.80 % of ΔT span [(1)]

(1) Calculation EE-0415 (Ref 5.32) estimates ± 3.0 % ΔI (i.e., ± 2.5 % of ΔI span) for this function. In order to calculate the Allowable Value, 1.0 % of span will be used for FΔI Channel Rack Drift.

The Rack Allowance for the OPΔT Reactor Trip function is developed by statistically combining the above error terms using SRSS as shown below. Note that method used to determine the OPΔT Reactor Trip Rack Allowance for Surry is identical to the method used to determine North Anna's OTΔT Reactor Trip Rack Allowance (i.e., Method 1a). As stated above, Method 1a will yield the most conservative Rack Allowance Value.

$$\text{Rack Allowance} = \pm (RCA_1^2 + RCA_2^2 + RCA_3^2 + RCA_4^2 + RCSA^2 + RD_1^2 + RD_2^2 + RD_3^2)^{1/2}$$

$$\text{Rack Allowance} = \pm (0.5^2 + 0.5^2 + 0.5^2 + 0.5^2 + 0.5^2 + 1.0^2 + 1.0^2 + 1.0^2)^{1/2}$$

$$\text{Rack Allowance} = \pm\ 2.062\ \%\ \text{of span} = \pm 3.09\ \%\ \Delta T\ \text{Power}$$

At the present time, Surry's current version of Technical Specifications does not provide Allowable Values (i.e., Setpoint Values) for the Overpower and Overtemperature ΔT Reactor Trips in a manner consistent with other plants that use Standardized Technical Specifications. In order to maintain a measure of conservatism, it has been a historical practice at Surry to reduce the actual installed K_1 term (OTΔT) and the K_4 term (OPΔT) by 2.0 %/% . For ITS, the Rack Allowance Value calculated above will be rounded back to ± 2.0 % of span = ± 3.0 % ΔT Power.

It is recommended that the Allowable Value for the Surry OPΔT Reactor Trip function be expressed as a NOTE. It is further recommended that the NOTE be written as follows :

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.0 % of the ΔT span "

4.0 RESULTS

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

Reactor Trips

4.1.1 Manual Reactor Trip

Allowable Value = N/A

There is no specific RTS Trip Setpoint associated with this function.

4.1.2 Power Range Neutron Flux High Reactor Trip

Allowable Value : $\leq$ 110.0 % RTP

This Allowable Value of $\leq$ 110.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 109.0 % RTP. The distance in percent of span between the Nominal Trip Setpoint and the Allowable Value is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0063 (Ref 5.15). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.3 Power Range Neutron Flux Low Reactor Trip

Allowable Value : $\leq$ 26.0 % RTP

This Allowable Value of $\leq$ 26.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 25.0 % RTP. The distance in percent of span between the Nominal Trip Setpoint and the Allowable Value is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0063 (Ref 5.15). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.4 Power Range Neutron Flux High Positive Rate Reactor Trip

Allowable Value : $\leq$ 5.5 % RTP @ $\geq$ 2 Seconds

This Allowable Value of $\leq$ 5.5 % RTP @ $\geq$ 2.0 Seconds is based on maintaining a Nominal Trip Setpoint value of 5.0 % RTP @ 2.25 Seconds. . The distance in percent of span between the Nominal Trip Setpoint and the Allowable Value is based on the time constant tolerance of $\pm$ 10.0 % for the NIS Rate Lag Derivative Amplifier. This Allowable Value is calculated based on the dynamics involved with the trip and does not conform to the static methodologies described in Section 3.3. The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

Note : This trip function is not credited in the Chapter 15 Safety Analysis. A CSA Calculation has not been performed for this function.

4.1.5 Power Range Neutron Flux High Negative Rate Reactor Trip

Allowable Value : $\leq$ 5.5 % RTP @ $\geq$ 2 Seconds

This Allowable Value of $\leq$ 5.5 % RTP @ $\geq$ 2.0 Seconds is based on maintaining a Nominal Trip Setpoint value of 5.0 % RTP @ 2.25 Seconds. The distance in percent of span between the Nominal Trip Setpoint and the Allowable Value is based on the time constant tolerance of $\pm$ 10.0 % for the NIS Rate Lag Derivative Amplifier. This Allowable Value is calculated based on the dynamics involved with the trip and does not conform to the static methodologies described in Section 3.3. The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

Note : This trip function is not credited in the Chapter 15 Safety Analysis. A CSA Calculation has not been performed for this function.

4.1.6 Intermediate Range Neutron Flux High Reactor Trip

Allowable Value : $\leq$ 40.0 % RTP

This Allowable Value of $\leq$ 40.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 35.0 % RTP. The distance in percent of span between the Nominal Trip Setpoint and the Allowable Value is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0738 (Ref 5.16). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.7 Source Range Neutron Flux High Reactor Trip

Allowable Value : $\leq 1.3 * 10^5$ CPS

This Allowable Value of $\leq 1.3 * 10^5$ CPS is based on maintaining a Nominal Trip Setpoint value of $1.0 * 10^5$ CPS. The distance in percent of span between the Nominal Trip Setpoint and the Allowable Value is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0710 (Ref 5.17). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.8 Overtemperature ΔT Reactor Trip

Allowable Value : See below

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.3 % of the ΔT span "

The Overtemperature 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 Allowable Value deviation for this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0434

(Ref 5.18). The derivation of North Anna's OTΔT Reactor Trip Allowable Value is described in detail in Section 3.3.

Note : The deviation allowance of 2.3 % of span is very conservative. Typically, most later plants that use Standardized Technical Specifications have a deviation allowance of ≥ 3.0 % of span as was calculated for North Anna is Section 3.3.

4.1.8 Overpower ΔT Reactor Trip

Allowable Value : See below

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.0 % of the ΔT span "

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 Allowable Value deviation for this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0434 (Ref 5.18). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.9 Pressurizer Low Pressure Reactor Trip

Allowable Value : ≥ 1860 PSIG

This Allowable Value of ≥ 1860 PSIG is based on maintaining a Nominal Trip Setpoint value of 1870 PSIG. In this case, the current Allowable Value of ≥ 1860 PSIG will be retained because it is sufficiently close enough to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0069 (Ref 5.19). The calculated Allowable Value for this function is ≥ 1860.8 PSIG. The 0.8 PSIG offset is accommodated in the 24.17 PSIG Safety Margin for this trip (Ref 5.2). The determination of the Allowable Value for the North Anna Pressurizer Pressure Low Reactor Trip function is discussed in detail in Section 3.3. The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.10 Pressurizer High Pressure Reactor Trip

Allowable Value : ≤ 2370 PSIG

This Allowable Value of ≤ 2370 PSIG is based on maintaining a Nominal Trip Setpoint value of 2360 PSIG. In this case, the current value of ≤ 2370 PSIG will be retained because it is sufficiently close enough to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0069 (Ref 5.19). The calculated Allowable Value for this function is ≤ 2368.3 PSIG. The 1.7 PSIG offset is accommodated in the 6.3 PSIG Safety Margin for this trip (Ref 5.2). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.11 Pressurizer High Level Reactor Trip

