ATTACHMENT 1

CHAPTER 5

SPDS CALCULATIONS

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5. SPDS CALCULATIONS

In order to determine the status of each of the six critical safety functions (CSF), the current values of the relevant parameters are taken from global common and checked against the various setpoints in the CSF trees. In many cases there is more than one analog signal for a given parameter. The preferred method for combining the individual signals into an "average" value is to use a coincidence logic scheme, such as is used by the reactor protection system (RPS) and the engineered safety features actuation system (ESFAS). If the parameter of interest is one which is used by the RPS or ESFAS, the coincidence logic scheme is used. This method is described below.

In the RPS or ESFAS logic, signals are combined in an M out of N coincidence. For example, there are 4 signals for power range flux, and if 2 of these signals indicate an abnormally high value, the reactor will trip. This is an example of 2 out of 4 coincidence. In the SPDS subcriticality tree there is a branch at power range greater than 5 percent. The SPDS software will compare each of the 4 analog signals for power range flux with the 5 percent power value. If 2 or more values are greater than 5 percent power the SPDS will consider power range to be greater than 5 percent, which is a RED condition. If less than 2 of 4 are greater than 5 percent, the condition will be less severe than RED.

Each CSF display also shows the current values of each parameter used in the tree. In the above example a value for power range will be displayed. This value will depend on the decision made by the SPDS logic described above. If 2 or more power range fluxes are greater than 5 percent the SPDS will calculate an average value of only those signals which are greater than 5 percent. Values less than 5 percent will be disregarded. If fewer than 2 power range fluxes are greater than 5 percent the SPDS will calculate an average value of only those signals less than 5 percent. Values greater than 5 percent will be disregarded. This will be done to avoid the potentially confusing situation where 2 of 4 signals are above the setpoint, but the average value of all 4 signals is below the setpoint.

The SPDS will also check for signals of "bad" quality. The SPDS will consider a signal to be bad if the quality status code is BAD or worse. This means the current value cannot be determined, for example because the

sensor limit is exceeded, there is an open thermocouple, or the point was deleted from processing. If the quality status code is above BAD the SPDS will treat the current values as usable, or good. Any signals of bad quality will be discarded, and a reduced logic will be used. For example, if a parameter normally has 2 of 4 logic, but one signal is of bad quality, the logic will be reduced to 2 of 3. Listed below is the order in which the SPDS logic will reduce when there are bad quality signals.

2 of 4
2 of 3
1 of 2
1 of 1
0

The containment pressure calculation, which uses a 2 of 6 logic, is a special case and is discussed in Section 5.5.1.

If there are no signals of good quality, a value for the parameter cannot be determined. In this case, the CSF will be given a status color of WHITE, and the tree will be filled in up to the point where the bad quality data occurs.

If a particular SPDS parameter is not included in the RPS or ESFAS the current value used by the SPDS will be calculated by other means. In situations where conservatism is required, the SPDS will use either the maximum value of minimum value of the individual signals. In other cases a straight arithmetic average of all available signals is used.

In general, a parameter that is calculated by the SPDS will be assigned a quality tag which is the lowest of the quality tags of its input points. However, in some cases this approach would assign a non-valid or bad quality to a parameter when one input is bad but the remaining inputs are good. In these cases the bad quality tag is discarded and the lowest of the remaining good tags is used. Other special cases will be discussed as they arise in this section.

Because H.B. Robinson is a 3-loop plant several critical safety function tree decisions look at three values, for example, three steam generator levels or three cold leg temperatures. The decisions are of an "all" vs. "any" nature. At branch points of this type the quality tags of the

calculated values come into play. As an example, consider the branch in the Heat Sink Tree where the decision is all SG NR levels < 25% vs. any SG NR level > 25%. If at least one level has a good quality value which is > 25%, the branch will be considered valid and processing of the tree will continue, even if the other two levels have bad quality. However, if there is at least one bad quality level and all of the remaining good quality levels are < 25%, the branch will be considered non-valid and the status will be WHITE. In this case it would not be accurate to say that "all" steam generator levels are < 25% because the bad quality level may be > 25%. The approach described above is used at all branch points where the decision refers to "all" vs. "any" of a parameter.

