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Duane Arnold Energy Center

Current-to-Improved Technical Specifications

Setpoint Cross-Reference Document

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Table of Contents

I. Forward

I. Forward

I.1 Introduction

This document was prepared in support of the Duane Arnold Energy Center Technical Specification Improvement Project. The primary purpose of this document is to provide an overview of the basis and calculational methodology used to determine the Allowable Values in the improved standard Technical Specifications. This document also has the secondary purpose of describing the type (i.e. Nominal Setting, Allowable Value, etc.) of the setpoint values in the current custom Technical Specifications.

Supporting sections provide general descriptions of the setpoint determination process given different calculational starting points, diagrams and formulas showing the relationships between setpoint values, and descriptions of acronyms used throughout this document.

> ***Note:*** *This document was prepared assuming the reader has a working-level knowledge of GE & ISA instrument setpoint methodologies and their relation to GE BWR design and licensing bases (Refer to R.G. 1.105, ISA-S67.04 Part 1, ISA-RP67.04 Part II and NEDC-31336.)*

I.2 Setpoint Determination Methodologies

I.2.a Calculating from a Specified Analytical Limit

This is the most common and straight forward case. In this case a specific value has been selected and shown by analysis to be satisfactory for fulfilling the intended function, i.e., an Analytical Limit has been established. The setpoint methodology is then used to combine process and instrument uncertainties to determine the amount of margin required to assure the actual trip will occur at a point consistent with, or conservative with respect to, the setpoint used in the analysis. This establishes limits for the in-plant setting and criteria for determining operability.

Since this is an additive process of combining uncertainties to determine the amount of margin required, it is always conservative to calculate, make assumptions, etc., that either increase the individual uncertainty values or the cumulative uncertainty.

I.2.b Back-Calculating in the Absence of a Specified Analytical Limit

This case occurs when no specific limiting ideal value has been identified for use as an Analytical Limit (AL). Common circumstances which lead to cases where settings and limits have been selected in the absence of a specific Analytical Limit are:

- settings and limits selected to be consistent with design basis transient analysis which explicitly identify that the type of setpoint value (i.e., Allowable Value, Nominal Trip Setpoint) intended to be used is not an Analytical Limit,

- settings and limits selected on the basis of satisfactory field testing and historical performance,

- settings and limits conservatively selected to satisfy requirements imposed by law and/or industrial standards that are generally recognized as consistent with or bounded by actual design limitations,

- settings and limits selected based on engineering expertise because the specific conditions (i.e. physical limitations, wide range of acceptable values, etc.) allow appropriate selection without the need for a specifically defined AL.

These circumstances require case-by-case consideration. Considerations include determining if a detailed calculation is necessary, where to start in the calculational process, and whether calculational factors and assumptions that tend to increase or decrease uncertainties are conservative or non-conservative and their relative significance.

For Example:

Given a nominal setting which has been established based on satisfactory field testing and historical performance, it is decided that a calculation will be prepared to establish a documented basis for instrument setting limits, including operability criteria. In the absence of an analytical basis, the calculational starting point is selected as the historically acceptable nominal setting interpreted as the Nominal Trip Setpoint (NTSP) as defined in the setpoint methodology. From this NTSP, values for the AV and AL will be back-calculated based on the setpoint methodology.

Under these circumstances, smaller uncertainties will result in more restrictive values for the back-calculated AV & AL. In this case, it is clearly conservative to calculate and make assumptions that tend to minimize individual uncertainty terms. But, whether minimizing the uncertainty terms is required or even appropriate is, again, a matter that requires case-by-case consideration. Instrument and process uncertainty specifications typically provide a reasonably conservative representation of their actual performance. If the calculation is too conservative and minimizes the uncertainty terms too much, the instrument setting limits and operability criteria may be too restrictive. If this occurs, it will result in unnecessary

effort to resolve issues for equipment that may be performing completely within specifications and design requirements. While it would not be appropriate to adopt a general principle to calculate and make assumptions that would tend to increase the uncertainty terms, there are circumstances where it is more appropriate to use a strategy that provides a best estimate of the actual uncertainties rather than a conservatively small estimate. In any case, the back-calculated AL has to be evaluated qualitatively and/or quantitatively to ensure that the value is suitable for its intended function.

This is only one example of where the AL was not the calculational starting point. But, it is representative of the in-depth considerations that are necessary and have been applied for the other cases as well.

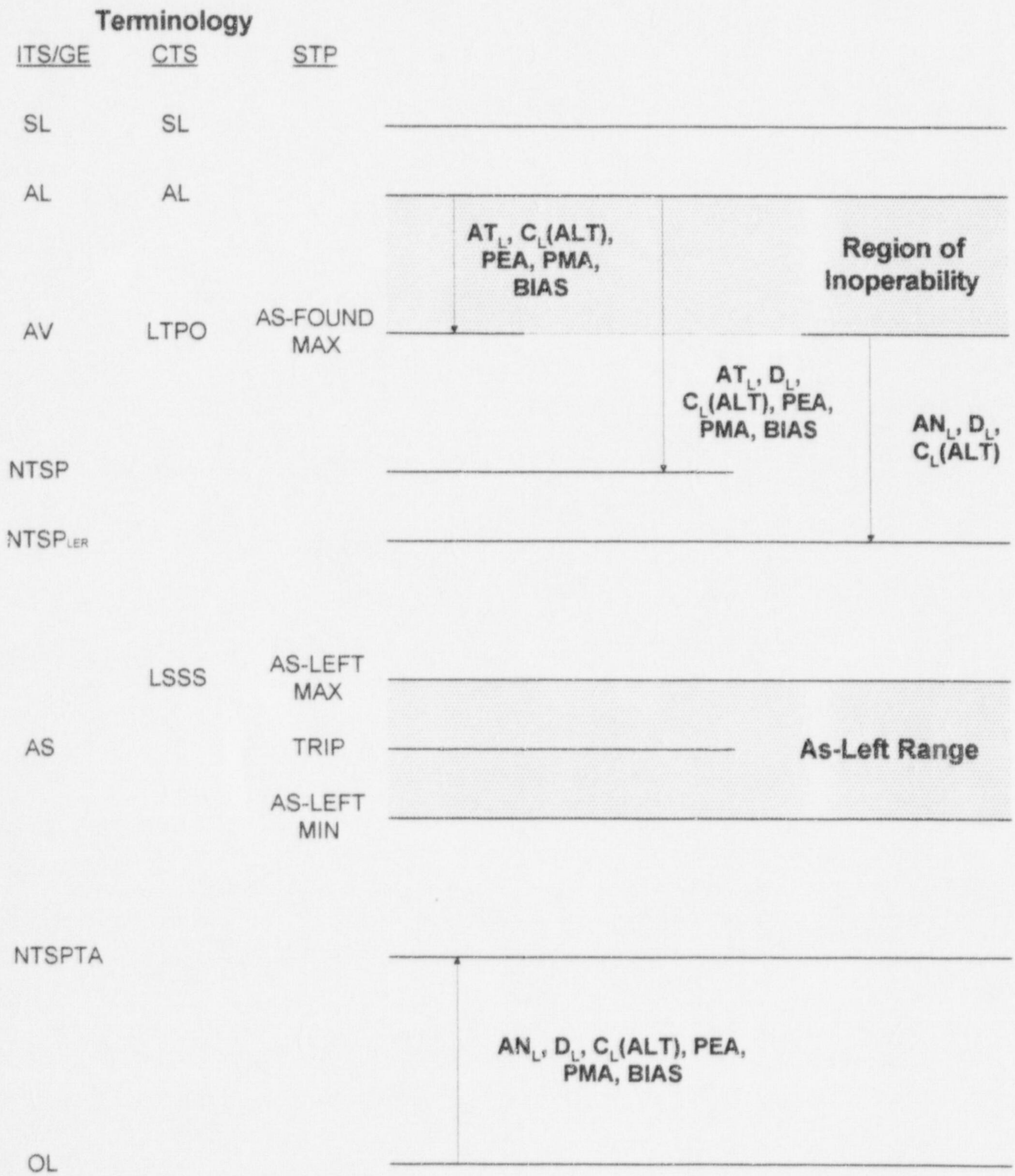
I.2.c No Calculation - Settings Established by Federal Regulation and/or Engineering Expertise

This case occurs when the settings and limits are selected based on engineering expertise and/or federal regulations because the specific conditions (e.g., physical limitations, wide range of acceptable values, etc.) allow selection without the need for a detailed mathematically rigorous analysis to demonstrate that they are acceptable. However, even in cases where a formal calculation is not prepared, the basis for selection and acceptability is still formally documented, independently reviewed and retained as an official plant record.

I.3 Setpoint Diagram, Terminology & Equations

The following diagram, terminology and equations are representative of the relationships between the various setpoint values and limits, and the associated uncertainty terms for a setpoint with an upper AL and Lower Operational Limit (OL). Also shown are the various nomenclatures used in the improved standard Technical Specifications (ITS), GE Setpoint Methodology, current custom Technical Specifications (CTS) and the DAEC surveillance test procedures (STP).

Relationship Between Variables for a Setpoint with an Upper AL and Lower OL (GE Setpoint Methodology)



Setpoint Terminology

ITS/GE Setpoint Values and Limits

SL	Safety Limit
AL	Analytical Limit
AV	Allowable Value (same as LTPO and As-Found Max)
NTSP	Nominal Trip Setpoint
$NTSP_{LER}$	Nominal Trip Setpoint - LER Avoidance
AS_{MAX}	Actual Setpoint - Maximum
AS	Actual Setpoint (same as TRIP)
AS_{MIN}	Actual Setpoint - Minimum
NTSPTA	Nominal Trip Setpoint - Trip Avoidance
OL	Operational Limit

CTS Setpoint Values and Limits

LTPO	Limiting Trip Point for Operation (same as AV and As-Found Max)
LSSS	Limiting Safety System Setting (same as As-Left Max)

STP Setpoint Values and Limits

As-Found Max	As-Found Limit - Maximum (same as AV and LTPO)
As-Left Max	As-Left Limit - Maximum (same as LSSS)
TRIP	Trip Point - Nominal (same as AS)
As-Left Min	As-Left Limit - Minimum

GE Types of Accuracy, Error and Uncertainty

A_{TL}	Loop Accuracy - Transient Conditions
A_{NL}	Loop Accuracy - Normal Conditions
C_L	Loop Calibration Accuracy
D_L	Loop Drift
PEA	Primary Element Accuracy
PMA	Process Measurement Accuracy
BIAS	Bias Effects
+AFT	As-Found Tolerance - Maximum
-AFT	As-Found Tolerance - Minimum
+ALT	As-Left Tolerance - Maximum
-ALT	As-Left Tolerance - Minimum

GE Components of Accuracy, Error and Uncertainty

PMA	**Process Measurment Accuracy**		
		IRA	Insulation Resistance Accuracy
		HDA	Head Correction Fluid Density Accuracy
		EA	Extrapolation Accuracy
PEA	**Primary Element Accuracy**		
		MTA	Mfg Tolerance Accuracy
		HEA	Head Correction Elevation Accuracy
A	**ACCURACY**		
		VAR	Vendor Accuracy - Repeatability
		VAL	Vendor Accuracy - Linearity
		VAH	Vendor Accuracy - Hysteresis
		DB	Deadband
		PSE	Power Supply Effect
		SE	Seismic Effect
		RE	Radiation Effect
		ATE	Accuracy Temperature Effect
		HE	Humidity Effect
		REE	RFI/EMI Effect
		OPE	Over Pressure Effect
		SPE	Static Pressure Effect
D	**Drift**		
		VD	Vendor Drift
		DTE	Drift Temperature Effect
C	**Calibration Accuracy**		
		Cn	Calibration Device Accuracy
		RA	Calibration Device Reading Accuracy
		CnSTD	Calibration Device Standard Accuracy
		ALT	As-Left Tolerance
		PE	Procedural Error

GE Setpoint Equations

$$A = \sqrt{VA^2 + ATE^2 + OPE^2 + SPE^2 + SE^2 + RE^2 + PSE^2 + REE^2 + \ldots} + any\ accuracy\ bias$$

$$C = N\sqrt{\left(\frac{ALT}{n}\right)^2 + \left(\frac{C}{n}\right)^2 + \left(\frac{C_{STD}}{n}\right)^2 + \ldots} + any\ calibration\ bias$$

Typically: n = 3 & N = 2

$$D = \sqrt{VD^2 + DTE^2 + \ldots} + any\ drift\ bias$$

Common assumption in abscence of vendor specification or performance data:

$$VD_{6\ months} = VA$$

$$VD_{n\ months} = VD_{m\ months}\sqrt{\frac{n}{m}}$$

$$A_L = \sqrt{A_1^2 + A_2^2 + A_3^2 + \ldots} + any\ accuracy\ bias$$

$$C_L = \sqrt{C_1^2 + C_2^2 + C_3^2 + \ldots} + any\ calibration\ bias$$

$$D_L = \sqrt{D_1^2 + D_2^2 + D_3^2 + \ldots} + any\ drift\ bias$$

$$AV = AL +/- \frac{1.645}{2}\sqrt{A_{TL}^2 + C_L^2 + PMA^2 + PEA^2} +/-BIAS$$

$$NTSP = AL +/- \frac{1.645}{2}\sqrt{A_{TL}^2 + C_L^2 + D_L^2 + PMA^2 + PEA^2} +/-BIAS$$

$$NTSP_{LER} = AV +/- \frac{Z}{2}\sqrt{A_{NL}^2 + C_L^2 + D_L^2}$$

Typically: Z = 0.81 (90% Confidence for Multi-Channel Trip Logic)
Z = 1.29 (90% Confidence for Single-Channel Trip Logic)

$$NTSPTA = OL +/- \frac{Z}{2}\sqrt{A_{NL}^2 + C_L^2 + D_L^2 + PMA^2 + PEA^2} +/-BIAS$$