Allowable Value : $\leq$ 93.0 % Level (Hot)

This Allowable Value of $\leq$ 93.0 % Level is based on maintaining a Nominal Trip Setpoint value of 92.0 % Level. In this case, the current value of $\leq$ 93.0 % Level will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0058 (Ref 5.20). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.12 Reactor Coolant Flow Low Reactor Trip

Allowable Value : $\geq$ 89.0 % Flow (Normalized)

This Allowable Value of $\geq$ 89.0 % Flow is based on maintaining a Nominal Trip Setpoint value of 90.0 % Flow. In this case, the current value of $\geq$ 89.0 % Flow will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0060 (Ref 5.21). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.13 Reactor Coolant Pump Breaker Position

Allowable Value : N/A

There is no specific RTS Trip Setpoint associated with this function.

4.1.14 Reactor Coolant Pump Undervoltage

Allowable Value : This Allowable Value will be provided by Corporate Electrical EE Power.

4.1.15 Reactor Coolant Pump Underfrequency

Allowable Value : This Allowable Value will be provided by Corporate Electrical EE Power.

4.1.16 Steam Generator Water Level Low Low Reactor Trip/SI

Allowable Value : $\geq$ 17.0 % Narrow Range (NR) Level

This Allowable Value of $\geq$ 17.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 18.0 % NR Level. In this case, the current Allowable Value of $\geq$ 17.0 % NR Level will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0492 (Ref 5.22). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.17 Steam Generator Water Level Low Coincident Reactor Trip

Allowable Value : $\geq$ 24.0 % Narrow Range (NR) Level

This Allowable Value of $\geq$ 24.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 25.0 % Level. In this case, the current value of $\geq$ 24.0 % NR Level will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0492 (Ref 5.22). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.18 Steam Flow Feed Flow Mismatch Coincident Reactor Trip

Allowable Value : $\leq$ 42.5 % of F_{nom} (i.e., nominal steam flow at RTP = 4.247 * 10^6 PPH)

This Allowable Value of $\leq$ 42.5 % of F_{nom} is based on maintaining a Nominal Trip Setpoint value of 40.0 % of F_{nom}. In this case, the current Allowable Value of $\leq$ 42.5 % of F_{nom} will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0736 (Ref 5.23). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.19 Turbine Trip – Low Auto Stop Oil Pressure

Allowable Value : $\geq$ 40.0 PSIG

This Allowable Value of $\geq$ 40.0 PSIG is based on maintaining a Nominal Trip Setpoint value of 45.0 PSIG. In this case, the current Allowable Value of $\geq$ 40.0 PSIG will be retained because it is sufficiently close enough to the calculated value. The calculated Allowable Value is based on adding the uncertainty values associated with the pressure switch calibration accuracy and drift / repeatability (i.e., 1.3 PSIG + 2.6 PSIG = 3.9 PSIG). In this case the current and historical Allowable Value of $\geq$ 40.0 PSIG will be retained because this trip is not credited in the Chapter 15 Safety Analysis and a CSA Calculation has not been performed for this function, thus no Safety or Design Basis analysis is adversely affected.

4.1.20 Turbine Stop Valve Closure

Allowable Value : $\geq$ 0.0 % Open

The Turbine Stop Valve Closure function is not credited in the Safety Analysis and therefore no Safety Analysis Limit is specified in References 5.1 and 5.2 for this function. In addition, a CSA Calculation has not been performed for this function. The current Trip Setpoint at North Anna for the Turbine Stop Valve Closure function is $\geq$ 1.0 % Open and the Allowable Value is $\geq$ 0.0 % Open (Ref 5.2). The basis for retaining the current Allowable Value for the Turbine Stop Valve Closure function is given below :

1. There is no Safety Analysis Limit or implied Design Basis Limit for this function that has been documented in Technical Specifications, UFSAR or the DBD. In addition, no CSA Calculation has been performed for this function at North Anna.

2. The proposed 1.0 % delta between the Trip Setpoint and the Allowable Value is consistent with North Anna's current values and has been used since the initial startup of the plant (Ref 5.3).

3. The proposed Allowable Value is also consistent with value given in the "Westinghouse Reactor Protection System / Engineered Safety Features Actuation System Setpoint Methodology provided to Virginia Power under S/N 541, Dockets 50-338 and 50-339 (Ref 5.3)

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

Allowable Value : N/A

There is no specific RTS Trip Setpoint associated with this function.

Reactor Trip Permissives

4.1.22 Permissive P-6, Intermediate Range Neutron Flux

Allowable Value : $\geq 3 * 10^{-11}$ **Amps**

This Allowable Value of $\geq 3 * 10^{-11}$ Amps is based on maintaining a Nominal Trip Setpoint value of $5 * 10^{-11}$ Amps. In this case, the current Allowable Value of $\geq 3 * 10^{-11}$ Amps will be retained because it is equal to the calibration accuracy of the device and is conservative based on the methodologies described in Section 3.3. Note that this function is assumed to be available in the Safety Analysis but no specific setpoint is assumed (Ref 5.1). A CSA Calculation has not been performed for this permissive. The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.23 Permissive P-7, Block Low Power Reactor Trips

Allowable Value : N/A

Permissive P-7 is made up of Permissives P-10 and P-13.

4.1.24 Permissive P-8, Power Range Neutron Flux

Allowable Value : $\leq$ **31.0 % RTP**

This Allowable Value of $\leq$ 31 % RTP is based on maintaining a Nominal Trip Setpoint value of 30.0 % RTP. In this case, the current Allowable Value of $\leq$ 31.0 % RTP will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0063 (Ref 5.15). The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.25 Permissive P-10, Power Range Neutron Flux

Allowable Values : $\geq$ **7.0 % RTP** **AND**
$\leq$ **11.0 % RTP**

These Allowable Values of $\geq$ 7.0 % RTP and $\leq$ 11.0 % RTP are based on maintaining a Nominal Trip Setpoint value of 10.0 % RTP and a Nominal Reset value of 8.0 % RTP. In this case, the current Allowable Values will be retained because they are conservative with respect to the calculated values using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0063 (Ref 5.15). The ITS Allowable Values for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.26 Permissive P-13, Turbine Impulse Pressure

Allowable Value : **≤ 11.0 % RTP**

This Allowable Value of ≤ 11.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 10.0 % RTP In this case, the current Allowable Value of ≤ 11.0 % RTP will be retained because it is conservative based on the methodologies described in Section 3.3. Note that this function is assumed to be available in the Safety Analysis but no specific setpoint is assumed (Ref 5.1). A CSA Calculation has not been performed for this permissive. The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.1.27 Reactor Trip Breakers

Allowable Value : **N/A**

There is no specific RTS Trip Setpoint associated with this function.