The following describes how the above general method will be used for each SPDS parameter in each CSF tree.

5.1 SUBCRITICALITY CALCULATIONS

5.1.1 Power Range

Input Point IDs: NIN0041A - NI-41 power range average flux
NIN0042A - NI-42 power range average flux
NIN0043A - NI-43 power range average flux
NIN0044A - NI-44 power range average flux

SPDS Point ID: NIN0001 - SPDS power range average flux

These four signals are combined in a 2 of 4 logic to produce an average value. The setpoint value is 5 percent power. Power range is ≥ 5 percent if 2 of 4 signals are ≥ 5 percent.

5.1.2 Intermediate Range Startup Rate

Input Point IDs: NIN0035A - NI-35 intermediate range flux
NIN0036A - NI-36 intermediate range flux

SPDS Point ID: NIN0002 - intermediate range startup rate

Intermediate range startup rate is calculated from the above fluxes. After a reactor shutdown the startup rate should be negative, but an occassional flux measurement may be greater than the previous reading. In order to smooth out the data 5 consecutive readings taken over the course of 10 seconds will be averaged. This average value will be compared with the succeeding block of 5 readings to calculate the startup rate. In each block of 5 values at least 3 must be of good quality for the startup rate to be assigned a good quality tag. Startup rates will be calculated for both IR fluxes and then combined in a 1 of 2 logic.

In the Subcriticality tree there are two setpoints for intermediate range startup rate, namely 0 and -0.2 DPM. The higher value of 0 represents the worst case, so if at least 1 of 2 IR SURs is above 0 the SPDS current value will be calculated from those SURs which are > 0. If none of the SURs is above 0 but at least 1 of 2 is between 0 and -0.2 DPM, the SPDS current value will be calculated from those SURs which are between 0 and -0.2 DPM.

5.1.2.1 Average Intermediate Range Flux

SPDS Point ID: NIN0004 - average intermediate range flux

An arithmetic average of the two fluxes is calculated for use by a third level trend plot. If only one flux has good quality its value will be used as the average.

5.1.3 Source Range Startup Rate

Input Point IDs: NIN0031A - NI-31 source range flux
NIN0032A - NI-32 source range flux

SPDS Point ID: NIN0003 - source range startup rate

The source range startup rate is calculated from the above fluxes using the same approach described for intermediate range startup rate. Startup rates will be calculated for both SR fluxes and then combined in a 1

of 2 logic. If either SR SUR is > 0 the SPDS current value will be calculated from those SURs which are > 0.

5.1.3.1 Average Source Range Flux

SPDS Point ID: NIN0005 - average source range flux

An arithmetic average of the two fluxes is calculated for use by a third level trend plot. If only one flux has good quality its value will be used as the average.

5.1.4 Source Range Energized

If either source range flux point ID is of good quality the source range will be considered energized. The quality tag of the average source range flux provides this information.

5.1.5 Scram Signal

During Power Operation and Startup modes, and before a shutdown is initiated, the Subcriticality tree would show a RED condition when in fact there is no event taking place. Therefore, the Subcriticality tree will be interlocked with the existence of a scram signal. Until a scram signal is sent the status of the Subcriticality CSF will be set to GREEN. When a scram signal is sent the correct status color for the current conditions will be activated.

There are 30 sequence-of-events (SOE) points and 2 Boolean points in the ERFIS system which are involved with the scram system. For example, the SOE point CVP1003D, Containment High Pressure Safety Injection Reactor Trip, is a 2 out of 3 combination of three partial reactor trip signals. Also, since actuation of the safety injection system causes a reactor trip, any signal which results in safety injection is included. If any of the 32 SOE or Boolean points indicates that a scram signal should have been generated, the SPDS will activate the Subcriticality tree. As discussed in Section 3.4.1, under Power Operation mode a time delay of 10 seconds will be

used to prevent Subcriticality status from briefly being RED until power decreases below 5%.