Typically: Z = 1.645 (95% Confidence for Single-Channel Trip Logic)

Bridge Forward

I.4 Acronyms

ADS	Automatic Depressurization System
ALARA	As Low As Reasonably Achievable
APRM	Average Power Range Monitor
ARI	Alternate Rod Injection
ATWS	Anticipated Transient Without Scram
CRD	Control Rod Drive
CRDA	Control Rod Drop Accident
CS	Core Spray (or Containment Spray)
CSCS	Core Spray Cooling System
CST	Condensate Storage Tank
CTS	Current custom Technical Specifications
d/t	differential temperature
DAEC	Duane Arnold Energy Center
DBA	Design Basis Accident
DCP	Design Change Package
DCR	Design Change Record
ECCS	Emergency Core Cooling System
ECP	Engineering Change Package
EDG	Emergency Diesel Generator (Also Referred to as SBDG)
EHC	Electro-Hydaulic Control
EOC	End of Cycle
EOP	Emergency Operating Procedure
GE	General Electric
HPCI	High Pressure Coolant Injection
HVAC	Heating, Ventilation and Air Conditioning
IES	IES Utilities, Inc
IRM	Intermediate Range Monitor
ITS	Improved standard Technical Specifications
LLS	Low Low Set
LOCA	Loss of Coolant Accident
LOOP	Loss Of Offsite Power
LPCI	Low Pressure Coolant Injection
MCPR	Minimum Critical Power Ratio
MSIV	Main Steam Isolation Valve
MSL	Main Steam Line
NRC	Nuclear Regulatory Commission
NWL	Normal Water Level
OISD	Observed In-Service Difference
OPL3	Cyclic Transient Input Form
PCIS	Primary Containment Isolation System
RBM	Rod Block Monitor
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
RPS	Reactor Protection System
RPT	Recirculation Pump Trip

Bridge Forward

RTD	Resistive Thermal Detector
RTP	Rated Thermal Power
RWCU	Reactor Water Cleanup
RWE	Rod Withdrawal Error
RWL	Reactor Water Level
SBDG	Standby Diesel Generator (Also Referred to as EDG)
SBFU	Standby Filter Unit
SBGT	Standby Gas Treatment
SDV	Scram Discharge Volume
SFU	Standby Filter Unit
SRV	Safety Relief Valve
STP	Surveillance Test Procedure
TAF	Top of Active Fuel
TBV	Turbine Bypass Valve
TCV	Turbine Control Valve
TEC	Temperature Equalization Column
TSV	Turbine Stop Valve
UFSAR	Updated Final Safety Analysis

II. Index & Legend

ITS Location	CTS Location	Calculation	Description	CalcStartPt	CTSType
3.3.1.1-1.1.a	Table 3.1-1 Function 1.a	NG-95-0345 NG-96-1196	IRM 120/125% Full Scale - SCRAM	N/A	Nominal Setting
3.3.1.1-1.2.a	Table 3.1-1 Function 2.a	CAL-E95-011	APRM High Flux - Startup Mode SCRAM	NTSPLER	Nominal Setting
3.3.1.1-1.2.b 3.3.1.1-1.2.c	2.1.A.1 Table 3.1-1 Function 2.b	CAL-E96-034 CAL-E94-012	APRM High Flux - Fixed & Flow Biased SCRAMs APRM Fixed -SCRAM APRM Flow Biased High Flux - Two Loop SCRAM APRM Flow Biased High Flux - Single Loop SCRAM	Fixed: AL Flow Biased: NTSP	Nominal Setting
3.3.1.1-1.3 3.3.6.3-1.1	Table 3.1-1 Function 3 2.2.1.A	CAL-E93-036	Reactor High Pressure - SCRAM	AL	Nominal Setting
3.3.1.1-1.4 3.3.6.1-1.2.a 3.3.6.1-1.6.b 3.3.6.2-1.1	Table 3.1-1 Function 4 Table 3.2 - A 2.1.B	CAL-E92-010	Low Reactor Level - SCRAM, PCIS Groups 2,3,4	AL	Nominal Setting
3.3.1.1-1.5	Table 3.1-1 Function 5 2.1.E	CAL-E94-005	Main Steam Isolation Valve 10% Closed - SCRAM	AV	AV
3.3.1.1-1.6 3.3.6.1-1.2.b 3.3.6.1-1.3.d 3.3.6.1-1.4.d 3.3.6.1-1.6.c 3.3.6.2-1.2	Table 3.1-1 Function 6 Table 3.2 - A	CAL-E95-009	High Drywell Pressure - SCRAM, PCIS Groups 2,3,4,8,9	AL	Nominal Setting
3.3.1.1-1.7.a 3.3.1.1-1.7.b	Table 3.1-1 Function 7	CAL-E93-034	SDV High Water Level - SCRAM	AL	Nominal Setting
3.3.1.1-1.8 3.3.1.1-1.9 3.3.4.1.4	Table 3.1-1 Function 10 Table 3.2 - G	CAL-E93-021	Turbine First Stage Pressure SCRAM Bypass, EOC-RPT	AL	AV
3.3.1.1-1.8 3.3.4.1.2	Table 3.1-1 Function 8 Table 3.2 - G 2.1.C	CAL-E95-008	Turbine Stop Valve 10% Closed - SCRAM, EOC-RPT	AV	AV
3.3.1.1-1.9 3.3.4.1.2	Table 3.1-1 Function 9 Table 3.2 - G 2.1.D	CAL-E94-008	Turbine Control Valve Fast Closure - SCRAM, EOC-RPT	AL	AV

ITS Location	CTS Location	Calculation	Description	CalcStartPt	CTSType
3.3.2.1-1.1.a 3.3.2.1-1.1.b 3.3.2.1-1.1.c 3.3.2.1-1.1.f	Table 3.2 - C 3.2.C.2.a	NG-95-2511	RBM Power Ref. Rod Blocks	AL	Nominal Setting
3.3.4.2.2.a	Table 3.2 - G	CAL-E93-026	Low Low Reactor Level - ATWS RPT/ARI	AL	Nominal Setting
3.3.4.2.2.b	Table 3.2 - G	CAL-E92-024	Reactor Vessel High Pressure - ATWS RPT/ARI	AL	Nominal Setting
3.3.5.1-1.1.a 3.3.5.1-1.2.a 3.3.5.1-1.4.a 3.3.5.1-1.5.a 3.3.6.1-1.1.a	Table 3.2 - B 2.1.G 2.1.I Table 3.2 - A	CAL-E93-016	Low Low Low Reactor Level - Core Spray,LPCI,SBDG,ADS & PCIS Groups 1,7	AL	Nominal Setting
3.3.5.1-1.1.b 3.3.5.1-1.2.b 3.3.5.1-1.3.b	Table 3.2 - B	CAL-E95-010	High Drywell Pressure - ECCS (HPCI, LPCI, CS & SBDG)	AL	Nominal Setting
3.3.5.1-1.1.c 3.3.5.1-1.2.c	Table 3.2 - B	CAL-E93-010	Reactor Low Pressure - LPCI, CS Injection Valve Permissive	UAL & LAL	Nominal Setting
3.3.5.1-1.1.d	N/A	CAL-E96-005	Core Spray Pump Discharge Flow Low (Min Flow Bypass)	UAL & LAL	N/A
3.3.5.1-1.1.e	Table 3.2 - B	CAL-E94-014	Core Spray Pump Timer - Start CSCS on Loss of Offsite Power	AL	Nominal Setting
3.3.5.1-1.2.d	Table 3.2 - B	CAL-E95-001	Reactor Vessel Low Level 2/3 Core Coverage - Containment Spray Permissive	AL	Nominal Setting
3.3.5.1-1.2.e	Table 3.2 - B	CAL-E94-014	LPCI Pump Timer - Start LPCI on Loss of Offsite Power	AL	Nominal Setting
3.3.5.1-1.2.f	N/A	CAL-E96-003	RHR Pump Discharge Flow Low (Min Flow Bypass)	UAL & LAL	N/A
3.3.5.1-1.2.g 3.3.5.2-1.1 3.3.5.1-1.3.a 3.3.6.1-1.5.e	Table 3.2 - B Table 3.2 - A 2.1.H	CAL-E93-026	Low Low Reactor Level - HPCI, RCIC, LPCI Loop Select, PCIS Group 5	AL	Nominal Setting
3.3.5.1-1.2.h	Table 3.2 - B	CAL-E94-010 CAL-E93-018	Reactor Low Pressure - LPCI Loop Select Permissive	NTSPLER	Nominal Setting
3.3.5.1-1.2.i	Table 3.2 - B	CAL-E93-006	Reactor Recirculation Pump Differential Pressure - LPCI Loop Select Pump Running Permissive	AL	Nominal setting

ITS Location	CTS Location	Calculation	Description	CalcStartPt	CTSType
3.3.5.1-1.2.j	Table 3.2 - B	CAL-E93-011 NG-96-1196	Reactor Recirc Pump Riser Differential Pressure - LPCI Loop Select	UNTSP & LAL	Nominal Range
3.3.5.1-1.3.c 3.3.5.2-1.2	Table 3.2 - B	CAL-E93-025	High Reactor Level - HPCI & RCIC Trips	AL	Nominal Setting
3.3.5.1-1.3.d 3.3.5.2-1.3	Table 3.2 - B	CAL-E93-027	Condensate Storage Tank Low Level - HPCI & RCIC Suction Swap	AL	Nominal Setting
3.3.5.1-1.3.e	Table 3.2 - B	CAL-E93-023	High Torus Level - HPCI Suction Transfer	NTSP	Nominal Setting
3.3.5.1-1.3.f	N/A	CAL-E96-006	HPCI Pump Discharge Flow Low (Min Flow Bypass)	UAL & LNTSP	N/A
3.3.5.1-1.4.b 3.3.5.1-1.5.b	Table 3.2 - B	NG-95-2633 NG-96-1196	ADS Auto Blowdown Timer - Blowdown on Rx Low Lvl, CS & LPCI Interlock	N/A	Nominal Setting
3.3.5.1-1.4.c 3.3.5.1-1.5.c	Table 3.2 - B	CAL-E92-010	Low Reactor Level - ADS Confirmation	AL	Nominal Setting
3.3.5.1-1.4.d 3.3.5.1-1.5.d	Table 3.2 - B	CAL-E93-008	Core Spray Pump Discharge Pressure - ADS Pump Running Interlock	UAL & LAL	Nominal Setting
3.3.5.1-1.4.e 3.3.5.1-1.5.e	Table 3.2 - B	CAL-E93-007	RHR Pump Discharge Pressure - ADS Pump Running Interlock	UAL & LAL	Nominal Setting
3.3.6.1-1.1.b	Table 3.2 - A 2.1.F	CAL-E93-003	Main Steam Line Low Pressure - PCIS Group 1 (RUN Mode only, Bypassed in STARTUP Mode)	AL	Nominal Setting
3.3.6.1-1.1.c	Table 3.2 - A	CAL-E93-014	Main Steam Line High Flow Isolation - PCIS Group 1	AL	AL
3.3.6.1-1.1.d	Table 3.2 - A 2.1.J	CAL-E93-004	Loss of Main Condenser Vacuum - PCIS Group 1 (MSIV Isolation)	AL	Nominal Setting
3.3.6.1-1.1.e	Table 3.2 - A	CAL-E94-001	Steam Tunnel High Temp - PCIS Group 1	NTSPLER	Nominal Setting
3.3.6.1-1.1.f	Table 3.2 - A	CAL-E95-005	Main Steam Line High Radiation - PCIS Group 1 (Except MSIVs)	AL	Nominal Setting
3.3.6.1-1.1.g	Table 3.2 - A	CAL-E94-001	Turbine Bldg High Temp - PCIS Group 1	NTSPLER	Nominal Setting
3.3.6.1-1.2.d 3.3.6.2-1.3	Table 3.2 - A	CAL-E94-013	Reactor Bldg Area Exhaust High Radiation - PCIS Group 3, Secondary Ctmt Isolation, SBGT	AS	Nominal Setting
3.3.6.1-1.2.e 3.3.6.2-1.4	Table 3.2 - A	CAL-E94-013	Refuel Area Exhaust High Radiation - PCIS Group 3, Secondary Ctmt Isolation, SBGT	AS	Nominal Setting

ITS Location	CTS Location	Calculation	Description	CalcStartPt	CTSType
3.3.6.1-1.3.a	Table 3.2 - A	CAL-E92-004	HPCI Steam Line High Flow Isolation - PCIS Group 6B	AL	Nominal Setting
3.3.6.1-1.3.b	Table 3.2 - A	CAL-E92-023 CAL-E92-002	HPCI Steam Line Low Pressure - PCIS Group 6B	AV	AV
3.3.6.1-1.3.c	Table 3.2 - A	CAL-E94-016	HPCI Turbine Exhaust Diaphragm Pressure High - PCIS Group 6B	AL	Nominal Setting
3.3.6.1-1.3.f	Table 3.2 - A	CAL-E95-002	HPCI Steam Leak Detection System Time Delay - PCIS Group 6B	AV	Nominal Setting
3.3.6.1-1.3.h 3.3.6.1-1.4.h 3.3.6.1-1.3.e 3.3.6.1-1.4.e 3.3.6.1-1.5.b	Table 3.2 - A	CAL-E93-038	HPCI, RCIC, RWCU Suppression Pool Area High Temp HPCI Equipment Room High Temp - PCIS Group 6B RCIC Equipment Room High Temp - PCIS Group 6A Suppression Pool Area High Temp - PCIS Group 6A&B RWCU Area High Temp - PCIS Group 5	NTSPLER	Nominal Setting
3.3.6.1-1.3.i 3.3.6.1-1.4.i 3.3.6.1-1.3.g 3.3.6.1-1.4.g 3.3.6.1-1.5.c	Table 3.2 - A	CAL-E93-038	HPCI, RCIC, RWCU Supp Pool Area High Diff Temp HPCI Room Vent High Diff Temp - PCIS Group 6B RCIC Room Vent High Diff Temp - PCIS Group 6A Supp Pool Area Vent High Diff Temp - PCIS Group 6A&B RWCU Area Vent High Diff Temp - PCIS Group 5	NTSPLER	Nominal Setting
3.3.6.1-1.4.a	Table 3.2 - A	CAL-E92-005	RCIC Steam Line High Flow Isolation - PCIS Group 6A	AL	Nominal Setting
3.3.6.1-1.4.b	Table 3.2 - A	CAL-E95-018 CAL-E93-013 CAL-E92-003	RCIC Steam Line Low Pressure - PCIS Group 6A	NTSPLER	Nominal Setting
3.3.6.1-1.4.c	Table 3.2 - A	CAL-E94-006	RCIC Turbine Exhaust Diaphragm Pressure High - PCIS Group 6A	AL	Nominal Setting
3.3.6.1-1.4.f	Table 3.2 - A	CAL-E95-002	RCIC Steam Leak Detection System Time Delay - PCIS Group 6A	AV	Nominal Setting
3.3.6.1-1.5.a	Table 3.2 - A	CAL-E93-017	RWCU High Differential Flow - PCIS Group 5	AL	Nominal Setting
3.3.6.1-1.5.f	Table 3.2 - A	CAL-E92-015	RWCU Area Near TIP Room High Temp - PCIS Group 5	AL	Nominal Setting