4.1.28 Reactor Trip Breaker Undervoltage and Shunt Trip Mechanism

Allowable Value : **N/A**

There is no specific RTS Trip Setpoint associated with this function.

4.1.29 Automatic Trip Logic

Allowable Value : **N/A**

There is no specific RTS Trip Setpoint associated with this function.

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

Safety Injection

4.2.1 Safety Injection, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.2 Safety Injection Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.3 Containment Pressure – High

Allowable Value : **≤ 17.7 PSIA**

This Allowable Value of ≤ 17.7 PSIA is based on maintaining a Nominal Trip Setpoint value of 17.0 PSIA. The Allowable Value of ≤ 18.5 PSIA used in North Anna's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0052 (Ref 5.25). The proposed ITS Allowable Value of ≤ 17.7 PSIA is approximately equal to the calculated Allowable Value.

4.2.4 Pressurizer Pressure Low-Low

Allowable Value : **≥ 1770 PSIG**

This Allowable Value of ≥ 1770 PSIG is based on maintaining a Nominal Trip Setpoint value of 1780.0 PSIG. The Allowable Value of ≥ 1755 PSIG used in North Anna's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0069 (Ref 5.19). The actual calculated Allowable Value is ≥ 1771.7 PSIG. The proposed Allowable Value of ≥ 1770 PSIG is sufficiently close enough to the calculated value and the offset is bounded by the Safety Margin as documented in Technical Report EE-0101 (Ref 5.2) Note that the Allowable Value referenced in the Calibration Procedure for this function is ≥ 1770 PSIG (Ref 5.44).

4.2.5 High Differential Pressure Between Steam Lines

Allowable Value : $\leq$ 112.0 PSID

This Allowable Value of $\leq$ 112.0 PSID is based on maintaining a Nominal Trip Setpoint value of 100.0 PSID. In this case, the current Allowable Value will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0121 (Ref 5.26). The ITS Allowable Values for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.2.6 High Steam Flow in Two Steam Lines

Allowable Value : $\leq$ 42.0 % of F_{nom} from 0 to 20 % Power, increasing linearly to $\leq$ 111.0 % of F_{nom} at 100 % Power.

The Allowable Values of $\leq$ 42.0 % of F_{nom} from 0 to 20 % Power increasing linearly to $\leq$ 111.0 % of F_{nom} at 100 % Power are based on maintaining a Nominal Trip Setpoint of 40.0 % of F_{nom} from 0 to 20 % Power increasing linearly to 110.0 % of F_{nom} at 100 % Power. In this case, the current Allowable Values will be changed based on the calculated values using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0736 (Ref 5.23).

Note: F_{nom} is the nominal design flow at 100 % power for North Anna. F_{nom} is equal to $4.247 * 10^6$ Pounds Per Hour (PPH) at 100 % power.

4.2.7 T_{AVG} Low-Low

Allowable Value : $\geq$ 542.0 °F

This Allowable Value of $\geq$ 542.0 °F is based on maintaining a Nominal Trip Setpoint value of 543.0 °F. In this case, the current Allowable Value will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0434 (Ref 5.18). The ITS Allowable Values for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.2.8 Steam Line Pressure - Low

Allowable Value : $\geq$ 585.0 PSIG

This Allowable Value of $\geq$ 585.0 PSIG is based on maintaining a Nominal Trip Setpoint value of 600.0 PSIG. In this case, the current Allowable Value will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0121 (Ref 5.26). The ITS Allowable Values for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

Containment Spray

4.2.9 Containment Spray, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.10 Containment Spray Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.11 Containment Pressure High - High

Allowable Value : **≤ 28.45 PSIA**

This Allowable Value of ≤ 28.45 PSIA is based on maintaining a Nominal Trip Setpoint value of 27.75 PSIA. The Allowable Value of ≤ 29.25 PSIA used in North Anna's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0052 (Ref 5.25). The proposed ITS Allowable Value of ≤ 28.45 PSIA is approximately equal to the calculated Allowable Value.

Containment Isolation – Phase A

4.2.12 Containment Isolation – Phase A, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.13 Containment Isolation – Phase A, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.14 Safety Injection

Allowable Value : **N/A**

See Items 4.2.1 through 4.2.8.

Containment Isolation – Phase B

4.2.15 Containment Isolation – Phase B, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.16 Containment Isolation – Phase B, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.17 Containment Pressure High - High

Allowable Value : **See Item 4.2.11**

Steam Line Isolation

4.2.18 Steam Line Isolation, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.19 Steam Line Isolation, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.20 Containment Pressure Intermediate High - High

Allowable Value : **$\leq$ 18.5 PSIA**

This Allowable Value of $\leq$ 18.5 PSIA is based on maintaining a Nominal Trip Setpoint value of 17.8 PSIA. The Allowable Value of $\leq$ 19.3 PSIA used in North Anna's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0052 (Ref 5.25). The proposed ITS Allowable Value of $\leq$ 18.5 PSIA is approximately equal to the calculated Allowable Value.

4.2.21 High Steam Flow in Two Steam Lines

Allowable Value : **See Item 4.2.6**

4.2.22 T_{AVG} Low-Low

Allowable Value : **See Item 4.2.7.**

4.2.23 Steam Line Pressure - Low

Allowable Value : **See Item 4.2.8**

Turbine Trip and Feedwater Isolation

4.2.25 Turbine Trip and Feedwater Isolation, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.26 SG Water Level - High High (P-14)

Allowable Value : **$\leq$ 76.0 % Narrow Range (NR) Level**

This Allowable Value of $\leq$ 76.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 75.0 % NR Level. In this case, the current Allowable Value will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0492 (Ref 5.22). The ITS Allowable Values for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.2.27 Safety Injection

Allowable Value : **N/A**

See Items 4.2.1 through 4.2.8.

Auxiliary Feedwater

4.2.28 Auxiliary Feedwater, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.29 SG Water Level - Low Low

Allowable Value : $\geq$ 17.0 % Narrow Range (NR) Level

This Allowable Value of $\geq$ 17.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 18.0 % NR Level. In this case, the current Allowable Value will be retained because it is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0492 (Ref 5.22). The ITS Allowable Values for this function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.2.30 Safety Injection

Allowable Value : N/A

See Items 4.2.1 through 4.2.8.

4.2.31 Loss of Offsite Power

Allowable Value : This Allowable Value will be provided by Corporate Electrical EE Power.

4.2.32 Trip of all Main Feedwater Pumps

Allowable Value : N/A

There is no specific ESFAS Trip Setpoint associated with this function.