The 30 SOE point IDs are:

1. RPY0004D - Manual Reactor Trip Train A
2. RPY0005D - Manual Reactor Trip Train B
3. NIN0030D - NI-31 Source Range Hi Flux Rx Trip
4. NIN0031D - NI-32 Source Range Hi Flux Rx Trip
5. NIN0020D - NI-35 Int Range Hi Flux Rx Trip
6. NIN0021D - NI-36 Int Range Hi Flux Rx Trip
7. NIN0005D - Pwr Range Hi Flux Rx Trip
8. NIN0010D - Pwr Range Lo Flux Rx Trip
9. RCT0498D - RC Loop Hi Ot Dt Rx Trip
10. RCT0499D - RC Loop Hi OP Dt Rx Trip
11. RCV0324D - RCP Bus UV Rx Trip
12. TBD - RCP Bus UF Rx Trip
13. RCP0483D - PZR Hi Press Rx Trip
14. RCP0488D - PZR Low Press Rx Trip
15. RCL0483D - PZR Hi Level Rx Trip
16. FWY0401D - S/G A Lo Lv & Stm/Fw Dev Rx Trip
17. FWY0421D - S/G B Lo Lv & Stm/Fw Dev Rx Trip
18. FWY0441D - S/G C Lo Lv & Stm/Fw Dev Rx Trip
19. FWL0406D - S/G A Lo-Lo Level Rx Trip
20. FWL0426D - S/G B Lo-Lo Level Rx Trip
21. FWL0446D - S/G C Lo-Lo Level Rx Trip
22. MSP0407D - Stm Line A Hi DP SI
23. MSP0427O - Stm Line B Hi DP SI
24. MSP0447D - Stm Line C Hi DP SI
25. TBD - Stm Line Hi Flow Temp/Press SI
26. TBD - PZR Lo Pressure SI
27. CVP1003D - CV Hi Pressure SI
28. SIY0920D - SI Manual Actuation
29. SIY0921D - SI Manual Actuation
30. EHP0399D - Auto Stop Oil Press Turb/Rx Trip

The 2 Boolean points are themselves summary points for other SOEs. They are:

1. RCF9901D - RC 1/3 Loop Lo Flow P8 Rx Trip
2. RCF9902D - RC 2/3 Loop Lo Flow P7 Rx Trip

which are defined as follows:

RCF9901D = [(RCF0403D or RCY0400D) or
(RCF0423D or RCY0420D) or
(RCF0443D or RCY0440D)] and
RCF0499D

RCF9902D = [2 of 3[(RCF0403D or RCY0400D),
(RCF0423D or RCY0420D),
(RCF0443D or RCY0440D)]] and
RPY0003D

where

RCF0403D - RC Loop 1 Lo Flow Rx Trip
RCF0423D - RC Loop 2 Lo Flow Rx Trip
RCF0443D - RC Loop 3 Lo Flow Rx Trip
RCY0400D - RCP A Breaker Status
RCY0420D - RCP B Breaker Status
RCY0440D - RCP C Breaker Status
RCF0499D - RC Loop Low Flow P-8 Permissive
RPY0003D - Nuc & Turb Power P-7 Permissive

5.1.5.1 Scram Reset

Input Point IDs: RPY0006D - 52/RTA Reactor Trip Breaker A
RPY0007D - 52/RTB Reactor Trip Breaker B
RPY0026D - 52/BYA Rx Trip Bypass Breaker A
RPY0027D - 52/BYB Rx Trip Bypass Breaker B

SPDS Point ID: RPY0006 - Rod Drive Power Supply Status

After an event is over and the reactor is brought back to power, it will be necessary to reset the Subcriticality status back to GREEN until the next scram occurs. In order to know when to reset Subcriticality, the SPDS will continually monitor the status of the two reactor trip circuit breakers and the two trip bypass breakers. Following a scram, the trip breakers will open and the rod drive power supply circuit will become open. When the status of the breakers and therefore the circuit changes from open to closed, the SPDS will consider that the event is over and Subcriticality status will be reset.