ITS Location	CTS Location	Calculation	Description	CalcStartPt	CTSType
3.3.6.1-1.6.a	Table 3.2 - A 2.2.2	CAL-E93-024	Reactor Low Pressure - RHR Shutdown Cooling	AL	Nominal Setting
3.3.6.1-1.7.a	Table 3.2 - B	CAL-E93-012	High Drywell Pressure - Containment Spray	AL	Nominal Setting
3.3.6.3-1.2	2.2.1.C	CAL-E94-003	Relief Valve Low-Low Set Logic Low Valve - Open Low Valve - Close High Valve - Open High Valve - Close	AL	Nominal Settings & AVs
3.3.6.3-1.3	Table 3.2 - H	CAL-E96-004	Tail Pipe Pressure Switches - Arm LLS	AL	Nominal Setting
3.3.7.1.3	N/A	NG-96-1320	Control Building Air Inlet Radiation High - Control Bldg Isolation, SBFU	N/A	N/A
3.3.8.1-1.1.a	Table 3.2 - B	CAL-E93-005 NG-96-1196	4.16 KV Emergency Bus Undervoltage (Loss of Voltage) - Load Shed	NTSPLER	Nominal Setting
3.3.8.1-1.2.a 3.3.8.1-1.2.b	Table 3.2 - B	CAL-E95-006 NG-96-1196 NG-95-1432	4.16 KV Emergency Bus Degraded Voltage - Start Diesel Generator	AL	Nominal Setting
3.3.8.1-1.3	Table 3.2 - B	NG-95-1415 NG-96-1196	4.16 KV Emergency Bus Sequential Loading Relay	N/A	Nominal Setting
3.3.8.1-1.4	Table 3.2 - B	NG-95-1415 NG-96-1196	4.16 KV Emergency Transformer Supply Undervoltage - Transfer Supply Source, Start Diesel Generator	N/A	Nominal Setting
3.3.8.2.2.a 3.3.8.2.2.b 3.3.8.2.2.c	4.1.B.2.a 4.1.B.2.b 4.1.B.2.c	CAL-E92-022	RPS Power Supply EPA Setpoints - Over Voltage, Under Voltage & Under Freq	AV	AV
3.6.1.6.3	4.7.D.3	CAL-E94-015	Vacuum Breaker Reactor Bldg to Torus	AL	Nominal Setting

II. Index & Legend

Legend

Title Section:

Description:	Description of setpoint and its function.

ITS Section:

ITS:	Location reference in the improved standard Technical Specifications.
ITS AV:	Allowable Value specified in the improved standard Technical Specifications.

CTS Section:

CTS:	Location reference in the current custom Technical Specifications.
CTS Value:	Setpoint value specified in the current custom Technical Specifications.
CTSType:	Type of setpoint value specified in the current custom Technical Specifications.
CTSTypeRef:	References used in the determination of CTSType (Note: Reference to "Setpoint Reconstitution Project" represents the many design/licensing documents, correspondence and drawings reviewed during the reconstitution effort).

Calculation Section:

Calculation:	Reference document(s) describing the selected setpoint values and their bases.
CalcStartPt:	The type of setpoint value used as the calculational starting point or basis from which the other setpoint values were derived.

II. Index & Legend

CalcStartPtRef: Reference document(s) describing the CalcStartPt value and its bases.

CalcSeq: Description of the calculational sequence used to determine the setpoint values.

This document uses an abbreviated notation to depict the calculation starting point and how the calculation sequence flows from one setpoint value to the next. The following notation would be used for the case where the calculational starting point is the Analytical Limit and margin is added to determine the Allowable Value and Nominal Trip Setpoint.

AL->AV
AL->NTSP

In contrast, the case of back-calculating the Analytical Limit from the Nominal Trip Setpoint and adding margin to the back-calculated Analytical Limit to determine the Allowable Value would be depicted as

NTSP->AL
AL->AV

Note: In some cases, there may be more than one AL applicable to a setpoint. For example, some setpoints have upper and lower ALs. In these cases, the setpoint terms in the abbreviated notation may be prefixed with a "U" for upper or "L" for lower. Additional details may also be provided in the setpoint's CalcKeyNotes section.

CalcSeqRef: Reference for the methodology used to define relationships between setpoint values, identify and combine uncertainties and determine required margins, setpoint limits and operability criteria.

CalcKeyNotes: Supplemental comments provided to highlight key points and enhance overall understanding of the setpoint values and their bases.

III. Datasheets

Description: IRM 120/125% Full Scale - SCRAM

ITS: 3.3.1.1-1.1.a **ITS AV:** <125/125 (administrative)

CTS: Table 3.1-1 Function 1.a **CTS Value:** < 120/125

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR description, Historical In-plant Usage

Calculation: NG-95-0345 NG-96-1196 **CalcStartPt:** N/A **CalcStartPtRef:** See CalcKeyNotes.

CalcSeq: N/A **CalcSeqRef:** N/A

CalcKeyNotes: In Office Memo NG-95-0345 several control rod related accidents are evaluated with the following conclusion:

"Since the accident analyses considered do not require the IRM High Flux SCRAM setpoint for their basis, the setpoint does not have an analytical limit for its function. The setpoint can be assumed to be a design function that ensures the rate of change of reactor power is maintained at a controlled value during reactor startup. Also, the setpoint is a backup for the APRM trip system. Since the IRM High Flux SCRAM setpoint is an inherent design function of the system and has no analytical limit, a setpoint calculation is not required for the reconstitution fo the design basis."

Therefore, the nominal setting, consistent with historical in-plant usage and specified in the CTS, is appropriate. The ITS AV has been administratively selected based on the upper range limit of the IRM scale.

Description: APRM High Flux - Startup Mode SCRAM

ITS: 3.3.1.1-1.2.a **ITS AV:** <=16.6 %RTP

CTS: Table 3.1-1 Function 2.a **CTS Value:** <= 15% Power

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E95-011 **CalcStartPt:** NTSPLER **CalcStartPtRef:** Current Technical Specifications

CalcSeq: NTSPLER->AV
AV->AL **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: The setpoint calc back-calculates the AL from the nominal setting specified in the CTS. The calculation then determines the AL is acceptable because it is less than the 25% power Safety Limit also specified in the CTS.

Description: APRM High Flux - Fixed & Flow Biased SCRAMs

ITS: 3.3.1.1-1.2.b
3.3.1.1-1.2.c

ITS AV: Fixed:
<=121.65%

Flow Biased 2 Loop:
%Flow,%RTP
100,<=121.65
75,<=107.13
50,<=92.57
25,<=77.72
0,<=63.41

Flow Biased Single Loop:
%Flow,%RTP
100,Not Applicable
75,Not Applicable
50,<=89.06
25,<=74.38
0,<=59.91

CTS: 2.1.A.1
Table 3.1-1
Function 2.b

CTS Value: Fixed:
<=120%

Flow Biased 2 Loop:
<= (0.58 W + 62%)

Flow Biased Single Loop:
<= (0.58 W + 58.5%)

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E96-034
CAL-E94-012

CalcStartPt: Fixed: AL
Flow Biased: NTSP

CalcStartPtRef: Fixed: OPL3
Flow Biased: CTS

CalcSeq: Fixed:
AL->AV
AL->NTSP
Flow Biased:
NTSP->AL
AL->AV

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: CAL-E94-012 was the original calculation for this setpoint that used the GE Setpoint Methodology. The non-flow biased AV and NTSP were calculated from the AL given in the OPL3 transient analysis input form. It also back-calculated conservatively restrictive values for the flow biased AL and AV based on the nominal settings in the CTS.

To support a plant modification to enhance recirculation flow measurement and revise calibration uncertainties, it was decided that a new calculation (CAL-E96-034) would be issued and the existing CAL-E94-012 retained to document the basis for the flow biased ALs.

CAL-E96-034 uses the AL from OPL3 for the non-flow biased setpoint values and the conservatively restrictive ALs from CAL-E94-012 for the flow biased setpoint values. CAL-E96-034 supports the setpoints and tolerances calculated in CAL-E94-012. The GE Setpoint Methodology was used throughout.

Description: Reactor High Pressure - SCRAM

ITS: 3.3.1.1-1.3
3.3.6.3-1.1

ITS AV: <=1069.21 psig

CTS: Table 3.1-1
Function 3
2.2.1.A

CTS Value: <= 1055 PSIG

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

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Calculation: CAL-E93-036

CalcStartPt: AL

CalcStartPtRef: OPL-3

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: None.

Description: Low Reactor Level - SCRAM, PCIS Groups 2,3,4

ITS:	3.3.1.1-1.4 3.3.6.1-1.2.a 3.3.6.1-1.6.b 3.3.6.2-1.1	**ITS AV:**	>=165.6 inRWL

CTS:	Table 3.1-1 Function 4 Table 3.2 - A 2.1.B	**CTS Value:**	>= 170 inches
CTSType:	Nominal Setting	**CTSTypeRef:**	DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation:	CAL-E92-010	**CalcStartPt:**	AL	**CalcStartPtRef:**	OPL3
		CalcSeq:	AL->AV AL->NTSP	**CalcSeqRef:**	GE Setpoint Methodology

CalcKeyNotes: None

Description: Main Steam Isolation Valve 10% Closed - SCRAM

ITS: 3.3.1.1-1.5 **ITS AV:** <=10% Closed

CTS: Table 3.1-1
Function 5
2.1.E

CTS Value: <=10% Closed

CTSType: AV

CTSTypeRef: DAEC Setpoint Reconstitution Project, OPL3 Description, Historical In-plant Usage

Calculation: CAL-E94-005

CalcStartPt: AV

CalcStartPtRef: OPL3

CalcSeq: AV->AL
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: None

Description: High Drywell Pressure - SCRAM, PCIS Groups 2,3,4,8,9

ITS: 3.3.1.1-1.6
3.3.6.1-1.2.b
3.3.6.1-1.3.d
3.3.6.1-1.4.d
3.3.6.1-1.6.c
3.3.6.2-1.2

ITS AV: <=2.2 psig

CTS: Table 3.1-1
Function 6
Table 3.2 - A

CTS Value: <= 2.0 PSIG

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR description, Historical In-plant Usage, NG-95-1813, NEDC-31310-P "SAFER/GESTR"

Calculation: CAL-E95-009

CalcStartPt: AL

CalcStartPtRef: NG-95-1813
NEDC-31310-P "SAFER/GESTR"

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The AL was selected to be consistent with the AL for ECCS initiation and RPS SCRAM on High Drywell Pressure LOCA analysis. Letter NG-95-1813 gives justification for using an AL of 2.3 psig (vs. the 2.0 psig assumed in the containment LOCA analysis) by showing that the delay in scramming the reactor due to the higher AL will not significantly reduce the margin between the peak pressure in the containment and containment design pressure. The containment LOCA analysis will reflect 2.3 psig in its next revision.

Description: SDV High Water Level - SCRAM

ITS: 3.3.1.1-1.7.a
3.3.1.1-1.7.b

ITS AV: float:<=769 ft 2.88 in
RTD:<=769 ft 3.04 in

CTS: Table 3.1-1
Function 7

CTS Value: <= 60 gals

CTSType: Nominal Setting

CTSTypeRef: Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage.

Calculation: CAL-E93-034

CalcStartPt: AL

CalcStartPtRef: See CalcKeyNotes

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. Design documents show the required prescram free voume in the SCRAM Discharge Volume (SDV) system is approximately 300 gal (3.34 gal for each of 89 control rod drives). Design documents also show that the 8" header piping to the SDVs has a capacity of over 400 gal. The header piping alone was designed to accomodate all of the discharged water from the CRDs. As a result, there is adequate volume without taking any credit for the SDV volume. Based on this, the AL for SDV level was selected as the bottom edge of the header piping just above the SDV. This AL (and the resulting AVs) are above the level of the fixed position RTD type switches and above the adjustable range of the float type level switches. Therefore, the switches will fullfill their purpose as long as they are functional.

2. The setpoint calculations provides the correlation between level elevation as presented in the ITS and SDV volume as presented in the CTS.