Automatic Switch Over to Containment Sump

4.2.33 Containment Sump Auto Switch Over, Automatic Actuation Logic and Actuation Relays

Allowable Value : N/A

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.34 Refueling Water Storage Tank Level – Low Low

Allowable Value : $\geq$ 18.4 % Wide Range (WR) Level and $\leq$ 20.4 % Wide Range (WR) Level

These Allowable Values of $\geq$ 18.4 % WR Level and $\leq$ 20.4 % WR Level are based on maintaining a Nominal Trip Setpoint value of 19.4 % WR Level. These Allowable Values are conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0092 (Ref 5.28). Allowable Values for this function are not included in North Anna's current Technical Specifications.

4.2.35 Safety Injection

Allowable Value : N/A

See Items 4.2.1 through 4.2.8.

ESFAS Permissives

4.2.36 Reactor Trip, P-4

Allowable Value : N/A

There is no specific ESFAS Trip Setpoint associated with this function.

4.2.37 Pressurizer Pressure, P-11

Allowable Value : $\leq$ **2010 PSIG**

For ITS, only one Allowable Value will be provided for the P-11 function. The automatic disabling of the manual block of safety injection on increasing pressure is the portion of this function that is important to safety. The Allowable Value of $\leq$ 2010 PSIG is based on maintaining a Nominal Trip Setpoint value of 2000 PSIG. In this case, the current value of $\leq$ 2010 PSIG will be retained because it is sufficiently close enough to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0069 (Ref 5.19). The calculated Allowable Value for this function is $\leq$ 2008.3 PSIG. Note that this function is assumed to be available in the Safety Analysis but no specific setpoint is assumed and thus the margin of safety is not affected. The ITS Allowable Value for this function is the same as the Allowable Value in North Anna's current Technical Specifications for the automatic disabling of the manual block of safety injection.

4.2.38 T_{AVG}, P-12

Allowable Value : $\leq$ **545.0 °F**

For ITS, only one Allowable Value will be provided for the P-12 function. The automatic disabling of the safety injection block on increasing temperature is the portion of this function that is important to safety. The Allowable Value of $\leq$ 545.0 °F is based on maintaining a Nominal Reset Setpoint value of 544.0 °F. This Allowable Value is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0434 (Ref 5.18). The Low-Low T_{AVG} Interlock function is developed from the same Bistable as Permissive P-12 (See item 4.2.7). The Allowable Value for the Low-Low T_{AVG} Interlock function will be used to ensure that the P-12 manual block function remains operable. The ITS Allowable Value for the safety portion of the P-12 function is the same as the Allowable Value in North Anna's current Technical Specifications.

4.3 Allowable Values for Surry ITS Table 3.3.1-1 (RPS Instrumentation)

Reactor Trips

4.3.1 Manual Reactor Trip

Allowable Value = N/A

There is no specific RPS Trip Setpoint associated with this function.

4.3.2 Power Range Neutron Flux High Reactor Trip

Allowable Value : ≤ 109.0 % RTP

This Allowable Value of ≤ 109.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 107.0 % RTP. The actual calculated Allowable Value is ≤ 108.7 % RTP. The proposed Allowable Value of ≤ 109.0 % RTP is sufficiently close enough to the calculated value using the methodology described in Section 3.3 and CSA rack error terms from Calculation EE-0198 (Ref 5.29). The offset between the calculated Allowable Value and the proposed Allowable Value is bounded by the Safety Margin as documented in Technical Report EE-0101 (Ref 5.2) Note that the ITS Allowable Value for this function is the same as the T. S. Limit Value in Surry's current Technical Specifications.

4.3.3 Power Range Neutron Flux Low Reactor Trip

Allowable Value : ≤ 25.0 % RTP

This Allowable Value of ≤ 25.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 23.0 % RTP. The actual calculated Allowable Value is ≤ 24.7 % RTP. The proposed Allowable Value of ≤ 25.0 % RTP is sufficiently close enough to the calculated value using the methodology described in Section 3.3 and CSA rack error terms from Calculation EE-0198 (Ref 5.29). The offset between the calculated Allowable Value and the proposed Allowable Value is bounded by the Safety Margin as documented in Technical Report EE-0101 (Ref 5.2) Note that the ITS Allowable Value for this function is the same as the T. S. Limit Value in Surry's current Technical Specifications.

4.3.4 Intermediate Range Neutron Flux High Reactor Trip

Allowable Value : ≤ 40.0 % RTP

This Allowable Value of ≤ 40.0 % RTP is based on maintaining a Nominal Trip Setpoint value of 35.0 % RTP. The distance in percent of span between the Nominal Trip Setpoint and the Allowable Value is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0722 (Ref 5.30). The ITS Allowable Value for this function is the same as the T. S. Limit Value in Surry's current Technical Specifications.

4.3.5 Source Range Neutron Flux High Reactor Trip

Allowable Value : $\leq 1.3 * 10^5$ **CPS**

This Allowable Value of $\leq 1.3 * 10^5$ CPS is based on maintaining a Nominal Trip Setpoint value of $1.0 * 10^5$ CPS. The T. S. Limit Value of $\leq 1.0 * 10^6$ CPS used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0719 (Ref 5.31). The distance in percent of span between the Nominal Trip Setpoint and the new ITS Allowable Value is conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0719 (Ref 5.31).

4.3.6 Overtemperature ΔT Reactor Trip

Allowable Value : **See below**

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.3 % of the ΔT span "

The Overtemperature 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 Allowable Value deviation for this trip is very close to and slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0415 (Ref 5.32). A detailed description of the derivation of Surry's OTΔT Reactor Trip Allowable Value is provided in Engineering Transmittal CEE 99-0028 (Ref 5.4).

Note : The deviation allowance of 2.3 % of span is very conservative. Typically, most later plants that use Standardized Technical Specifications have a deviation allowance of ≥ 3.0 % of span as was calculated for North Anna is Section 3.3.

4.3.7 Overpower ΔT Reactor Trip

Allowable Value : **See below**

" The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.0 % of the ΔT span "

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 Allowable Value deviation for this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0415 (Ref 5.32). A detailed description of the derivation of Surry's OPΔT Reactor Trip Allowable Value is provided in Engineering Transmittal CEE 99-0028 (Ref 5.4).

4.3.8 Pressurizer Low Pressure Reactor Trip

Allowable Value : ≥ 1865 PSIG

This Allowable Value of ≥ 1865 PSIG is based on maintaining a Nominal Trip Setpoint value of 1875 PSIG. The T. S. Limit Value of ≥ 1860 PSIG used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0514 (Ref 5.33). The calculated Allowable Value for this function is ≥ 1865.24 PSIG. The 0.24 PSIG offset is accommodated in the Safety Margin for this trip (Ref 5.2).

Note : The determination of the Allowable Value for the Surry Pressurizer Pressure Low Reactor Trip function is discussed in detail in Section 3.3.