Trip breaker status is used in another way, at the beginning of an event. If the trip breakers fail to open following receipt of a scram signal, the SPDS will not wait 10 seconds before monitoring the Subcriticality tree. Failure of the trip breakers to open is considered serious enough to warrant immediately setting Subcriticality status to RED.

The possible values for the SPDS point RPY0006, rod drive power supply status, are:

0 - circuit was closed during previous scan and remains closed
1 - circuit was open during previous scan and is now closed
2 - circuit was closed during previous scan and is now open
3 - circuit was open during previous scan and remains open.

Breaker status is scanned every 2 seconds. A value of 0 in conjunction with receipt of a scram signal could be an indication of failure to scram or ATWS. A value of 1 indicates the termination of an event. A value of 2 indicates a successful scram. A value of 3 indicates an event is still in progress.

5.2 CORE COOLING CALCULATIONS

5.2.1 <u>Core Exit TCs</u>

There are 51 core exit thermocouples.[1] The SPDS will use the average of the 5 hottest thermocouples as the core exit temperature. This

[1] Indication from all 51 core exit thermocouples is currently not available. Upgrade of the core exit thermocouples is scheduled to be performed as part of the RG 1.97 implementation.

value will also be used by the RCS Integrity tree as the RCS temperature. The average of the 5 hottest thermocouples is used to provide a degree of conservatism.

The 51 thermocouple point IDs are:

RXT0001A through RXT0051A - Incore T/C POS xxx Temperature

SPDS Point ID: RXT0001 - Avg. of 5 hottest thermocouples

5.2.2 Subcooling

SPDS Point ID: RCT0003 - RCS subcooling

Subcooling is the difference between the saturation temperature at the current RCS pressure and temperature. The RCS temperature used for the subcooling calculation will be the average of the five hottest thermocouples. In order to calculate saturation temperature it is first necessary to calculate the RCS pressure.

5.2.2.1 Low RCS Pressure

Input Point IDs: RCP0480A - PT-455 pressurizer pressure
RCP0481A - PT-456 pressurizer pressure
RCP0482A - PT-457 pressurizer pressure
RCP0493A - PT-500 pressurizer pressure
RCP0494A - PT-501 pressurizer pressure

SPDS Point ID: RCP0002 - Low RCS pressure signal

Points RCP0480A, RCP0481A, and RCP0482A are associated with narrow range pressure sensors, while RCP0493A and RCP0494A are wide range. As long as at least one narrow range pressure signal is of good quality the subcooling calculation will use the lowest value. If none are of good quality the lowest wide range pressure will be used.

5.2.2.2 Saturation Temperature

Saturation temperature will be calculated from the steam tables for the low RCS pressure.

5.2.2.3 Subcooling Target Value

SPDS Point ID: RCT0004 - subcooling target value

The subcooling target value is used for a third level display in the Core Cooling hierarchy. This display shows the maximum temperature to reach the subcooling target value and the minimum pressure to reach the subcooling target value. The subcooling target value will be 35°F if containment pressure is greater than or equal to 5 psig, and 25°F if containment pressure is less than 5 psig. This determination will be performed after the calculation of containment pressure (See Section 5.5.1). If containment pressure cannot be calculated the conservative value of 35°F will be used for the subcooling target value.

5.2.2.4 Maximum Temperature to Reach Subcooling Target Value

SPDS Point ID: RCT0005 - maximum temperature to reach subcooling target value

This parameter is used in a third level display. It indicates what the RCS temperature would be if the RCS subcooling were equal to the target value, at the current RCS pressure.

5.2.2.5 Minimum Pressure to Reach Subcooling Target Value

SPDS Point ID: RCP0006 - minimum pressure to reach subcooling target value

This parameter is used in a third level display. It indicates whatthe RCS pressure would be if subcooling were equal to the target value, at the current RCS temperature.

5.2.3 RCPs Running

Input Point IDs: RCY0400D - RCP A breaker status
RCY0420D - RCP B breaker status
RCY0400D - RCP C breaker status

SPDS Point ID: RCV0007 - Number of RC Pumps running

In order to determine whether a reactor coolant pump (RCP) is running its breaker status will be checked. A closed breaker indicates that the pump is running.