Description: Turbine First Stage Pressure SCRAM Bypass, EOC-RPT

ITS:	3.3.1.1-1.8 3.3.1.1-1.9 3.3.4.1.4	**ITS AV:**	<=171.9 PSIG (AL=30% RTP)

CTS:	Table 3.1-1 Function 10 Table 3.2 - G	**CTS Value:**	<= 165 PSIG
CTSType:	AV	**CTSTypeRef:**	NG-84-3589

Calculation:	CAL-E93-021	**CalcStartPt:**	AL	**CalcStartPtRef:**	NG-84-3589
		CalcSeq:	AL->AV AL->NTSP	**CalcSeqRef:**	GE Setpoint Methodology

CalcKeyNotes: 1. The AL is 30% rated core thermal power per OPL3. During power uprate (1984), GE provided the turbine first stage pressure (174 psig) corresponding to this power. At the same time, GE also provided the Tech Spec Limit (165 psig) and nominal setting (145 psig). This is documented in NG-84-3589. These values have been confirmed conservative by the current setpoint calculation.

2. The CTS and UFSAR specify the AL when the setpoint is discussed in terms of % rated thermal power, and the Tech Spec Limit when the setpoint is discussed in units of psig.

Description: Turbine Stop Valve 10% Closed - SCRAM, EOC-RPT

ITS: 3.3.1.1-1.8
3.3.4.1.2

ITS AV: <=10% Closed

CTS: Table 3.1-1
Function 8
Table 3.2 - G
2.1.C

CTS Value: <=10% Closed

CTSType: AV

CTSTypeRef: DAEC Setpoint Reconstitution Project, OPL3 Description, Historical In-plant Usage

Calculation: CAL-E95-008

CalcStartPt: AV

CalcStartPtRef: OPL3

CalcSeq: AV->AL
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: None

Description: Turbine Control Valve Fast Closure - SCRAM, EOC-RPT

ITS: 3.3.1.1-1.9
3.3.4.1.2

ITS AV: >=465 psig

CTS: Table 3.1-1
Function 9
Table 3.2 - G
2.1.D

CTS Value: Within 30 msec of start of Control Valve fast closure

CTSType: AV

CTSTypeRef: DAEC Setpoint Reconstitution Project, OPL3, Historical In-plant Usage.

Calculation: CAL-E94-008

CalcStartPt: AL

CalcStartPtRef: AL determined in setpoint calculation

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The CTS states a response time requirement and the ITS states a pressure limit requirement. The following discussion explains the relationship:

PURPOSE:
The purpose of the TCV fast closure sensors (pressure switches) is to provide timely signals that are indicative of the start of fast closure of the turbine control valves. The signals are used to initiate reactor scram and to initiate the trip of the reactor recirculation pumps for a generator load rejection event.

PRESSURE SWITCH SETPOINT VS RESPONSE TIME:
The pressure switch senses the hydraulic oil pressure of the disc dump valves. The response time is composed of three parts; 1) response time of the fast acting solenoid, 2) oil pressure decay to pressure switch setpoint, and 3) response time of pressure switch. The response time of the solenoid valve and pressure switch are dependent on the performance of the devices, where as the response time for pressure decay is affected by the pressure switch set point.

SETPOINT BASIS:
Design response time data for the fast acting solenoid valve is 16 msec at 3000 psi, 12 gpm. No information is available at lower pressures or flow rates. However, if the response time vs pressure is a linear relationship, the solenoid valve response time would be approximately 8.5 msec.

Energization of the fast acting solenoid blocks the trip system oil pressure holding the disc dump valve closed and vents the disc dump valve oil pressure to the EHC drain system. This rapid pressure decay (normal EHC pressure of 1600 psig to zero) occurs within 8 to 10 msec. With a minimum pressure decay rate of 160 psi/msec, the time to decay to the switches lowest adjustable setpoint of 250 psig is less than 9 msec.

The presssure switch vendor manual does not specify a response time. However, suveillance test data indicates that actual response time is significantly less than 30 msec.

Surveillance test data that was reviewed, shows that the response time from fast acting solenoid energization to pressure switch contact change of state is less than 20 msec. Therefore, the actual overall response time performance is significantly better than required.

This combined with the fact that the switch setpoint affects only one part of the total response time, indicates that compliance with overall response time requirements is relatively insensative to the switch setting. Therefore, the setpoint is governed more by functional requirements rather than response time requirements.

BASIS FOR THE ANALYTICAL LIMIT:
When the TCV is in the full open position the emergency trip system oil pressure must decrease to 400 psig before

Description: Turbine Control Valve Fast Closure - SCRAM, EOC-RPT

the TCV will actually start fast closure. Therefore, the lower analytical limit is conservatively established at 400 psig to ensure the pressure switch trip will occur at or prior to start of TCV fast closure. (Note that even if the switch was adjusted to its lowest setpoint of 250 psig, the effect on response time would be < 1 msec.)

Description: RBM Power Ref. Rod Blocks

ITS: 3.3.2.1-1.1.a
3.3.2.1-1.1.b
3.3.2.1-1.1.c
3.3.2.1-1.1.f

ITS AV: Low Power:<=115.5/125
Interm Power:<=109.7/125
High Power:<=105.9/125
Bypass Delay:<=2.0 sec

CTS: Table 3.2 - C
3.2.C.2.a

CTS Value: <= 115/125
<= 109/125
<= 105/125
>= 94/125
<= 2.0 sec

CTSType: Nominal Setting

CTSTypeRef: NEDC-30813-P

Calculation: NG-95-2511

CalcStartPt: AL

CalcStartPtRef: NEDC-30813-P

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. The design controlled source for the AL, AV and NTSP along with their design basis is NEDC-30813-P 12/84 "Average Power Range Monitor, Rod Block Monitor and Technical Specification Improvement Program for the Duane Arnold Energy Center." The setpoints are based on the Minimum Critical Power Ratio (MCPR) derived from analysis of a statistical model of the limiting Rod Withdrawal Error (RWE). The RWE analysis, discussed in detail in NEDC-30813-P, is reanalyzed in "Supplemental Reload Licensing Report for Duane Arnold Energy Center ..." before each cycle, using the new core and fuel design, to verify that the NEDC-30813-P values are still valid.

Description: Low Low Reactor Level - ATWS RPT/ARI

ITS: 3.3.4.2.2.a **ITS AV:** >=112.65 inRWL

CTS: Table 3.2 - G **CTS Value:** >= 119.5 inches

CTSType: Nominal Setting **CTSTypeRef:** Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage.

Calculation: CAL-E93-026 **CalcStartPt:** AL **CalcStartPtRef:** OPL3

CalcSeq: AL->AV
AL-->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: None

Description: Reactor Vessel High Pressure - ATWS RPT/ARI

ITS: 3.3.4.2.2.b **ITS AV:** <=1154.2 psig

CTS: Table 3.2 - G **CTS Value:** <= 1140 PSIG

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E92-024 **CalcStartPt:** AL **CalcStartPtRef:** OPL-3

CalcSeq: AL->NTSP
AL->AV **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: None.

Description: Low Low Low Reactor Level - Core Spray,LPCI,SBDG,ADS & PCIS Groups 1,7

ITS: 3.3.5.1-1.1.a
3.3.5.1-1.2.a
3.3.5.1-1.4.a
3.3.5.1-1.5.a
3.3.6.1-1.1.a

ITS AV: >=38.3 inRWL

CTS: Table 3.2 - B
2.1.G
2.1.I
Table 3.2 - A

CTS Value: >= 18.5 inches

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-016

CalcStartPt: AL

CalcStartPtRef: See CalcKeyNotes.

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The AL defined by NEDC-31336 is Top of Active Fuel (TAF). However, this is below the lowest point where variable leg pressure change can be sensed, which is the Temperature Equalization Column (TEC) tee at 5.5 in TAF. Hence, for the purpose of this evaluation, the lowest practical AL is considered to be the elevation of the TEC tee (5.5 in TAF).

The nominal setting specified in the CTS does not include offsets due to environmental conditions during a LOCA. Actual in-plant settings include the approriate offsets for LOCA conditions.

The ITS AV includes the offsets due to LOCA conditions.

Description: High Drywell Pressure - ECCS (HPCI, LPCI, CS & SBDG)

ITS: 3.3.5.1-1.1.b
3.3.5.1-1.2.b
3.3.5.1-1.3.b

ITS AV: <=2.19 psig

CTS: Table 3.2 - B

CTS Value: <= 2.0 PSIG

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR description, Historical In-plant Usage

Calculation: CAL-E95-010

CalcStartPt: AL

CalcStartPtRef: NEDC-31310-P "SAFER/GESTR"

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: None.

Description: Reactor Low Pressure - LPCI, CS Injection Valve Permissive

ITS: 3.3.5.1-1.1.c
3.3.5.1-1.2.c

ITS AV: >=363.3 psig
<=485.1 psig

CTS: Table 3.2 - B

CTS Value: >= 450 PSIG

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-010

CalcStartPt: UAL & LAL

CalcStartPtRef: See CalcKeyNotes.

CalcSeq: UAL->UAV
UAL->UNTSP
LAL->LAV
LAL->LNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. The LAL was taken from NEDC-31310P "DAEC SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis."

2. The UAL was taken from NEDC-31336 and determined to be acceptable by Engineering in DAEC Letter NG-96-0078.

Description: Core Spray Pump Discharge Flow Low (Min Flow Bypass)

ITS: 3.3.5.1-1.1.d

ITS AV: >=256.6 gpm
<=2382.1 gpm

CTS: N/A

CTS Value:

CTSType: N/A

CTSTypeRef: Not in Current Tech Spec.

Calculation: CAL-E96-005

CalcStartPt: UAL & LAL

CalcStartPtRef: See CalcKeyNotes.

CalcSeq: UAL->UAV
UAL->UNTSP
LAL->LAV
LAL->LNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. There are an upper and lower setpoint associated with the Core Spray min flow bypass.

2. The UAL is selected such that the bypass valve will close before the Core Spray system reaches the flow rate assumed in the SAFER/GESTR LOCA analysis.

3. The LAL is considered to be the minimum flow rate at which pump damage will not occur, per letter from Bill Davidor, BW/IP International to Dean Curtland, IES dated 3/21/89.

Description: Core Spray Pump Timer - Start CSCS on Loss of Offsite Power

ITS: 3.3.5.1-1.1.e

ITS AV: >=2.6 sec
<=6.8 sec

CTS: Table 3.2 - B

CTS Value: 5 sec

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR & Tech Spec Description, Historical In-plant Usage

Calculation: CAL-E94-014

CalcStartPt: AL

CalcStartPtRef: UFSAR Description and supporting References

CalcSeq: LAL->LAV
LAL->LNTSP
UAL->UAV
UAL->UNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The Analytical Limits are based on two criteria. First, the time delay relays must distribute out the addition of large electrical loads until the essential bus voltage has recovered from the starting transient of any previous load. Second, they must support the ECCS injection time assumed in the LOCA analysis. As a result, the time delay setting has upper and lower ALs to ensure the delay is long enough between load additions, but not so long that it invalidates assumed transient analysis injection times. The UFSAR and supporting references provide the upper and lower ALs.

Description: Reactor Vessel Low Level 2/3 Core Coverage - Containment Spray Permissive

ITS: 3.3.5.1-1.2.d **ITS AV:** >= -40.89 inRWL

CTS: Table 3.2 - B **CTS Value:** >= - 39 inches

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, Historical In-plant Usage

Calculation: CAL-E95-001 **CalcStartPt:** AL **CalcStartPtRef:** See CalcKeyNotes.

CalcSeq: AL->AV
AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: The AL is considered to be the top of the jet pump inlet, which is at approximatly 2/3 core height. This AL is acceptable because, per the UFSAR, there is no recirulation line break that can prevent reflooding the vessel to the jet pump inlet.

Description: LPCI Pump Timer - Start LPCI on Loss of Offsite Power

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ITS: 3.3.5.1-1.2.e

ITS AV: RHR A&B:
>=8.8 sec
<=11.2 sec
RHR C&D:
>=13.8 sec
<=33.5 sec

CTS: Table 3.2 - B

CTS Value: 10 sec (A&B)
15 sec (C&D)

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR & Tech Spec Description, Historical In-plant Usage

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Calculation: CAL-E94-014

CalcStartPt: AL

CalcStartPtRef: UFSAR Description and supporting References

CalcSeq: LAL->LAV
LAL->LNTSP
UAL->UAV
UAL->UNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The Analytical Limits are based on two criteria. First, the time delay relays must distribute out the addition of large electrical loads until the essential bus voltage has recovered from the starting transient of any previous load. Second, they must support the ECCS injection time assumed in the LOCA analysis. As a result, the time delay setting has upper and lower ALs to ensure the delay is long enough between load additions, but not so long that it invalidates assumed transient analysis injection times. The UFSAR and supporting references provide the upper and lower ALs.

Description: RHR Pump Discharge Flow Low (Min Flow Bypass)

ITS: 3.3.5.1-1.2.f

ITS AV: >=471.8 gpm
<=3770.2 gpm

CTS: N/A

CTS Value:

CTSType: N/A

CTSTypeRef: Not in current Tech Spec.

Calculation: CAL-E96-003

CalcStartPt: UAL & LAL

CalcStartPtRef: See CalcKeyNotes.

CalcSeq: UAL->UAV
UAL->UNTSP
LAL->LAV
LAL->LNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. The UAL is selected such that the bypass valve will close before the LPCI system reaches the flow rate assumed in the SAFER/GESTR LOCA analysis.

2. The LAL is conservatively selected as twice the minimum flow rate at which pump damage will not occur.

Description: Low Low Reactor Level - HPCI, RCIC, LPCI Loop Select, PCIS Group 5

ITS: 3.3.5.1-1.2.g
3.3.5.2-1.1
3.3.5.1-1.3.a
3.3.6.1-1.5.e

ITS AV: >=112.65 inRWL

CTS: Table 3.2 - B
Table 3.2 - A
2.1.H

CTS Value: >= 119.5 inches

CTSType: Nominal Setting

CTSTypeRef: Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage.