4.3.9 Pressurizer High Pressure Reactor Trip

Allowable Value : ≤ 2380 PSIG

This Allowable Value of ≤ 2380 PSIG is based on maintaining a Nominal Trip Setpoint value of 2370 PSIG. The T. S. Limit Value of ≤ 2385 PSIG used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0514 (Ref 5.33). The calculated Allowable Value for this function is ≤ 2378.96 PSIG. The 1.04 PSIG offset is accommodated in the Safety Margin for this trip (Ref 5.2).

4.3.10 Pressurizer High Level Reactor Trip

Allowable Value : ≤ 89.1 % Level (Hot)

This Allowable Value of ≤ 89.1 % Level is based on maintaining a Nominal Trip Setpoint value of 88.0 % Level. The T. S. Limit Value of ≤ 92.0 % Level used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0458 (Ref 5.34). The proposed ITS Allowable Value this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0458 (Ref 5.34).

4.3.11 Reactor Coolant Flow Low Reactor Trip

Allowable Value : ≥ 91.0 % Flow (Normalized)

This Allowable Value of ≥ 91.0 % Flow is based on maintaining a Nominal Trip Setpoint value of 92.0 % Flow. The T. S. Limit Value of ≥ 90.0 % Flow used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0183 (Ref 5.35). The proposed ITS Allowable Value this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0183 (Ref 5.35).

4.3.12 Reactor Coolant Pump Breaker Position

Allowable Value : N/A

There is no specific RPS Trip Setpoint associated with this function.

4.3.13 Reactor Coolant Pump Undervoltage

Allowable Value : This Allowable Value will be provided by Corporate Electrical EE Power.

4.3.14 Reactor Coolant Pump Underfrequency

Allowable Value : This Allowable Value will be provided by Corporate Electrical EE Power.

4.3.15 Steam Generator Water Level Low Low Reactor Trip/SI

Allowable Value : $\geq$ 16.0 % Narrow Range (NR) Level

This Allowable Value of $\geq$ 16.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 17.0 % NR Level. The T. S. Limit Value of $\geq$ 14.5 % NR Level used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0432 (Ref 5.36). The proposed ITS Allowable Value this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0432 (Ref 5.36).

4.3.16 Steam Generator Water Level Low Coincident Reactor Trip

Allowable Value : $\geq$ 19.0 % Narrow Range (NR) Level

This Allowable Value of $\geq$ 19.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 20.0 % NR Level. The T. S. Limit Value of $\geq$ 15.0 % NR Level used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0432 (Ref 5.36). The proposed ITS Allowable Value this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0432 (Ref 5.36).

4.3.17 Steam Flow Feed Flow Mismatch Coincident Reactor Trip

Allowable Value : $\leq 0.809 * 10^6$ PPH (i.e., nominal steam flow at RTP = $3.7533 * 10^6$ PPH)

This Allowable Value of $\leq 0.809 * 10^6$ PPH is based on maintaining a Nominal Trip Setpoint value of $0.709 * 10^6$ PPH. The T. S. Limit Value of $\leq 1.0 * 10^6$ PPH used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0355 (Ref 5.37). The proposed ITS Allowable Value this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0355 (Ref 5.37).

4.3.18 Turbine Trip –Low Auto Stop Oil Pressure

Allowable Value : $\geq$ **40.0 PSIG**

This Allowable Value of $\geq$ 40.0 PSIG is based on maintaining a Nominal Trip Setpoint value of 45.0 PSIG. In this case, the difference between the Trip Setpoint and the Allowable Value is calculated by adding the uncertainty values associated with the pressure switch calibration accuracy and drift / repeatability (i.e., 1.9 PSIG + 2.9 PSIG = 4.8 PSIG; round to 5.0 PSIG). Note that the difference between the Trip Setpoint and the Allowable Value is arrived at deterministically instead of statistically. The basis for the derivation of this Allowable Value is provided in Engineering Transmittal CEE 99-0028 (Ref 5.4).

Note : This trip function is not credited in the Chapter 14 Safety Analysis. A CSA Calculation has not been performed for this function.

4.3.19 Turbine Stop Valve Closure

Allowable Value : $\geq$ **0.0 % Open**

The Turbine Stop Valve Closure function is not credited in the Safety Analysis and therefore no Safety Analysis Limit is specified in References 5.1 and 5.2 for this function. In addition, a CSA Calculation has not been performed for this function. The basis for the derivation of this Allowable Value is provided in Engineering Transmittal CEE 99-0028 (Ref 5.4).

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

Allowable Value : N/A

There is no specific RPS Trip Setpoint associated with this function.

Reactor Trip Permissives

4.3.21 Permissive P-6, Intermediate Range Neutron Flux

Allowable Value : $\geq 3 * 10^{-11}$ Amps

This Allowable Value of $\geq 3 * 10^{-11}$ Amps is based on maintaining a Nominal Trip Setpoint value of $5 * 10^{-11}$ Amps. The T. S. Limit Value of $\geq 5.0 * 10^{-11}$ Amps used in Surry's current Technical Specifications is set equal to the Nominal Trip Setpoint and does not conform to the methodologies described in Section 3.3. Note that this function is assumed to be available in the Safety Analysis but no specific setpoint is assumed (Ref 5.1). A CSA Calculation has not been performed for this permissive. The proposed ITS Allowable Value for this function is conservative with respect to the calculated value and is the same as the Allowable Value used at North Anna for this function.

4.3.22 Permissive P-7, Block Low Power Reactor Trips

Allowable Value : N/A

Permissive P-7 is made up of Permissives P-10 and P-13.

4.3.23 Permissive P-8, Power Range Neutron Flux

Allowable Value : ≤ 37.0 % RTP

This Allowable Value of ≤ 37 % RTP is based on maintaining a Nominal Trip Setpoint value of 35.0 % RTP. The T. S. Limit Value of ≤ 50.0 % RTP used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0198 (Ref 5.29). The actual calculated ITS Allowable Value is ≤ 36.7 % RTP. The proposed Allowable Value of ≤ 37.0 % RTP is sufficiently close enough to the calculated value using the methodology described in Section 3.3 and CSA rack error terms from Calculation EE-0198 (Ref 5.29). The offset between the calculated Allowable Value and the proposed Allowable Value is bounded by the Safety Margin as documented in Technical Report EE-0101 (Ref 5.2)

4.3.24 Permissive P-10, Power Range Neutron Flux

Allowable Values : ≥ 7.0 % RTP <u>AND</u>
≤ 11.0 % RTP

These Allowable Values of ≥ 7.0 % RTP and ≤ 11.0 % RTP are based on maintaining a Nominal Trip Setpoint value of 10.0 % RTP and a Nominal Reset value of 8.0 % RTP. Note that this function is assumed to be available in the Safety Analysis but no specific setpoint is assumed (Ref 5.1). The proposed ITS Allowable Value for this function is conservative with respect to the calculated value and is the same as the Allowable Value used at North Anna for this function. The basis for the derivation of this Allowable Value is provided in Engineering Transmittal CEE 99-0028 (Ref 5.4).