5.2.4 RVLIS Full Range

Input Point IDs: RCL0487A - LT-511AB Rx Vessel Full Rng Lev
RCL0490A - LT-511BB Rx Vessel Full Rng Lev

SPDS Point ID: RCL0008 - Low RVLIS Full Range

The SPDS will use the lower of the two RVLIS full range values.

5.2.5 RVLIS Dynamic Head Range

Input Point IDs: RCL0488A - LT-511AC Rx Vessel Dyn Head Lev
RCL0491A - LT-511BC Rx Vessel Dyn Head Lev

SPDS Point ID: RCL0009 - Low RVLIS Dyn Head Range

The SPDS will use the lower of the two RVLIS dynamic head range values.

5.2.5.1 RVLIS Dynamic Head Range Setpoint In Core Cooling Tree

SPDS Point ID: RCL0010 - RVLIS Dyn Head Range Setpoint

The setpoint for RVLIS dynamic head range can be one of three possible values, depending on the number of reactor coolant pumps running. As the number of pumps running decreases the RVLIS setpoint increases, indicating the need for additional inventory with the loss of forced flow.

5.3 HEAT SINK CALCULATIONS

5.3.1 Total Auxiliary Feedwater Flow to Steam Generators

Input Point IDs: TBD - MDAFW Pump 1 Disch Flow
TBD - MDAFW Pump 2 Disch Flow
TBD - SDAFW Pump Disch Flow

SPDS Point ID: AFF0001 - Total Aux. FW to all S/Gs

The total auxiliary feedwater flow to all steam generators is the sum of the individual auxiliary feedwater flows. Normally, the quality tag for the sum will be the lowest of the three individual qualities. However, if one signal has bad quality but the sum of the remaining signals is still above the setpoint in the next Heat Sink tree, the bad signal's quality tag will be discarded so that the sum will have a good quality tag. Otherwise, the status of the tree would be WHITE despite the presence of adequate feedwater flow. If the total auxiliary feedwater flow is below the tree setpoint with at least one bad quality signal, the calculation will be considered non-validated and the status will be WHITE.

5.3.2 Steam Generator Narrow Range Level

Input Point IDs: FWL0400A - LT-474 S/G A narrow range level
FWL0401A - LT-475 S/G A narrow range level
FWL0402A - LT-476 S/G A narrow range level
FWL0420A - LT-484 S/G B narrow range level

FWL0421A - LT-485 S/G B narrow range level
FWL0422A - LT-486 S/G B narrow range level
FWL0440A - LT-494 S/G C narrow range level
FWL0441A - LT-495 S/G C narrow range level
FWL0442A - LT-496 S/G C narrow range level

SPDS Point IDs: FWL0002 - avg S/G A narrow range level
FWL0003 - avg S/G B narrow range level
FWL0004 - avg S/G C narrow range level
FWL0005 - high S/G narrow range level
FWL0006 - low S/G narrow range level

For each steam generator the three signals are combined in a 2 out of 3 logic. In the heat sink tree there are two setpoints for steam generator narrow range level, a high level setpoint and a low level setpoint. The low level setpoint represents the worst case. If two or more levels are beyond either setpoint the SPDS current value will be calculated from those levels which are beyond that setpoint. In the unlikely case that one signal is above the high level, one signal is below the low level, and one signal is of bad quality (reducing the logic to 1 of 2), priority is given to the low value.