Calculation: CAL-E93-026

CalcStartPt: AL

CalcStartPtRef: OPL3

CalcSeq: AL->AV
AL-->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. PCIS Group 5 moved from Low Level to Low-Low Level per Engineering Change Package (ECP) 1562. Reactor level is a backup isolation signal to RWCU isolation provided by steam leak detection temperature, differential temperature isolations. This change is reflected in Tech Spec Amendment 217.

Description: Reactor Low Pressure - LPCI Loop Select Permissive

ITS: 3.3.5.1-1.2.h **ITS AV:** >=887PSIG

CTS: Table 3.2 - B **CTS Value:** >=900 PSIG

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E94-010
CAL-E93-018 **CalcStartPt:** NTSPLER **CalcStartPtRef:** CTS

CalcSeq: NTSPLER->AV
AV->AL **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. Per NEDO-10139, the nominal setting is selected to allow the transient to stabilize before initiating the LPCI-LOOP select logic, without delaying the loop selection logic unnecessarily.

Description: Reactor Recirculation Pump Differential Pressure - LPCI Loop Select Pump Running Permissive

ITS: 3.3.5.1-1.2.i **ITS AV:** <=7.8 psid

CTS: Table 3.2 - B **CTS Value:** <= 2 PSID

CTSType: Nominal setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-006 **CalcStartPt:** AL **CalcStartPtRef:** AL determined in setpoint calculation.

CalcSeq: AL->NTSP
AL->AV **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: The nominal setting for the Reactor Recirculation Pump d/p is 2.0 psid. However, during single loop operation back-flow through the idle pump can cause the d/p across the idle pump to reach 4.0 psid. The CTS value does not reflect this offset. In-plant settings include allowances for this offset. The d/p across the idle pump was determined from data in "Evaluation of Deviation Report 90-306" and includes errors due to variations in the density of the water. Therefore, a 4.0 psi offset has been established for head and flow correction for both two loop and single loop operation. The ITS AV includes allowances for the offset due to back-flow.

Description: Reactor Recirc Pump Riser Differential Pressure - LPCI Loop Select

ITS: 3.3.5.1-1.2.j

ITS AV: >=0.5 psid
<=2.0 psid

CTS: Table 3.2 - B

CTS Value: 0.5< P< 1.5 PSID

CTSType: Nominal Range

CTSTypeRef: Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage.

Calculation: CAL-E93-011
NG-96-1196

CalcStartPt: UNTSP & LAL

CalcStartPtRef: See CalcKeyNotes

CalcSeq: UNTSP->UAL
UAL->UAV
LAL->LAV
LAL->LNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The first version of calculation CAL-E93-011 (prepared by GE) states that there are no safety analysis values or operating data available upon which to base the setpoint limits. Historically, the original nominal setpoint was selected based on engineering judgment that 1 psid was the smallest reasonably detectable difference between recirculation riser pressures. GE used this basis and other expected uncertainties in the first version of the calculation to back calculate an AL (2.2 psid) on the high side and an OL (0.0 psid) on the low side. Since then, the DAEC has made the conservative decision to treat both the upper and lower limits as ALs to better support the Technical Specifications which specify both upper and lower limits for operability. While this decision does not have any effect on the upper AL, it requires additional margin between the lower AL and the corresponding AV, NTSP.

The purpose of the limit on the low side is to ensure the setpoint is not lowered so far that the switch can not reset. When the lower limit is treated as an OL, there is adequate margin to support the 1 psid setpoint and assure reset within the 0-10 psid range of the switch. But, when the lower limit is treated as an AL, more than 1 psi of margin is required to support the existing 1 psi setting. Therefore, the nominal setting must be increased or the AL must be less than 0 psid. (i.e. the reset must be able to occur below the 0 psid). For this case, the AL was selected to be less than 0 psid. This is acceptable because, the process will in fact create a reverse differential pressure (i.e. create a negative differential pressure) if the break is in the opposite loop and the switch is also still functional at 5%-10% FS below its specified range per the switch vendor's installation and operations manaul. Therefore, the lower AL was established at 0-(0.05)(10) = -0.5 psid and switch deadband was added as a bias in the calculations for the lower AV and NTSP.

Description: High Reactor Level - HPCI & RCIC Trips

ITS: 3.3.5.1-1.3.c
3.3.5.2-1.2

ITS AV: <=214.8 inRWL

CTS: Table 3.2 - B

CTS Value: <= 211 inches

CTSType: Nominal Setting

CTSTypeRef: Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage.

Calculation: CAL-E93-025

CalcStartPt: AL

CalcStartPtRef: BECH-JC-L100A

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. AL corresponds to level of instruments upper tap elevation.

Description: Condensate Storage Tank Low Level - HPCI & RCIC Suction Swap

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ITS: 3.3.5.1-1.3.d
3.3.5.2-1.3

ITS AV: >=11.6 inBOT

CTS: Table 3.2 - B

CTS Value: >= 12 inches

CTSType: Nominal Setting

CTSTypeRef: Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage.

Calculation: CAL-E93-027

CalcStartPt: AL

CalcStartPtRef: AL determined in setpoint calculation

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. The AL is the minimum level at which vortexing will not occur at the pump suction from the tank. The setpoint calculation performs the vortexing analysis to determine the limiting level.

2. The level sensors are electrode type suspended from the top of the CST. The mechnical nature of these devices does not permit drift in the non-conservative direction.

Description: High Torus Level - HPCI Suction Transfer

ITS:	3.3.5.1-1.3.e	**ITS AV:**	<=5.9 inNWL
CTS:	Table 3.2 - B	**CTS Value:**	<= 5 inches (above normal torus level)
CTSType:	Nominal Setting	**CTSTypeRef:**	DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation:	CAL-E93-023	**CalcStartPt:**	NTSP	**CalcStartPtRef:**	CTS
		CalcSeq:	NTSP->AL AL->AV	**CalcSeqRef:**	GE Setpoint Methodology

CalcKeyNotes: The NTSP was selected to accommodate considerations pertaining to both the minimum water volume needed for HPCI operation and minimum freespace air volume needed for acceptable containment loading. At the AL determined in the calculation, the minimum required free airspace in Torus is still met.

Description: HPCI Pump Discharge Flow Low (Min Flow Bypass)

ITS: 3.3.5.1-1.3.f **ITS AV:** >=264.2 gpm
<=2025.1 gpm

CTS: N/A **CTS Value:**

CTSType: N/A **CTSTypeRef:** Not in Current Tech Spec.

Calculation: CAL-E96-006 **CalcStartPt:** UAL & LNTSP **CalcStartPtRef:** See CalcKeyNotes.

CalcSeq: UAL->AV
UAL->NTSP
LNTSP->LAL
LAL->LAV

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. There are an upper and lower setpoint associated with the Core Spray min flow bypass.

2. The UAL is selected such that the bypass valve will close before the HPCI system reaches the flow rate assumed in the SAFER/GESTR LOCA analysis.

3. In the absence of an analytical limit for the lower flow setpoint, the historical value of the setpoint was considered the NTSP with an analytical limit being back-calculated from this value. Since operational experience has shown that this setpoint does not result in damage to the HPCI pump, this back-calculated AL is acceptable. In addition, quarterly trending of pump operation will detect any pump degradation further ensuring the acceptability of the setpoint.

Description: ADS Auto Blowdown Timer - Blowdown on Rx Low Lvl, CS & LPCI Interlock

ITS: 3.3.5.1-1.4.b
3.3.5.1-1.5.b

ITS AV: <=125 sec
(administrative)

CTS: Table 3.2 - B

CTS Value: 120 sec

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR & Tech Spec & NEDO-10139 Description, Historical In-plant Usage

Calculation: NG-95-2633
NG-96-1196

CalcStartPt: N/A

CalcStartPtRef: See CalcKeyNotes

CalcSeq: N/A

CalcSeqRef: N/A

CalcKeyNotes: This summarizes the basis for the ADS timer settings and why a formal setpoint calculation is not required to establish appropriate setpoints and tolerances.

The purpose of the Automatic Depressurization System (ADS) is to provide automatic depressurization of the reactor vessel following a small break loss-of-coolant-accident (LOCA) when the High Pressure Coolant Injection system (HPCI) is not available. A nominal 120 second time delay is provided to allow operators time to reset the ADS timer if depressurization of the reactor vessel is not necessary to avoid core damage.

The UFSAR states that the ADS time delay provides operators time to inhibit actuation of ADS, but does not mention any basis for the 120 second nominal setting. This suggests that the setting is an operational setting.

However, the DAEC LOCA analysis show that some small breaks will cause vessel level to decrease but not depressurize the vessel. If HPCI is not available and a small break of this nature occurs, ADS is necessary to depressurize the vessel to the LPCI injection point. Two breaks in this range are analyzed in the LOCA Analysis. In both cases HPCI is assume to fail, and water level drops below top of active fuel. Vessel level, in both cases, does not recover until ADS actuates and pressure drops below the LPCI injection point. The LOCA analysis uses a 125 second time delay setting for these analysis, but notes that the results of both cases are well within the bounds of the limiting DBA-LOCA. This shows that a 125 second time delay setting is acceptable, with margin.

NEDO-10139, 6/70, "Compliance of Protection System to Industry Criteria: General Electric BWR Nuclear Steam Supply System" states that the accuracy requirements for the ADS initiation signals are not such that precision of measurement is required. Although this is stated with respect to the initiation signals, it also indicates that the accuracy of the timer does not require a precision measurement either. NEDO-10139 suggests a timer setting of 120 second +/-10% (12 seconds). NEDO-10139 also says that the timer should be set long enough to give HPCI time to recover and maintain level but not so long that LPCI cannot prevent core damage. Per the UFSAR, HPCI will reach rated speed with injection valves fully open within a maximum of 30 seconds after the initiation signal. HPCI initiation will occur before the ADS timer is initiated leaving at least 90 seconds to determine if HPCI is recovering level. The time delay settings in the DAEC LOCA analysis, currrent Technical Specifications and Surveillance Test Procedures are well within the range recommended in NEDO-10139 and appropriate to fulfill this funcitonal criteria.

Per Operating Procedures, lockout of ADS may be performed if specifically directed by the Emergency Operating Procedures (EOP). The EOPs direct that ADS be reset early in an event and therefore do not allow automatic initiation of ADS. If depressurization of the reactor vessel is necessary, Operators do not wait for the ADS timers to time out. They open the SRVs manually. Thus, the setting is irrelevant provided it allows operators time to reset ADS.

Based on this information, it was determined that a precise time delay setting was not necessary and the CTS nominal setpoint of 120 seconds and the STP As-Found setting of 120+/-5 seconds and As-Left settings of 120+/-3 seconds were adequate to fulfill their function. Therefore, a design basis setpoint calculation was not necessary.

Description: Low Reactor Level - ADS Confirmation

ITS:	3.3.5.1-1.4.c 3.3.5.1-1.5.c	**ITS AV:**	>=166.1 inRWL

CTS:	Table 3.2 - B	**CTS Value:**	>= 170 inches
CTSType:	Nominal Setting	**CTSTypeRef:**	DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation:	CAL-E92-010	**CalcStartPt:**	AL	**CalcStartPtRef:**	OPL3
		CalcSeq:	AL->AV AL->NTSP	**CalcSeqRef:**	GE Setpoint Methodology
CalcKeyNotes:	None				

Description: Core Spray Pump Discharge Pressure - ADS Pump Running Interlock

ITS: 3.3.5.1-1.4.d
3.3.5.1-1.5.d

ITS AV: >=114.2 psig
<=177.0 psig

CTS: Table 3.2 - B

CTS Value: 145 PSIG

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-008

CalcStartPt: UAL & LAL

CalcStartPtRef: NEDC-31336

CalcSeq: UAL->UAV
UAL->UNTSP
LAL->LAV
LAL->LNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. The LAL is selected to be above the static water head pressure at the pump discharge piping when the pump is idle, to prevent inadvertant pump running indication. The CS keep-fill system ensures that the discharge piping is kept full of water to prevent water hammer when the pump starts. Per CAL-E91-005 the static head in the RHR discharge piping is 35.5 psig. This is well below the LAL specified in NEDC-31336.

2. The UAL is chosen such that it is below the CS pump discharge pressure in minimum flow bypass mode. Per the process diagram the flow rate in min flow bypass mode is 312 gpm. On the CS pump curves this corresponds to a differential pressure across the pump of ~380 psi. Even with suction pressure at atmospheric pressure, the pressure in the discharge piping will be 380 psi. This is well above the UAL specified in NEDC-31336.

Description: RHR Pump Discharge Pressure - ADS Pump Running Interlock

ITS: 3.3.5.1-1.4.e
3.3.5.1-1.5.e

ITS AV: >=103.8 psig
<=147.0 psig

CTS: Table 3.2 - B

CTS Value: 125 PSIG

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-007

CalcStartPt: UAL & LAL

CalcStartPtRef: NEDC-31336

CalcSeq: UAL->UAV
UAL->UNTSP
LAL->LAV
LAL->LNTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. The LAL is selected to be above the static water head pressure at the pump discharge piping when the pump is idle, to prevent inadvertant pump running indication. The RHR keep-fill system ensures that the discharge piping is kept full of water to prevent water hammer when the pump starts. Per CAL-E91-004 the static head in the RHR discharge piping is 29 psig. This is well below the LAL specified in NEDC-31336.

2. The UAL is chosen such that it is below the RHR pump discharge pressure in minimum flow bypass mode. Per the process diagram the flow rate in min flow bypass mode is 250 gpm. On the RHR pump curves this corresponds to a differential pressure across the pump of ~250 psi. Even with suction pressure at atmospheric pressure, the pressure in the discharge piping will be 250 psi. This is well above the UAL specified in NEDC-31336.