4.3.25 Permissive P-13, Turbine Impulse Pressure

Allowable Value : $\leq$ 12.2 % RTP

This Allowable Value of $\leq$ 12.2 % RTP is based on maintaining a Nominal Trip Setpoint value of 11.2 % RTP. The T. S. Limit Value of $\leq$ 10.0 % RTP used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 and does not reflect the rack uncertainties detailed in CSA Calculation EE-0457 (Ref 5.39). In addition, the current T. S. Limit does not account for the inherent deadband in the Signal Comparator Module used to develop this permissive function. The basis for the derivation of this Allowable Value is provided in Engineering Transmittal CEE 99-0028 (Ref 5.4).

4.3.26 Reactor Trip Breakers

Allowable Value : N/A

There is no specific RPS Trip Setpoint associated with this function.

4.3.27 Reactor Trip Breaker Undervoltage and Shunt Trip Mechanism

Allowable Value : N/A

There is no specific RPS Trip Setpoint associated with this function.

4.3.28 Automatic Trip Logic

Allowable Value : N/A

There is no specific RPS Trip Setpoint associated with this function.

4.4 Allowable Values for Surry ITS Table 3.3.2-1 (ESFAS Instrumentation)

Safety Injection

4.4.1 Safety Injection, Manual Initiation

Allowable Value : N/A

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.2 Safety Injection Automatic Actuation Logic and Actuation Relays

Allowable Value : N/A

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.3 Containment Pressure – High

Allowable Value : ≤ 18.5 PSIA

This Allowable Value of ≤ 18.5 PSIA is based on maintaining a Nominal Trip Setpoint value of 17.7 PSIA. The T. S. Limit Value of ≤ 19.0 PSIA used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 and does not reflect the rack uncertainties detailed in CSA Calculation EE-0131 (Ref 5.40). The actual calculated ITS Allowable Value is ≤ 18.43 PSIA which is sufficiently close enough to the proposed ITS Allowable Value and the offset is bounded by the Safety Margin as documented in Technical Report EE-0101 (Ref 5.2)

4.4.4 Pressurizer Pressure Low-Low

Allowable Value : ≥ 1765 PSIG

This Allowable Value of ≥ 1765 PSIG is based on maintaining a Nominal Trip Setpoint value of 1775.0 PSIG. The T. S. Limit value of ≥ 1760 PSIG used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0514 (Ref 5.33). The actual calculated Allowable Value is ≥ 1766.04 PSIG. The proposed Allowable Value of ≥ 1765 PSIG is sufficiently close enough to the calculated value and the offset is bounded by the Safety Margin as documented in Technical Report EE-0101 (Ref 5.2)

4.4.5 High Differential Pressure Steam Line versus Steam Header

Allowable Value : $\leq$ 140.0 PSID

This Allowable Value of $\leq$ 140.0 PSID is based on maintaining a Nominal Trip Setpoint value of 120.0 PSID. The T. S. Limit value of $\leq$ 150.0 PSID used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0355 (Ref 5.37). In this case, the proposed ITS Allowable Value is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0355 (Ref 5.37).

4.4.6 High Steam Flow in Two Steam Lines

Allowable Values : $\leq$ 40.0 % of F_{nom} from 0 to 20 % Power, increasing linearly to $\leq$ 110.0 % of F_{nom} at 100 % Power.

The Allowable Values of $\leq$ 40.0 % of F_{nom} from 0 to 20 % Power increasing linearly to $\leq$ 110.0 % of F_{nom} at 100 % Power are based on maintaining a Nominal Trip Setpoint of 38.0 % of F_{nom} from 0 to 20 % Power increasing linearly to 109.0 % of F_{nom} at 100 % Power. The ITS Allowable Values are the same as the T. S. Limit values used in Surry's current Technical Specifications.

Note: F_{nom} is the nominal design flow at 100 % power for Surry. F_{nom} is equal to 3.7533 * 10^6 Pounds Per Hour (PPH) at 100 % power.

4.4.7 T_{AVG} Low-Low

Allowable Value : $\geq$ 542.0 °F

This Allowable Value of $\geq$ 542.0 °F is based on maintaining a Nominal Trip Setpoint value of 543.0 °F. The T. S. Limit value of $\geq$ 541.0 °F used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0415 (Ref 5.32). In this case, the proposed ITS Allowable Value is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0415 (Ref 5.32).

4.4.8 Steam Line Pressure - Low

Allowable Value : $\geq$ **510.0 PSIG**

This Allowable Value of $\geq$ 510.0 PSIG is based on maintaining a Nominal Trip Setpoint value of 525.0 PSIG. The T. S. Limit value of $\geq$ 500.0 PSIG used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0355 (Ref 5.37). In this case, the proposed ITS Allowable Value is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0355 (Ref 5.37).

Containment Spray

4.4.9 Containment Spray, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.10 Containment Spray Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.11 Containment Pressure High - High

Allowable Value : $\leq$ **23.7 PSIA**

This Allowable Value of $\leq$ 23.7 PSIA is based on maintaining a Nominal Trip Setpoint value of 23.0 PSIA. The T. S. Limit value of $\leq$ 25.0 PSIA used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0131 (Ref 5.40). In this case, the proposed ITS Allowable Value is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0131 (Ref 5.40).

Containment Isolation – Phase 1

4.4.12 Containment Isolation – Phase 1, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.13 Containment Isolation – Phase 1, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.14 Safety Injection

Allowable Value : **N/A**

See Items 4.4.1 through 4.4.8.

Containment Isolation – Phase 2

4.4.15 Containment Isolation – Phase 2, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.16 Containment Isolation – Phase 2, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.17 Containment Pressure High

Allowable Value : **See Item 4.4.3**

Containment Isolation – Phase 3

4.4.18 Containment Isolation – Phase 3, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.19 Containment Isolation – Phase 3, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.20 Containment Pressure High - High

Allowable Value : **See Item 4.4.11**

Steam Line Isolation

4.4.21 Steam Line Isolation, Manual Initiation

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.22 Steam Line Isolation, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.23 Containment Pressure High - High

Allowable Value : **See Item 4.4.11**

4.4.24 High Steam Flow in Two Steam Lines

Allowable Value : **See Item 4.4.6**

4.4.25 T_{AVG} Low-Low

Allowable Value : **See Item 4.4.7.**

4.4.26 Steam Line Pressure - Low

Allowable Value : **See Item 4.4.8**

Turbine Trip and Feedwater Isolation

4.4.27 Turbine Trip and Feedwater Isolation, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.28 SG Water Level - High High (P-14)

Allowable Value : ≤ 76.0 % Narrow Range (NR) Level

This Allowable Value of ≤ 76.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 75.0 % NR Level. The T. S. Limit value of ≤ 80.0 % NR Level used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties in detailed in CSA Calculation EE-0432 (Ref 5.36). In this case, the proposed ITS Allowable Value is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0432 (Ref 5.36).