5.3.3 Steam Generator Pressure

Input Point IDs: MSP0400A - PT-474 S/G A steam pressure
MSP0401A - PT-475 S/G A steam pressure
MSP0402A - PT-476 S/G A steam pressure
MSP0420A - PT-484 S/G B steam pressure
MSP0421A - PT-485 S/G B steam pressure
MSP0422A - PT-486 S/G B steam pressure
MSP0440A - PT-494 S/G C steam pressure
MSP0441A - PT-495 S/G C steam pressure
MSP0442A - PT-496 S/G C steam pressure

SPDS Point IDs: MSP0007 - avg S/G A steam pressure
MSP0008 - avg S/G B steam pressure
MSP0009 - avg S/G C steam pressure
MSP0010 - high S/G steam pressure

For each steam generator the three signals are combined in a 2 out of 3 logic. In the heat sink tree there are two setpoints for steam generator pressure, a high pressure setpoint and a high-high pressure setpoint. The high-high pressure setpoint point represents the worst case. Priority is given to the high-high value when the logic is reduced to 1 of 2 due to bad quality data. If one signal is above the high-high pressure, one signal is above only the high pressure, and the third signal is in the normal range, the value which is above only the high pressure is used. In this unlikely case, 2 of 3 signals are above the high pressure but only 1 of 3 is above the high-high pressure.

5.4 RCS INTEGRITY CALCULATIONS

5.4.1 High RCS Pressure

SPDS Point ID: RCP0012 - high RCS pressure signal

The input point IDs for RCS pressure were given in Section 5.2.2.1. Decisions in the RCS Integrity tree will be based upon the highest good quality narrow range pressure. If none are of good quality, the highest wide range pressure will be used.

5.4.2 Cold Leg Temperatures

Point IDs: RCT0406A - TE-410 loop 1 W/R cold leg temp
RCT0426A - TE-420 loop 2 W/R cold leg temp
RCT0446A - TE-430 loop 3 W/R cold leg temp

SPDS Point ID: RCT0013 - low cold leg temperature

For determining the tree logic when the decision refers to all vs any cold leg temperatures, or all vs. any pressure-temperature points, each cold leg temperature will be checked individually. However, on the third level display of the plant operational limits, only the low cold leg temperature will be plotted.

5.4.3 RCS Temperature Decreases

SPDS Point ID: RCT0008 - cold leg A temp decr. last 60 min.
RCT0009 - cold leg B temp decr. last 60 min.
RCT0010 - cold leg C temp decr. last 60 min.
RCT0011 - limiting cold leg temp decrease.

The RCS Integrity tree requires the temperature decrease over the past 60 minutes in each cold leg. The SPDS stores these temperatures in an array which is updated in a circular fashion every four seconds (every other cycle through the SPDS calculations). The temperature differences is calculated by scanning the array of temperatures and determining the maximum decrease that occurs anywhere within the 60 minutes. For example, in Figure 5.4.1 the temperature starts at 500°F, drops in stages to 350°, rises to 550°, then drops again to 450°F. In this case, the largest negative delta anywhere on this plot is between point A and point D, or 500°F - 350°F. Therefore, the value used by the SPDS for the temperature decrease over the past 60 minutes is 150°F.

5.4.4 RCS Temperature

The RCS temperature used in the RCS Integrity tree will be the average of the 5 hottest core exit thermocouple temperatures (see Section 5.2.1).