Description: Main Steam Line Low Pressure - PCIS Group 1 (RUN Mode only, Bypassed in STARTUP Mode)

ITS: 3.3.6.1-1.1.b **ITS AV:** >=821 psig

CTS: Table 3.2 - A 2.1.F **CTS Value:** >= 850 PSIG

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-003 **CalcStartPt:** AL **CalcStartPtRef:** OPL3

CalcSeq: AL->AV AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: None

Description: Main Steam Line High Flow Isolation - PCIS Group 1

ITS: 3.3.6.1-1.1.c **ITS AV:** <=138 % Rated

CTS: Table 3.2 - A **CTS Value:** <= 140% Rated

CTSType: AL **CTSTypeRef:** Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage.

Calculation: CAL-E93-014 **CalcStartPt:** AL **CalcStartPtRef:** OPL3, CAL-E94-007

CalcSeq: AL->AV
AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. GE performed the setpoint calculation using 140% of rated flow (127.8 psid) as defined in the OPL3 and translating from flow (lb/hr) to differential pressure (psid) using equations from GE SIL-438. This AL was reconfirmed by IES calculation CAL-E94-007.

2. The interpretation of the CTS value of 140% of rated flow (127.8 psid) as an AL, is consistent with the UFSAR description which references a nominal differential pressure setting of 120 psid. The ITS specification of <=138% of rated flow (125 psid) is consistent with both the CTS and UFSAR.

Description: Loss of Main Condenser Vacuum - PCIS Group 1 (MSIV Isolation)

ITS: 3.3.6.1-1.1.d **ITS AV:** >=7.2 inHg vac

CTS: Table 3.2 - A 2.1.J **CTS Value:** <= 20 in Hg abs (>= 10 in Hg vac)

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, TS and OPL3 Description, Historical In-plant Usage

Calculation: CAL-E93-004 **CalcStartPt:** AL **CalcStartPtRef:** DAEC Setpoint Reconstitution Project, OPL3 Desc.

CalcSeq: AL->AV AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. The setpoint calculation and ITS AV units are inHg vacuum. The CTS nominal setting is specificed in units of inHg absolute (i.e. 20 inHg abs is approximately 10 inHg vacuum).

2. Condenser over-pressure protection during a Loss of Condenser Vacuum event is provided by the anticipatory isolations of the MSIVs and/or the Turbine Bypass Valves (TBV). Three critical considerations for this analysis are the pressure at which the isolations are initiated, the valve stroke time and the rate of pressure increase in the condenser. The AL for the initiating MSIV closure is 7.0 inHg vacuum. This is also the nominal setting for TBV isolation. However, the switches that initiate TBV isolation are non-safety related and not credited in the analysis. The MSIVs have a stroke time of 3-5 sec required by Tech Specs. For condenser over-pressure protection, the rate at which condenser pressure is increasing is a maximum of 24 inHg/min (0.4 inHg/sec) due to a loss of one or more circulating water pumps. (A hole in the condensor could cause a more rapid rate of vacuum loss ~120 inHg/min. But, this rate is not used since a hole would be helpful from the perspective of condensor over pressure protection.) With MSIV closure initiated at an AL of 7.0 inHg vacuum, a maximum 5 sec MSIV stroke time, and a maximum 0.4 inHg/sec rate of pressure increase, the condensor pressure could reach a maximum of 5 inHg vacuum. Since this is well below atmospheric pressure, the AL is acceptable.

Description: Steam Tunnel High Temp - PCIS Group 1

ITS: 3.3.6.1-1.1.e **ITS AV:** <=205.1 °F

CTS: Table 3.2 - A **CTS Value:** <= 200°F

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E94-001 **CalcStartPt:** NTSPLER **CalcStartPtRef:** Technical Specifications

CalcSeq: NTSPLER->AV
AV->AL **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. Research of design and licensing documents indicates that the original analytical basis for this setpoint was to detect a 8 - 10 gpm leak. The equipment settings were selected to be low enough to be sensative to such a break but high enough to prevent spurious trips. The current equipment settings are consistent with the original settings at the time of plant startup. DAEC Engineering has acquired a thermal hydraulic analysis code and plans to confirm acceptability of the setpoints when the code package is qualified for use.

2. For purposes of operability determinations and use as an AV in the ITS, uncertainties used for back-calculating the AV and AL were rounded down to produce conservatively restrictive values.

3. DAEC Engineering is investigating options for confirming the back calculated AL.

4. These instruments are montitored by the DAEC Instrument Trending Program to confirm actual in-plant performance is consistent with design expectations.

Description: Main Steam Line High Radiation - PCIS Group 1 (Except MSIVs)

ITS: 3.3.6.1-1.1.f **ITS AV:** <=5530 mrem/hr

CTS: Table 3.2 - A **CTS Value:** <= 3 x Normal Rated Power Background

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR & Tech Spec Description, Historical In-plant Usage

Calculation: CAL-E95-005 **CalcStartPt:** AL **CalcStartPtRef:** Radiation Chemistry Calculation 94-14A.

CalcSeq: AL->AV
AL->NTSP
AS=3 x Normal **CalcSeqRef:** GE Setpoint Methodology, 3 x Normal Tech Spec Requirement

CalcKeyNotes: The following is a chronological summary of the setpoints design and licensing basis spanning from original plant startup to present:

ORIGINAL DESIGN (1973):
Function of MSL Hi Rad is to detect increased radiation levels and initiate automatic actions in the event of a gross fuel failure (i.e. Control Rod Drop Accident - CRDA). MSL Hi Rad gives a direct RPS SCRAM and a full PCIS Group I (MSIV closure also produces another SCRAM at 10% closed position.). Because, setpoint is not used in accident or transient analysis, there is no basis for an Analytical Limit or Allowable value. MSL Hi Rad trip setpoint arbitrarily selected as 3xnormal to provide reasonable sensitivity without undo risk of spurious trip. DAEC Tech. Specs. specify a nominal setting of 3xnormal at rated power.

TECH SPEC SELECTION CRITERIA (NEDO 31466):
MSL Hi Rad is not taken credit for in any accident or transient events and does not meet any criteria and is identified as a candidate for removal from Tech Specs. However, it was decided to retain in Tech Specs. as an enhancement to RPS reliability.

ELIMINATION of MSL Hi Rad RPS SCRAM and MSIV ISOLATION (1987-PRESENT, NEDO-31400, DCP-1523):
SCRAM and MSIV Isolation functions removed because they were not required for mitigation or necessary to ensure compliance with 10CFR100 release limits. In fact, removal improved overall plant safety. MSL Hi Rad function now is only to isolate sample and drain lines. Elimination of the SCRAM and isolation functions essentially removes the original reason the setpoint was retained in Tech. Specs - "to enhance RPS reliability." However, it is still retained in Tech Specs because it also provides additional assurance that there is no unfiltered release paths in the event of a gross fuel failure. (Note: "additional assurance" is used because of other monitoring instrumentation that would also initiate immediate isolations and/or corrective actions if there were any significant change in radiation levels - offgas post treatment monitor, offgas pretreatment monitor, offgas stack monitor, etc.)

BASIS FOR SETPOINT (1994 - PRESENT, Rad. Chemistry Calc 94-014A, CAL-E95-005):
Radiological calculation was performed to determine rad level at MSL Rad Monitors during postulated CRDA described in the UFSAR. AL is based on this calc which determined the dose rate at MSL Rad Monitors to be 6000 mR/hr. Allowable Value based on necessity to perform safety function of detecting gross fuel failure (i.e. CRDA) and isolating test and sample lines. Nominal setpoint based on arbitrary regulatory requirement of 3xnormal and spurious trip avoidance. However, setpoint calculation results show that the safety function will be fulfilled with a Nominal Trip Setpoint as high as 5000 mR/hr and Allowable Value as high as 5500 mR/hr. The limits for the actual field settings were based on estimated normal MSL radiation levels. The estimated radiation levels were based on GE test results which correlated nominal MSL radiation levels to various hydrogen injection rates. The upper limits for the actual field settings are selected to not exceed 3 times the normal radiation level. Setpoint calculation results show that there is 300% to 10000% of margin between the upper limit of the actual field setting and Allowable Value.

Description: Turbine Bldg High Temp - PCIS Group 1

ITS: 3.3.6.1-1.1.g **ITS AV:** <=205.1 °F

CTS: Table 3.2 - A **CTS Value:** <= 200°F

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E94-001 **CalcStartPt:** NTSPLER **CalcStartPtRef:** Technical Specifications

CalcSeq: NTSPLER->AV
AV->AL **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. Research of design and licensing documents indicates that the original analytical basis for this setpoint was to detect a 8 - 10 gpm leak. The equipment settings were selected to be low enough to be sensative to such a break but high enough to prevent spurious trips. The current equipment settings are consistent with the original settings at the time of plant startup. DAEC Engineering has acquired a thermal hydraulic analysis code and plans to confirm acceptability of the setpoints when the code package is qualified for use.

2. For purposes of operability determinations and use as an AV in the ITS, uncertainties used for back-calculating the AV and AL were rounded down to produce conservatively restrictive values.

3. DAEC Engineering is investigating options for confirming the back calculated AL.

4. These instruments are montitored by the DAEC Instrument Trending Program to confirm actual in-plant performance is consistent with design expectations.

Description: Reactor Bldg Area Exhaust High Radiation - PCIS Group 3, Secondary Ctmt Isolation, SBGT

ITS: 3.3.6.1-1.2.d
3.3.6.2-1.3

ITS AV: <=12.8 mrem/hr

CTS: Table 3.2 - A

CTS Value: <= 11 mR/HR

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, Historical In-plant Usage, Letter DAEC-1761 GE to IE

Calculation: CAL-E94-013

CalcStartPt: AS

CalcStartPtRef: CTS

CalcSeq: AS->NTSPLER
NTSPLER->AV
AV->AL

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: 1. The AL is back-calculated from the AS setpoint presented in the CTS.

2. The AL was evaluated within the calculation and judged to be acceptable. Acceptance of the AL is based on the following: The function of these monitors is to detect and limit the consequences of abnormal operating conditions governed by 10CFR100.11. However, the dose limits actually used to determine the setpoint for protecting the public is conservatively based on the normal release limits specified in 10CFR20, which are much more restrictive than 10CFR100.11. Therefore, back-calculating an AL from the CTS nominal setting is conservative.

Description: Refuel Area Exhaust High Radiation - PCIS Group 3, Secondary Ctmt Isolation, SBGT

ITS:	3.3.6.1-1.2.e 3.3.6.2-1.4	**ITS AV:**	<=10.6 mrem/hr

CTS:	Table 3.2 - A	**CTS Value:**	<= 9 mR/HR
CTSType:	Nominal Setting	**CTSTypeRef:**	DAEC Setpoint Reconstitution Project, Historical In-plant Usage, Letter DAEC-1761 GE to IE

Calculation:	CAL-E94-013	**CalcStartPt:**	AS	**CalcStartPtRef:**	CTS
		CalcSeq:	AS->NTSPLER NTSPLER->AV AV->AL	**CalcSeqRef:**	GE Setpoint Methodology

CalcKeyNotes: 1. The AL is back-calculated from the AS setpoint presented in the CTS.

2. The AL was evaluated within the calculation and judged to be acceptable. Acceptance of the AL is based on the following: The function of these monitors is to detect and limit the consequences of abnormal operating conditions governed by 10CFR100.11. However, the dose limits actually used to determine the setpoint for protecting the public is conservatively based on the normal release limits specified in 10CFR20, which are much more restrictive than 10CFR100.11. Therefore, back-calculating an AL from the CTS nominal setting is conservative.

Description: HPCI Steam Line High Flow Isolation - PCIS Group 6B

ITS: 3.3.6.1-1.3.a **ITS AV:** <=409 inH2O (inbrd)
<=110 inH2O (outbrd)

CTS: Table 3.2 - A **CTS Value:** <= 386 inH2O (inbrd)
<= 103 inH2O

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E92-004 **CalcStartPt:** AL **CalcStartPtRef:** CAL-E92-002 rev. 1

CalcSeq: AL->NTSP
AL->AV **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: None.

Description: HPCI Steam Line Low Pressure - PCIS Group 6B

ITS: 3.3.6.1-1.3.b **ITS AV:** >=50.0 psig

CTS: Table 3.2 - A **CTS Value:** 50 < P < 100 PSIG

CTSType: AV **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E92-023 CAL-E92-002 **CalcStartPt:** AV **CalcStartPtRef:** CTS

CalcSeq: AV->AL AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. The AL is back-calculated from the AV which is assumed to be the 50 psig lower end of the required trip level setting per Tech Specs. The AV is deemed acceptable based on past plant operating experience.

Description: HPCI Turbine Exhaust Diaphragm Pressure High - PCIS Group 6B

ITS: 3.3.6.1-1.3.c **ITS AV:** >=2.5 psig

CTS: Table 3.2 - A **CTS Value:** <= 10 PSIG

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, Historical In-plant Usage.

Calculation: CAL-E94-016 **CalcStartPt:** AL **CalcStartPtRef:** AL determined in setpoint calculation

CalcSeq: AL->AV
AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. The purpose of the setpoint is to trip HPCI upon detection of a failing inner diaphragm thereby reducing the potential for a failure in the outer diaphragm and a steam release to the HPCI room. However, this function is for equipment protection. The safety function of the setpoint is to NOT inadvertantly trip and make HPCI unavailable. The "<" preferred direction of the setpoint specified in the CTS reflects the operational desire to keep the setpoint below normal HPCI exhaust pressure. The ">" for the ITS AV reflects a minimum allowable setting to ensure that the switches do not inadvertantly trip and make HPCI unavailable.

2. As an interim solution to address both the CTS and safety function requirements, upper and lower AVs (i.e. As-Found limits) have been established in the surveillance test procedures with the intent to remove the upper As-Found limit after ITS is approved. The surveillance test procedures currently have and will continue to have both upper and lower As-Left limits.

Description: HPCI Steam Leak Detection System Time Delay - PCIS Group 6B

ITS: 3.3.6.1-1.3.f

ITS AV: 15 min nominal

CTS: Table 3.2 - A

CTS Value: <=15 min

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E95-002

CalcStartPt: AV

CalcStartPtRef: CTS & Historical In-plant usage.