4.4.29 Safety Injection

Allowable Value : N/A

See Items 4.4.1 through 4.4.8.

Auxiliary Feedwater

4.4.30 Auxiliary Feedwater, Automatic Actuation Logic and Actuation Relays

Allowable Value : N/A

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.31 SG Water Level - Low Low

Allowable Value : ≥ 16.0 % Narrow Range (NR) Level

This Allowable Value of ≥ 16.0 % NR Level is based on maintaining a Nominal Trip Setpoint value of 17.0 % NR Level. The T. S. Limit Value of ≥ 14.5 % NR Level used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 nor does it reflect the rack uncertainties detailed in CSA Calculation EE-0432 (Ref 5.36). The proposed ITS Allowable Value this trip is slightly conservative with respect to the calculated value using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0432 (Ref 5.36).

4.4.32 Safety Injection

Allowable Value : N/A

See Items 4.4.1 through 4.4.8.

4.4.33 Loss of Offsite Power

Allowable Value : This Allowable Value will be provided by Corporate Electrical EE Power.

4.4.34 Undervoltage Reactor Coolant Pump

Allowable Value : **This Allowable Value will be provided by Corporate Electrical EE Power.**

4.4.35 Trip of all Main Feedwater Pumps

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

Automatic Switch Over to Containment Sump

4.4.36 Containment Sump Auto Switch Over, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.37 Refueling Water Storage Tank Level – Low Low

Allowable Value : **≥ 12.4 % Wide Range (WR) Level and ≤ 14.6 % Wide Range (WR) Level**

These Allowable Values of ≥ 12.4 % WR Level and ≤ 14.6 % WR Level are based on maintaining a Nominal Trip Setpoint value of 13.5 % WR Level. The T. S. Limit values of ≥ 11.25 % WR Level and ≤ 15.75 % WR Level used in Surry's current Technical Specifications do not conform to the methodologies described in Section 3.3 nor do they reflect the rack uncertainties in detailed in CSA Calculation EE-0112 (Ref 5.42). The proposed ITS Allowable Values are conservative with respect to the calculated Allowable Values using the methodologies described in Section 3.3 and the CSA rack error terms from Calculation EE-0112 (Ref 5.42).

Service Water Inventory

4.4.38 Service Water Inventory, Automatic Actuation Logic and Actuation Relays

Allowable Value : **N/A**

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.39 Intake Canal Level - Low

Allowable Value : **$\geq$ 23.5 feet**

The Trip Setpoint is accomplished based on the Level Probe/Switch which is mounted at Elevation 23 feet, 6 inches. The trip takes place when the level probe is uncovered. Under normal operating conditions when the probe is covered with water, the millivolt output readings from the probes can vary considerably. The time it takes the probe to reach the 250 millivolt (fixed) setpoint will vary depending upon the probe output value just prior to reaching the 23 foot 6 inch elevation. Based on Calculation EE-0724 (Ref 5.43) converting the channel instrument uncertainties (i.e., 6.49 inches) to time response yields a value of 71.68 seconds (based on a probe starting output voltage ranging from 0 to 250 mVDC). The six inches between the T. S. Setting Limit and the minimum T. S. Limit Value equates to 66 seconds. Based on the results of Calculation EE-0724, the Level Probe Trip Setpoint has been changed to a value $\leq$ 225 mVDC. This setpoint will result in a maximum probe response time of 62.50 seconds and a maximum uncertainty value 5.66 inches.

ESFAS Permissives

4.4.40 Reactor Trip, P-4

Allowable Value : N/A

There is no specific ESFAS Trip Setpoint associated with this function.

4.4.41 Pressurizer Pressure, P-11

Allowable Value : ≤ 2010 PSIG

For ITS, only one Allowable Value will be provided for the P-11 function. The automatic disabling of the manual block of safety injection is the portion of this function that is important to safety. The Allowable Value of ≤ 2010 PSIG is based on maintaining a Nominal Trip Setpoint value of 2000 PSIG. The T. S. Limit Value of ≤ 2000.0 PSIG used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 and does not reflect the rack uncertainties detailed in CSA Calculation EE-0514 (Ref 5.33). In addition, the current T. S. Limit does not account for the inherent deadband in the Signal Comparator Module used to develop this permissive function. P-11 is assumed to be available in the Safety Analysis but no specific setpoint is assumed (Ref 5.1). The proposed ITS Allowable Value for this function is slightly greater than the calculated value. The calculated Allowable Value is ≤ 2008.96 PSIG. The offset between the proposed Allowable Value and the calculated Allowable Value does not affect the margin of safety for this permissive (Refs 5.1 and 5.2).

4.4.42 T_{AVG}, P-12

Allowable Value : ≤ 545.0 °F

For ITS, only one Allowable Value will be provided for the P-12 function. The automatic disabling of the safety injection block on increasing temperature is the portion of this function that is important to safety. The Allowable Value of ≤ 545.0 °F is based on maintaining a Nominal Reset Setpoint value of 544.0 °F. The T. S. Limit Value of ≤ 543.0 °F used in Surry's current Technical Specifications does not conform to the methodologies described in Section 3.3 and does not reflect the rack uncertainties detailed in CSA Calculation EE-0415 (Ref 5.32). In addition, the current T. S. Limit does not account for the inherent deadband in the Signal Comparator Module used to develop this permissive function. The Low-Low T_{AVG} Interlock function is developed from the same Bistable as Permissive P-12 (See item 4.4.7). The Allowable Value for the Low-Low T_{AVG} Interlock function will be used to ensure that the P-12 manual block function remains operable. Note that this function is assumed to be available in the Safety Analysis but no specific setpoint is assumed (Ref 5.1). The proposed ITS Allowable Value for this function is conservative with respect to the calculated value.

5.0 REFERENCES

5.1 NE Technical Report 0994, Revision 7, Safety Analysis Limits for Technical Specification Instrumentation - Companion to EE-0101 - Surry and North Anna Power Stations, Dated April 28, 1999.

5.2 Technical Report EE-0101, Revision 3, Setpoint Basis Document – Analytical Limits, Setpoints and Calculations for Technical Specification Instrumentation At North Anna and Surry Power Stations, Dated 10-19-99.

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 Virginia Power STD-EEN-0304, Instrument Uncertainty Calculations.

5.6 Virginia Power STD-GN-0030, Nuclear Plant Setpoints.

5.7 Surry Power Station Technical Specifications.

5.8 North Anna Power Station Unit 1 Technical Specifications (Volume 1).

5.9 North Anna Power Station Unit 2 Technical Specifications (Volume 2).

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 Virginia Power Technical Report EE-0099, Revision 0, North Anna Instrument Tolerance Document.