5.5 CONTAINMENT CALCULATIONS

5.5.1 Containment Pressure

Input Point IDs: CVP1000A - CV pressure

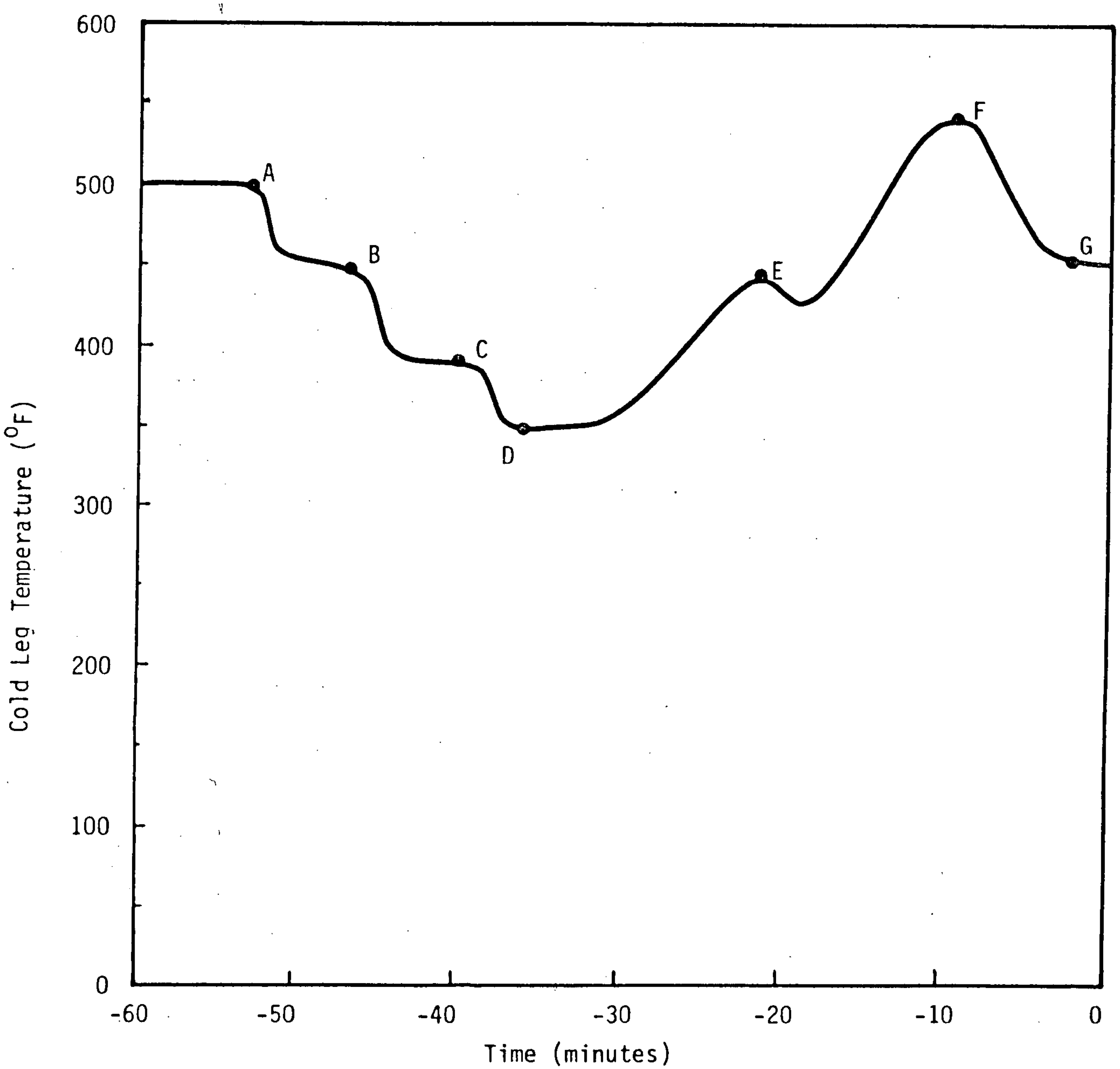

Figure 5.4-1. Example Cold Leg Temperature Decrease.

CVP1001A - CV pressure
CVP1002A - CV pressure
CVP1003A - CV pressure
CVP1004A - CV pressure
CVP1005A - CV pressure

SPDS Point ID: CVP0001 - average CV pressure

The six signals are combined in a 2 out of 6 logic. In the containment tree there are two setpoints for containment pressure, a high pressure setpoint and a high-high pressure setpoint. The high-high pressure setpoint represents the worst case. Priority is given to the high-high values when there are two or more signals above each setpoint. If one signal is above the high-high pressure, one signal is above only the high pressure, and the other signals are in the normal range, the value which is above only the high pressure is used. In this unlikely case 2 of 6 signals are above the high pressure but only 1 of 6 is above the high-high pressure.

In the case of bad quality signals the logic is reduced to 2 of 5, then 2 of 4, then 2 of 3. If there are fewer than 3 good quality signals the calculation will be considered non-validated. This is a special case of the logic reduction method discussed at the beginning of Section 5.