CalcSeq: AV->AL
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The AL is back-calculated from the AV. The AV was considered the the AS-Found value in the surveillance test procedure. The AL is evaluated in calculation CAL-E93-038 and found to be acceptable.

Description: HPCI, RCIC, RWCU Suppression Pool Area High Temp

ITS:	3.3.6.1-1.3.h 3.3.6.1-1.4.h 3.3.6.1-1.3.e 3.3.6.1-1.4.e 3.3.6.1-1.5.b	**ITS AV:**	<=178.3 °F (HPCI/RCIC) <=153.3 °F (Supp. Pool) <=133.3 °F (RWCU)
CTS:	Table 3.2 - A	**CTS Value:**	<= 175 °F (HPCI/RCIC) <= 150 °F (Supp. Pool) <= 130 °F (RWCU)
CTSType:	Nominal Setting	**CTSTypeRef:**	DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation:	CAL-E93-038	**CalcStartPt:**	NTSPLER	**CalcStartPtRef:**	CTS
		CalcSeq:	NTSPLER->AV AV->AL	**CalcSeqRef:**	GE Setpoint Methodology

CalcKeyNotes: 1. The AL is back calculated from the nominal setting presented in the Technical Specifications and the UFSAR. To validate the AL a room heat-up calculation was done to show that the coolant lost from a steam leak is less than that from a Main Steam Line break, and therefore, has a smaller offsite release than a MSL break, which is less than the limits in 10CFR100. DAEC Engineering has acquired a thermal hydraulic analysis code and plans to confirm acceptability of the setpoints when the code package is qualified for use.

Description: HPCI, RCIC, RWCU Supp Pool Area High Diff Temp

ITS: 3.3.6.1-1.3.i
3.3.6.1-1.4.i
3.3.6.1-1.3.g
3.3.6.1-1.4.g
3.3.6.1-1.5.c

ITS AV: <=51.5 °F

(RWCU)
TDS2743A:<=22.5 °F
TDS2743B:<=23.5 °F
TDS2743C:<=34.5 °F
TDS2743D-F:<=51.5 °F

CTS: Table 3.2 - A

CTS Value: <= 50°F

(RWCU) D 14 °F(above 100% operational ambient)

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-038

CalcStartPt: NTSPLER

CalcStartPtRef: CTS

CalcSeq: NTSPLER->AV
AV->AL

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: All Except RWCU:

1. The AL is back calculated from the nominal setting presented in the CTS and the UFSAR. DAEC Engineering has acquired a thermal hydraulic analysis code and plans to confirm acceptability of the setpoints when the code package is qualified for use.

RWCU:

1. The normal differential temperatures (d/t) for each switch was determined by a special test. Per the CTS the nominal setting is 14 degrees above the normal 100% d/t. For this calculation the nominal setting was determined by adding 14 degrees to the normal d/t. The AL was then back-calculated from the nominal setting.

Description: RCIC Steam Line High Flow Isolation - PCIS Group 6A

ITS: 3.3.6.1-1.4.a

ITS AV: <=164 inH2O (inbrd)
<=159 inH2O (outbrd)

CTS: Table 3.2 - A

CTS Value: <= 155 inH2O

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E92-005

CalcStartPt: AL

CalcStartPtRef: CAL-E92-003 rev. 1

CalcSeq: AL->NTSP
AL->AV

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The CTS specifies conservative nominal settings for both inboard and outboard switches.

Description: RCIC Steam Line Low Pressure - PCIS Group 6A

ITS: 3.3.6.1-1.4.b **ITS AV:** >=50.3 psig

CTS: Table 3.2 - A **CTS Value:** 50 < P < 100 PSIG

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, Historical In-plant Usage

Calculation: CAL-E95-018
CAL-E93-013
CAL-E92-003

CalcStartPt: NTSPLER **CalcStartPtRef:** CAL-E93-013

CalcSeq: NTSPLER->AV
AV->AL

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The LAL is back calculated, in CAL-E93-013, from the central value of the CTS nominal range, using it as an NTSPLER. Plant operating experience demonstrates that this LAL is acceptable.

Description: RCIC Turbine Exhaust Diaphragm Pressure High - PCIS Group 6A

ITS: 3.3.6.1-1.4.c **ITS AV:** >=3.3 psig

CTS: Table 3.2 - A **CTS Value:** <= 10 PSIG

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, Historical In-plant Usage.

Calculation: CAL-E94-006 **CalcStartPt:** AL **CalcStartPtRef:** AL determined in setpoint calculation

CalcSeq: AL->AV
AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: 1. The purpose of the setpoint is to trip RCIC upon detection of a failing inner exhaust diaphragm thereby reducing the potential for a failure in the outer diaphragm and a steam release to the RCIC room. However, this function is for equipment protection. The safety function of the setpoint is to NOT inadvertantly trip and make RCIC unavailable. The "<" preferred direction of the setpoint specified in the CTS reflects the operational desire to keep the setpoint below normal RCIC exhaust pressure. The ">" for the ITS AV reflects a minimum allowable setting to ensure that the switches do not inadvertantly trip and make RCIC unavailable.

2. As an interim solution to address both the CTS and safety function requirements, upper and lower AVs (i.e. As-Found limits) have been established in the surveillance test procedures with the intent to remove the upper As-Found limit after ITS is approved. The surveillance test procedures currently have and will continue to have both upper and lower As-Left limits.

Description: RCIC Steam Leak Detection System Time Delay - PCIS Group 6A

ITS: 3.3.6.1-1.4.f

ITS AV: 30 min nominal

CTS: Table 3.2 - A

CTS Value: <=30 min

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

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Calculation: CAL-E95-002

CalcStartPt: AV

CalcStartPtRef: CTS & Historical In-plant usage.

CalcSeq: AV->AL
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The AL is back-calculated from the AV. The AV was considered the the AS-Found value in the surveillance test procedure. The AL is evaluated in calculation CAL-E93-038 and found to be acceptable.

Description: RWCU High Differential Flow - PCIS Group 5

ITS: 3.3.6.1-1.5.a **ITS AV:** <=59 gpmd

CTS: Table 3.2 - A **CTS Value:** <= 40 gpmd

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-017 **CalcStartPt:** AL **CalcStartPtRef:** CAL-BECH-487-M005 CAL-BECH-487-M006

CalcSeq: AL->AV AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: The AL is taken as the minimum flow from a critical crack in a high energy portion of the RWCU piping as determined in CAL-BECH-487-M005 and CAL-BECH-487-M006. Consequences of a break this size are acceptable per EQ analysis.

Description: RWCU Area Near TIP Room High Temp - PCIS Group 5

ITS: 3.3.6.1-1.5.f **ITS AV:** <=115.7°F

CTS: Table 3.2 - A **CTS Value:** <= 111.5 °F

CTSType: Nominal Setting **CTSTypeRef:** CAL-E92-015

Calculation: CAL-E92-015 **CalcStartPt:** AL **CalcStartPtRef:** CAL-BECH-487-M-006
NG-92-1821

CalcSeq: AL->AV
AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: These temperature switches were added by design change package DCP-1506. CAL-E92-015 was prepared to support the design change. The in-plant settings and values specified in the CTS come from CAL-E92-015. DAEC Engineering has acquired a thermal hydraulic analysis code and plans to confirm acceptability of the setpoints when the code package is qualified for use.

Description: Reactor Low Pressure - RHR Shutdown Cooling

ITS: 3.3.6.1-1.6.a **ITS AV:** <=152.7 psig

CTS: Table 3.2 - A 2.2.2 **CTS Value:** <= 135 PSIG

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E93-024 **CalcStartPt:** AL **CalcStartPtRef:** See CalcKeyNotes.

CalcSeq: AL->AV AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: The AL for these instruments is the rated design pressure of the suction pipe plus the ANSI B31.1-1986 allowance for normal transients of 15% above design pressure, provided they occur less than 10% of plant life, minus the static head in the suction pipe.

Description: High Drywell Pressure - Containment Spray

ITS:	3.3.6.1-1.7.a	**ITS AV:**	>=1.25 psig
CTS:	Table 3.2 - B	**CTS Value:**	>= 2.0 PSIG
CTSType:	Nominal Setting	**CTSTypeRef:**	DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation:	CAL-E93-012	**CalcStartPt:**	AL	**CalcStartPtRef:**	GE letter DTS 86-28, D.T. Shen to D.L. Wilson.
		CalcSeq:	AL->AV AL->NTSP	**CalcSeqRef:**	GE Setpoint Methodology

CalcKeyNotes: None.

Description: Relief Valve Low-Low Set Logic

ITS: 3.3.6.3-1.2

ITS AV:
High/Close:
>=893.4PSIG
<=930PSIG
Low/Open:
>=1014PSIG
<=1045PSIG
Low/Close:
>=893.4PSIG
<=925PSIG
Hi/Open:
>=1019PSIG
<=1050PSIG

CTS: 2.2.1.C

CTS Value:
1020 +/-25 PSIG
900 +/-25 PSIG
1025 +/-25 PSIG
905 +/-25 PSIG

CTSType: Nominal Settings & AVs

CTSTypeRef: DAEC Setpoint Reconstitution Project, DCP-1178, Tech Spec, UFSAR Description, Historical In-plant Usage

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Calculation: CAL-E94-003

CalcStartPt: AL

CalcStartPtRef: Design Change Package (DCP) 1178

CalcSeq:
AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes:

1. There are two pair of switches. Each pair has an associated SRV. Each pair consists of one switch to open the associated SRV and one switch to close the associated SRV. To reduce cycling, the switch setpoints are staggered such that one pair actuates/deactuates 5 psi higher than the other pair.

2. There are actually three ALs for these switches - minimum closing pressure, maximum opening pressure and minimum blow down pressure. These are documented in DCP-1178. The minimum closing pressure AL for LLS is the OL for MSIV Low Pressure Isolation. This AL is to ensure that an inadvertent MSIV isolation does not occur. The maximum opening pressure AL is 30 psig below the lowest non-LLS SRV setpoint. The setpoint of the lowest non-LLS SRV is 1130 psig. Therefore, the maximum opening pressure AL becomes 1100 psig. The minimum required blowdown between the open and close setpoints is 70 psig to ensure that the SRV tailpipes have sufficient time to drain before the SRVs open again.

3. The setpoint calculation determines upper and lower AVs for each setpoint. The upper end of the nominal setting and range specified in the CTS is more restrictive than the calculated upper AVs for the open & close setpoints. The calculated lower AVs for the open & close setpoints is more restrictive than the lower end of the nominal setting and range specified in the CTS. Therefore, the ITS AVs and the As-Found tolerances in the surveillance test procedures are based on the more restrictive upper limits from the CTS and more restrictive lower limits from the setpoint calculation.

Description: Tail Pipe Pressure Switches - Arm LLS

ITS: 3.3.6.3-1.3 **ITS AV:** <=99 psig

CTS: Table 3.2 - H **CTS Value:** N/A

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, Historical In-plant Usage

Calculation: CAL-E96-004 **CalcStartPt:** AL **CalcStartPtRef:** AL determined in setpoint calculation.

CalcSeq: AL->AV
AL->NTSP **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: The AL is based on the pressure drop in the tailpipes from the pressure switch to the T-quencher using the ASME flow capacity for each SRV and corresponding setpoint. The setpoint for these switches are preset by the manufacturer and are not adjustable onsite.

Description: Control Building Air Inlet Radiation High - Control Bldg Isolation, SBFU

ITS: 3.3.7.1.3 **ITS AV:** <=50 mrem/hr (administrative)

CTS: N/A **CTS Value:** N/A (Not in CTS)

CTSType: N/A **CTSTypeRef:** N/A

Calculation: NG-96-1320 **CalcStartPt:** N/A **CalcStartPtRef:** N/A

CalcSeq: N/A **CalcSeqRef:** N/A

CalcKeyNotes: Although a setpoint just high enough to prevent spurious trips is most desirable for ALARA, any setpoint and tolerances within the radiation monitor's adjustable range (0.05 mrem/hr to 50 mrem/hr) is adequate to provide the required protection to control room personnel during design basis accidents.

The following is an explanation of how we reached this conclusion and determined that preparing and maintaining a formal setpoint calculation to establish settings and tolerances for "Control Building Ventilation High Radiation - Control Building Isolation and Standby Filter Unit Initiation" is not necessary or cost effective.

FUNCTIONAL DESCRIPTION AND DESIGN BASIS:
These radiation monitors detect high radiation conditions at the control building HVAC air intake. Upon detection of high radiation, a control building isolation redirects normal ventilation paths through the SFUs for filtering and holdup to reduce radioactive contaminants to acceptable levels before passing the air to the control building environment (including the main control room). The action performed by the radiation monitors supports the control room habitability analysis described in UFSAR Section 6.4. The design goal is to allow access and occupancy of the control room for a 30 day period without control room personnel receiving radiation exposures in excess of 5 rem whole body. The analysis is conservatively based on a LOCA which instantaneously produces a 2620 mrem/hr cloud at the control building HVAC air intake. The personnel dose calculations take credit for the filtering provided by the SFUs throughout the event. Therefore, the analysis implicitly assumes that the SFUs were actuated early enough to prevent any significant amount of unfiltered air from entering the control building. For the maximum analyzed primary containment leak rate (2.0% per day), the total whole body dose for control building occupancy (0.6 rem) and ingress/egress (0.02 rem) was 0.62 rem. This results in a 4.38 rem margin between the design goal and predicted dose.

BASIS FOR SETPOINT SELECTION:
To provide for the earliest possible detection, the radiation monitor setpoints should be selected just enough above normal background radiation levels to prevent spurious trips. However, a much higher setpoint will also provide good assurance that doses will remain below the design goal.