5.12 Virginia Power Technical Report EE-0100, Revision 1 with Appendices 12 and 18.

5.13 Virginia Power Technical Report EE-0085, Revision 1 with Appendices 12 and 18

5.14 Engineering Transmittal CEE 95-037, Revision 1, Surveillance Limits For Surry Power Station RPS and ESFAS Instrumentation, Dated 06-23-98.

5.15 Virginia Power Calculation EE-0063, Revision 0 with ADD0A, CSA for North Anna NIS Power Range Trips.

5.16 Virginia Power Calculation EE-0738, Revision 0, CSA for North Anna NIS Intermediate Range Trips.

5.17 Virginia Power Calculation EE-0710, Revision 0, CSA for North Anna NIS Source Range Trips.

5.18 Virginia Power Calculation EE-0434, Revision 0 with ADD 0A and 0B, CSA for North Anna ΔT and T_{AVG} Protection.

5.19 Virginia Power Calculation EE-0069, Revision 3, CSA for North Anna Pressurizer Pressure Protection.

5.20 Virginia Power Calculation EE-0058, Revision 1 with ADD 01A, CSA for North Anna Pressurizer Level Protection.

5.21 Virginia Power Calculation EE-0060, Revision 1 with ADD 01A, CSA for North Anna Reactor Coolant Flow Protection.

5.22 Virginia Power Calculation EE-0492, Revision 1, CSA for North Anna Steam Generator Narrow Range Level Protection.

5.23 Virginia Power Calculation EE-0736, Revision 0, CSA for North Anna Steam Flow, Steam Pressure and Feedwater Flow Protection.

5.24 Virginia Power Calculation EE-0524, Revision 0 with ADD 0A and 0B, CSA for North Anna RCP Undervoltage and Underfrequency Protection.

5.25 Virginia Power Calculation EE-0052, Revision 2, CSA for North Anna Containment Narrow Range Pressure ESFAS Trips.

5.26 Virginia Power Calculation EE-0121, Revision 2 with ADD 02A, CSA for North Anna High ΔP Between Steam Lines and Low Steam Line Pressure ESFAS Trips.

5.27 Virginia Power Calculation EE-0305, Revision 0, CSA for North Anna High Steam Flow in 2/3 Lines ESFAS Trip.

5.28 Virginia Power Calculation EE-0092, Revision 1, CSA for North Anna RWST Level.

5.29 Virginia Power Calculation EE-0198, Revision 1 with ADD01A, CSA for Surry NIS Power Range Trips.

5.30 Virginia Power Calculation EE-0722, Revision 0, CSA for Surry NIS Intermediate Range Trips.

5.31 Virginia Power Calculation EE-0719, Revision 0, CSA for Surry NIS Source Range Trips.

5.32 Virginia Power Calculation EE-0415, Revision 1, CSA for Surry ΔT and T_{AVG} Protection.

5.33 Virginia Power Calculation EE-0514, Revision 0, CSA for Surry Pressurizer Pressure Protection.

5.34 Virginia Power Calculation EE-0458, Revision 0, CSA for Surry Pressurizer Level Protection.

5.35 Virginia Power Calculation EE-0183, Revision 2 with ADD 02A, CSA for Surry Reactor Coolant Flow Protection.

5.36 Virginia Power Calculation EE-0432, Revision 1, CSA for Surry Steam Generator Narrow Range Level Protection.

5.37 Virginia Power Calculation EE-0355, Revision 3, CSA for Surry Steam Flow, Steam Pressure and Feedwater Flow Protection.

5.38 Virginia Power Calculation EE-0412, Revision 0 with ADD 0A and 0B, CSA for Surry RCP Undervoltage and Underfrequency Protection.

5.39 Virginia Power Calculation EE-0457, Revision 0 with ADD 0A, CSA for Surry Turbine First Stage Pressure Protection.

5.40 Virginia Power Calculation EE-0131, Revision 3, CSA for Surry Containment Narrow Range Pressure ESFAS Trips.

5.41 Virginia Power Calculation EE-0182, Revision 2, CSA for Surry High Steam Flow in 2/3 Lines ESFAS Trip.

5.42 Virginia Power Calculation EE-0112, Revision 1 with ADD 01A, CSA for Surry RWST Level.

5.43 Virginia Power Calculation EE-0724, Revision 0, CSA for Surry Intake Canal Level.

5.44 North Anna Instrument Calibration Procedure ICP-RC-1-P-1455, Revision 8, Pressurizer Pressure Protection Channel 1, Loop P-1455.

5.45 North Anna Instrument Calibration Procedure 1-ICP-LO-PS-609-4, Revision 5, Auto Stop Oil Pressure Switch (63-4/AST) Calibration.

Attachment

Proposed Improved Technical Specifications
Response to Request for Additional Information
Section 3.3.2: Beyond Scope Issue

Updated Final Safety Analysis Report – Page 7.3-5

Virginia Electric and Power Company
(Dominion)

North Anna Power Station Units 1 and 2

3. Ranges of sensed variables to be accommodated until the conclusion of protective action is ensured—Ranges required in generating the required actuation signals for loss-of-coolant protection are:

a. Pressurizer pressure	1700 to 2500 psig
b. Containment pressure	0 to 65 psia

Ranges required in generating the required actuation signals for steam-line break protection are:

a. T_{avg}	530°F to 630°F
b. Steam-line pressure	0 to 1400 psig
c. Steam-line flow	0 to 120% maximum steam flow
d. Containment pressure	0 to 65 psia

7.3.1.3 **Implementation of Functional Design**

7.3.1.3.1 Analog Circuitry

The process analog sensors and racks for the ESF actuation system are covered in Reference 1. Discussed in this report are the parameters to be measured including pressures, flows, tank and vessel water levels, and temperatures, as well as the measurement and signal transmission considerations. These latter considerations include the basic current transmission system, transmitters, orifices and flow elements, resistance temperature detectors, and pneumatics. Other considerations covered are automatic calculations, signal conditioning, and location and mounting of the devices.

See Section 7.7.1.11 for a discussion of electrical separation between safety- and nonsafety-related portions of the process analog system.

The sensors monitoring the primary system are located as shown on the piping flow diagrams and reference drawings in Chapter 5, *Reactor Coolant System*. The secondary system sensor locations are shown on the steam system flow diagrams and reference drawings given in Chapter 10.

7.3.1.3.2 Containment Pressure

Narrow range containment pressure (0-65 psia) is sensed by four physically separated absolute pressure transmitters mounted outside the containment, connected to containment atmosphere by four independent 3/8-inch stainless steel lines. The distance from penetration to transmitter is kept to a minimum, and separation is maintained. Wide range containment pressure (0-180 psia) is sensed by two absolute pressure transmitters mounted outside the containment. Their sensing lines are tapped off the narrow range containment pressure transmitted sensing lines.