5.5.2 Containment Sump Level

Input Point IDs: SIL5321A - LT-801 CV wide range water level
SIL5322A - LT-802 CV wide range water level

SPDS Point ID: SIL0002 - average CV wide range water level

The average of the two wide range levels is used for the SPDS current value.

5.5.3 Containment Radiation

Input Point IDs: RMR0043A - R-32A CV Hi Range Area Monitor
RMR0044A - R-32B CV Hi Range Area Monitor

SPDS Point ID: RMR0003 - High CV Hi Range Area Monitor

The Containment critical safety function tree will use the higher of these two points as the value for containment radiation.

5.5.3.1 ID Number of High Radiation Monitor

SPDS Point ID: RMR0004 - ID number of High CV Rod Monitor

The SPDS will save the ID number of the highest radiation monitor (either R-32A or R-32B) for use in a third-level display.

5.6 RCS INVENTORY CALCULATIONS

5.6.1 Pressurizer Level

Input Point IDs: RCL0480A - LT-459 pressurizer level
RCL0481A - LT-460 pressurizer level
RCL0482A - Lt-461 pressurizer level

SPDS Point ID: RCL0006 - average pressurizer level

The three pressurizer level signals are combined in a 2 out of 3 logic. In the RCS Inventory tree there are two setpoints for pressurizer level, a high level setpoint and a low level setpoint. The high level setpoint represents the worst case. If two or more levels are beyond either setpoint the SPDS current value will be calculated from those levels which are beyond that setpoint. In the unlikely case that one signal is above the high level, one signal is below the low level, and one signal is of bad quality (reducing the logic to 1 of 2), priority is given to the high value.

5.6.2 RVLIS Upper Head

Input Point IDs: RCL0486A - LT-511AA Rx Vessel Upper Rng Lev
RCL0489A - LT-511BA Rx Vessel Upper Rng Lev

SPDS Point ID: RCL0007 - Low RVLIS Upper Range

The SPDS will use the lowest of the two RVLIS upper range values.

TABLE 5-1. SAIPMS DATA QUALITY CODES

CODE	RESCAN CODE	DESCRIPTION
UNK	N/A	UNKNOWN; POINT NOT YET PROCESSED
DEL	N/A	POINT DELETED FROM PROCESSING
ADEL		POINT AUTOMATICALLY DELETED FROM PROCESSING
NCAL	NCAL/R	CANNOT BE CALCULATED DUE TO ERROR CONDITIONS
INVL	INVL/R	DAS FRONT-END HARDWARE ERROR
RDER	RDER/R	SENSOR READ ERROR
OTD	OTD/R	OPEN THERMOCOUPLE DETECTED
BAD	BAD/R	INPUT COUNTS EXCEED SENSOR RANGE
HENG	HENG/R	POINT EXCEEDS HIGH REASONABLE LIMITS (ENGINEERING HIGH)
LENG	LENG/R	POINT IS BELOW LOW REASONABLE LIMITS (ENGINEERING LOW)
REDU	REDU/R	POINT FAILS REDUNDANT POINT CHECK
HALM	HALM/R	POINT ABOVE HIGH ALARM LIMIT
LALM	LALM/R	POINT BELOW LOW ALARM LIMIT
HWRN	HWRN/R	POINT ABOVE HIGH WARNING LIMIT
LWRN	LWRN/R	POINT BELOW WARNING LIMIT
ALRM	N/A	STATE/CHANGE-OF-STATE ALARM
COS	N/A	CHANGE-OF-STATE ALARM
SUB	N/A	SUBSTITUTE VALUE FOR POINT
CSUB	N/A	CALCULATED POINT BECAUSE INPUT WAS A "SUB"
DALM	N/A	POINT DELETED FROM ALARM CHECKS
INHB	N/A	ALARM INHIBITED BY CUTOUT POINT
OTT	N/A	OPEN THERMOCOUPLE TEST (WOULD APPEAR ON ARCHIVAL COPY)
GOOD	N/A	POINT PASSES ALL ABOVE CHECKS

SAI-12907/0751
7/18/84

ATTACHMENT 2

VERIFICATION AND VALIDATION PLAN

(2079MDM/ccc)