Whether a setpoint is acceptable or not depends on the following factors:

* The purpose of the radiation monitors,

* The likelihood that the dose rate would be elevated to just below the setpoint, not exceed the setpoint, and go unnoticed for the time period necessary to exceed the dose limit.

First, the purpose of these radiation monitors is to provide protection only during accident conditions. Normal environmental radiation levels and occupational exposures are monitored and controlled by other instrumentation and administrative programs for 10CFR20 compliance.

Since the design goal is specified in terms of an integrated dose and the radiation monitors measure a dose rate, the plant's sensitivity and response time to changes in dose rate are important considerations in determining whether a specific radiation monitor setpoint is acceptable.

With respect to sensitivity - radiation levels are one of the most closely monitored parameters at a nuclear plant.

Description: Control Building Air Inlet Radiation High - Control Bldg Isolation, SBFU

Even during normal operation, small increases in background radiation levels are quickly recognized and given high priority. (Background levels at the at the control building HVAC air intake are typically between 0.05 mrem/hr and 0.2 mrem/hr.) The sensitivity to radiation levels would be significantly more heightened during any accident.

The benefit of the radiation monitors is that they provide continuous monitoring for cases when extremely high radiation levels could cause dose limits to be exceeded in a time interval so short that the response time of normal monitoring and manual actions may not be adequate. However, the control building isolation can be manually initiated if abnormally high radiation levels are detected during normal plant surveillance monitoring. Therefore, the radiation monitors and surveillance's are backups to each other.

Although the radiation monitors can be set to detect very small increases in dose rates, they are only required to provide assurance that the design goal is met. The radiation monitors are a benefit only if normal surveillance monitoring is not adequate to maintain doses within the limit. If the increase in dose rates is small, a long time period would be required to exceed the integrated dose limit. If the time period is long enough, the radiation monitors are not required because credit can be taken for normal surveillance monitoring to detect the change. For large increases in dose rate, the quick response time of radiation monitors is required. However, because the dose rates are higher, the radiation monitor setpoint may be higher.

For example: With a radiation monitor setpoint of 5 mrem/hr, an integrated dose limit of 5 rem would be exceeded in about 1000 hrs if actual dose rates were just below the setpoint and there were no other means of detecting the high radiation condition. (Note: This does not take any credit for holdup or dilution in the control building atmosphere that would further reduce the effective dose to the control room personnel.) Similarly, if the radiation monitor setpoints were adjusted to their upper range limit of 50 mrem/hr, it would take about 87.6 hrs (~3.5 days) before the 4.38 rem margin available in the control room habitability analysis would be exceeded. Considering that 50 mrem/hr represents over a 25,000% increase from normal background radiation levels, it is inconceivable that this would go unnoticed by normal surveillance monitoring for over 3.5 days. Therefore, even a setpoint at the upper limit of the radiation monitor's adjustable range would provide assurance that the design goal would be met.

Description: 4.16 KV Emergency Bus Undervoltage (Loss of Voltage) - Load Shed

ITS: 3.3.8.1-1.1.a **ITS AV:** >=595 volts

CTS: Table 3.2 - B **CTS Value:** 20 <= V <= 28 volts

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, Historical In-plant Usage

Calculation: CAL-E93-005
NG-96-1196

CalcStartPt: NTSPLER **CalcStartPtRef:** See Key Notes.

CalcSeq: NTSPLER->AV
AV->AL

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The AL was determined in the calc to be 0 volts. However, to account for stray voltages across the Potential Transformer the AL was conservatively back-calculated from the NTSPLER, which was assumed to be the lower value of the range in the CTS.

Description: 4.16 KV Emergency Bus Degraded Voltage - Start Diesel Generator

ITS: 3.3.8.1-1.2.a
3.3.8.1-1.2.b

ITS AV: >=3780 volts
<=8.5 sec (administrative)

CTS: Table 3.2 - B

CTS Value: 108 <= V <= 111 volts
8.0 <= t <= 8.5 sec

CTSType: Nominal Setting

CTSTypeRef: DAEC Setpoint Reconstitution Project, UFSAR Description, Historical In-plant Usage

Calculation: CAL-E95-006
NG-96-1196
NG-95-1432

CalcStartPt: AL

CalcStartPtRef: See CalcKeyNotes.

CalcSeq: AL->AV
AL->NTSP

CalcSeqRef: GE Setpoint Methodology

CalcKeyNotes: The AL is considered to be the minimum permissible voltage for the safety related loads to perform their function plus the worst case voltage drop from the 4160 volt essential buss to the 480 volt Motor Control Centers, per the UFSAR. This will ensure enough voltage for the safety related loads to perform their function.

Description: 4.16 KV Emergency Bus Sequential Loading Relay

ITS: 3.3.8.1-1.3 **ITS AV:** <=3500 volts (administrative)

CTS: Table 3.2 - B **CTS Value:** 65% of rated voltage

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR & Tech Spec Description, Historical In-plant Usage

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Calculation: NG-95-1415
NG-96-1196

CalcStartPt: N/A **CalcStartPtRef:** N/A

CalcSeq: N/A **CalcSeqRef:** N/A

CalcKeyNotes: This explains how it was determined that it was not necessary to perform a formal calculation for the transformer undervoltage and sequential loading relay setpoints.

In short, these relays sense whether or not the Startup/Standby transformers and the essential busses are energized. Therefore, a broad range of setpoints will fulfill the safety function.

REFERENCES:
1. UFSAR section 8.2
2. Vendor Manual G080FOS
3. M015-106<1,1a>
4. STP-42B032-A
5. APED-E21-006<1,2>
6. APED-E11-007<07>
7. BECH-E104<2-4,10-13,25,25a,26,26a>
8. BECH-E021,22,23

TRANSFORMER UNDERVOLTAGE RELAYS FUNCTIONAL DESCRIPTION:
The safety function of the transformer undervoltage relays is to transfer the safety related loads to an available source of power. Relays 127/ST11 and 127/ST12 monitor the Startup transformer and open the essential bus supply breakers (152-302 and 152-402) and transfer the safety related loads to the Standby transformer on voltage of 65%(78 volts) or less of nominal 120 volts. Upon a voltage of 65% or less on the Standby transformer, relays 127/SB1, 127/SB11, 127/SB2 and 127/SB12 open the essential bus supply breakers (152-301 and 152-401). The supply breakers are also opened by a degraded voltage signal (voltage <92.5% for 8.5 seconds). The diesel generators will start on a loss-of-offsite-power (LOOP) or a loss-of-coolant-accident (LOCA) signal or low essential bus voltage (<65%, relays 127-31 and 127.41). A LOOP signal is generated by less than 65% voltage on both the Startup and Standby transformers or a degraded voltage signal. A LOCA signal is comprised of 2 psig drywell pressure or lo-lo-lo water level. Automatic load shedding will occur on a loss of voltage (<20%) on the essential busses or from a LOOP/LOCA signal. A LOOP/LOCA signal is one of the LOOP signals discussed above in conjunction with one of the LOCA signals also discussed above.

SEQUENTIAL LOADING RELAYS FUNCTIONAL DESCRIPTION:
The 4.16 kV sequential loading relays 127-31 and 127-41 have two functions. The safety function is to initiate sequential loading of the Core Spray and RHR pumps on to essential busses 1A3 and 1A4 following a LOOP/LOCA. This function is accomplished when the relays reset after power to 1A3 and 1A4 has been restored by the EDG. Power to the essential busses, as indicated by 127-31 and 127-41, must be available and a LOCA signal present for sequential loading to begin. The secondary function is to start the EDGs on low 4.16 kV essential bus voltage (<65%), as discussed above. This is not a safety function of the relays. These relays provide the only start signal to the EDG when the following conditions exist:

1. There is no LOOP or LOCA signal.

2. Supply breaker to the essential bus from the Startup transformer fails open.

3. Failure of the mechanism to transfer the power source to the Standby transformer.

4. Failure of the degraded voltage relays.

This is not a plausible scenario. It would include multiple failures and, since there is no LOCA, emergency loads would not be sequenced onto the bus anyway. Therefore, this is considered a backup function for defense-in-depth and not a primary safety function.

Per Reference 1 the transmission system voltage is not expected to be outside the normal range of 100% to 105% for extended periods of time. If voltage is above the degraded voltage setpoint, safety related equipment is expected to operate normally. If voltage is below the degraded voltage setpoint but above the undervoltage setpoint, a LOOP signal will be generated in 8.5 seconds. In any other situation the voltage is either dropping to zero or returning to normal after being re-energized by the EDG or from offsite power.

SELECTION OF TRANSFORMER UNDERVOLTAGE RELAYS SETTINGS:
Per Reference 1 the relay settings were chosen to avoid spurious initiation of the onsite power source or a spurious transfer of power from the offsite to the onsite source due to possible transients caused by large motor starts. The minimum expected essential bus voltage after a LOCA, assuming minimum transmission system voltage of 95%, is 82.8%, per Reference 1. This is equivalent to 98.4 volts in the 120 volt system. Review of historical data shows that the worst case observed in-service difference (OISD) out of 162 data points for the undervoltage relays is 2.5 volts (1 sigma, nominal 120), for a surveillance interval of one year. A conservatively estimate of the uncertainty for the system is 4 volts (1 sigma) or 8 volts (2 sigma). A setpoint of less than 90.4 volts (i.e.98.4-8 volts) is adequate to ensure spurious trip avoidance. The current 78 volt setpoint is well away from this value.

Unless there is a LOCA coincident with a low voltage condition, safety related motors will not be required to start and a delay in the undervoltage trip will not delay the mitigation of an accident. Should a LOCA condition be present, the diesel generator is assumed to start and be ready to accept loads in 10 seconds. Voltage on the essential bus should decay to <20% in approximately 1 second. This will leave 8-9 seconds before the EDGs are ready to accept loads after the undervoltage relays have tripped the supply breakers. Based on this, a delay due to the undervoltage setpoint will not prolong the mitigation of a LOCA.

Based on the above discussion, these relays will only sense the 65% setpoint as voltage is dropping to zero or returning to normal. The relays for the transformer undervoltage have an adjustable range of 70 to 100 volts per vendor manual G080FOS. This physical characteristic of the relays will prevent setting the relays such that the accuracy, drift and other uncertainties could cause the relays to have a setpoints less than zero or greater than 120 volts, ensuring that the drop out will occur.

Therefore an administratively based AV has been selected as >=70 V on a 0-120 V Scale, or >=2450 V on a 0-4160V scale (120/4200 potential transformer)

SELECTION OF SEQUENTIAL LOADING RELAYS SETTINGS:
For the sequential loading relays, the safety function is accomplished on relay pickup. Once these relays have dropped out due to a loss of bus voltage they will pickup as voltage on the bus is returning to normal. These relays also have an adjustable range of 70 to 100 volts, for the drop-out. Vendor manual G080FOS also states that the relays will reset at less than 110% of the drop out voltage. Per STP-42B032-A, the current nominal drop-out setpoint is 78 volts (65%) and can be left as high as 82 volts. Adding an allowance of 8 volts (2 sigma) for uncertainty, the maximum drop-out setting would be 99 volts or less. These settings and tolerances are low enough to prevent spurious drop-outs and ensure the pickup is low enough to detect to restoration of power (120 volt nominal) by the EDGs.

Therefore an administratively based AV has been selected as <=100 V on a 0-120 V Scale, or <=3500 V on a 0-4160V scale (120/4200 potential transformer)

Description: 4.16 KV Emergency Transformer Supply Undervoltage - Transfer Supply Source, Start Diesel Generator

ITS: 3.3.8.1-1.4 **ITS AV:** >=2450 volts (administrative)

CTS: Table 3.2 - B **CTS Value:** 65% of rated voltage

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, UFSAR & Tech Spec Description, Historical In-plant Usage

Calculation: NG-95-1415 NG-96-1196 **CalcStartPt:** N/A **CalcStartPtRef:** N/A

CalcSeq: N/A **CalcSeqRef:** N/A

CalcKeyNotes: (See discussion for Sequential Loading Relays)

Description: RPS Power Supply EPA Setpoints - Over Voltage, Under Voltage & Under Freq

ITS:	3.3.8.2.2.a 3.3.8.2.2.b 3.3.8.2.2.c	**ITS AV:**	<=132VAC >=108VAC >=57Hz

CTS:	4.1.B.2.a 4.1.B.2.b 4.1.B.2.c	**CTS Value:**	<=132 VAC >=108 VAC >=57 Hz
CTSType:	AV	**CTSTypeRef:**	RTS-135 DCR 1044

Calculation:	CAL-E92-022	**CalcStartPt:**	AV	**CalcStartPtRef:**	RTS-135 DCR 1044
		CalcSeq:	AV->NTSPLER	**CalcSeqRef:**	GE Setpoint Methodology

CalcKeyNotes: The AVs (i.e. Tech Spec Limits) for these trips are derived from regulatory requirements in IEEE-STD-323-1974 " Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations" as documented in RTS-135 and DCR 1044. Therefore, ALs are not applicable to these instruments.

Description: Vacuum Breaker Reactor Bldg to Torus

ITS: 3.6.1.6.3 **ITS AV:** <=0.614 psid

CTS: 4.7.D.3 **CTS Value:** <= 0.5 PSID

CTSType: Nominal Setting **CTSTypeRef:** DAEC Setpoint Reconstitution Project, Historical In-plant Usage

Calculation: CAL-E94-015 **CalcStartPt:** AL **CalcStartPtRef:** AL determined in setpoint calculation.

CalcSeq: AL->NTSP
AL->AV **CalcSeqRef:** GE Setpoint Methodology

CalcKeyNotes: The AL for these switches is calculated in the body of the calculation. The AL is based on the 2 psid external design pressure of the drywell and suppression pool minus the pressure drop from the drywell to the reactor building, the drywell-to-torus vacuum breaker setpoint and a time delay for the reactor building-to-torus pressure switches.