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MFN 07-015, Supplement 2

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Subject: **Follow-up Response to NRC Request for Additional Information Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 7.2-36, Supplement 1**

Enclosures 1 and 2 contain the subject GE Hitachi Nuclear Energy (GEH) follow-up response to the supplemental RAI response provided in the Reference 1 letter. Additional partial follow-up responses to the subject RAI response were also provided in References 2 and 3.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Joseph Savage

for James C. Kinsey
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 07-015, Supplement 1, Letter from James C. Kinsey to U.S. Nuclear Regulatory Commission, *Response to NRC Request for Additional Information Email A. Howe (NRC) to D. Hinds (GE), Dated November 16, 2006 Related to ESBWR Design Certification Application - Instrumentation and Control - RAI Number 7.2-36, Supplement 1,* May 15, 2007
2. MFN 07-535, *ESBWR Instrumentation Setpoint Methodology -- Supplemental Response to RAI 7.2-36, Supplement 1*, October 23, 2007
3. MFN 07-536, *Response to Portion of NRC Request for Additional Information Letter No. 97 and email Dated April 24, 2007 Related to ESBWR Design Certification Application – Technical Specifications – RAI Numbers 7.1-30 Supplement 1, 16.2-146, and 16.2-149*, November 12, 2007

Enclosure:

1. MFN 07-015, Supplement 2 - RAI Number 7.2-36, Supplement 1 Follow-up Response
2. MFN 07-015, Supplement 2 - RAI Number 7.2-36, Supplement 1 Follow-up Response

cc:	AE Cubbage	USNRC (with enclosure)
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Enclosure 1

MFN 07-015, Supplement 2

RAI Number 7.2-36, Supplement 1
Follow-up Response

RAI 7.2-36, Supplement 1

(Partial Extract Only -- providing the commitments made in the "DCD Impact" section. For complete RAI 7.2-36, Supplement 1 response refer to MFN 07-015, Supplement 1.)

DCD Impact

SL-related Functions will be identified in Revision 4 of the ESBWR DCD Chapter 16 by inclusion of new Footnote addressing the Notes discussed in Item #3 of this RAI. The basis for determining a Function is a SL-related Function will be provided in the Bases for that Function. The instrumentation Table columns indicating "Setting Basis" will be revised to reflect "Allowable Value" and the Administrative Controls Program 5.5.11, "Setpoint Control Program," will be deleted.

GEH Follow-up Response

The "GEH ABWR/ESBWR Setpoint Methodology," NEDE-33304-P, was submitted in MFN 07-535, dated October 23, 2007. The ESBWR DCD changes, appropriate for incorporating this setpoint methodology, were included in response to RAI 16.2-146 and RAI 16.2-149 in MFN 07-536, November 12, 2007. These two submittals (MFN 07-535 and MFN 07-536) incorporated the appropriate technical content of the ESBWR setpoint methodology outlined in response to RAI 7.2-36, Supplement 1, from MFN 07-015, Supplement 1.

As shown above, the DCD Impact description in the previous response to RAI 7.2-36, Supplement 1 (MFN 07-015, Supplement 1, dated May 15, 2007), outlined four commitments to Technical Specification (TS) changes. Three of the four commitments [i.e., (a) the addition of instrument calibration "notes" associated with safety limit (SL) related Functions, (b) addition of Bases rationale for determining which Functions are SL-related, and (c) the removal of the TS 5.5.11, "Setpoint Control Program (SCP)"] were addressed in response to RAI 16.2-146 and RAI 16.2-149, in MFN-07-536.

The remaining commitment was that "The instrumentation Table columns indicating 'Setting Basis' will be revised to reflect 'Allowable Value'." This remaining commitment is the scope of this follow-up response to RAI 7.2-36, Supplement 1. Enclosure 2 presents the DCD Tier 2, Chapter 16 and Chapter 16B changes revising the instrumentation Table columns to reflect 'Allowable Value'.

DCD Impact

See Enclosure 2 for the DCD Tier 2 changes.

Enclosure 2

MFN 07-015, Supplement 2

RAI Number 7.2-36, Supplement 1
Follow-up Response

Table 3.3.1.1-1 (page 1 of 2)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE~~SETTING BASIS~~
1. Neutron Monitor System Input - Startup Range Neutron Monitors	2	G	SR 3.3.1.1.2	NA
	6(a)	H	SR 3.3.1.1.2	NA
2. Neutron Monitor System Input - Average Power Range Monitors / Oscillation Power Range Monitors	1,2	G	SR 3.3.1.1.2	NA
3. Control Rod Drive Accumulator Charging Water Header Pressure - Low	1,2	G	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3	≥ {~~12.75~~ MPa G (~~1850~~ psig)}
	6(a)	H	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3	≥ {~~12.75~~ MPa G (~~1850~~ psig)}
4. Reactor Vessel Steam Dome Pressure - High	1,2	G	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≤ {~~7.619~~ MPa G (~~1105~~ psig)}
5. Reactor Vessel Water Level - Low, Level 3	1,2	G	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≥ {~~19.78~~ m (~~778.7~~ inches)}
6. Reactor Vessel Water Level - High, Level 8	≥ 25% RTP	E	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≤ {~~21.89~~ m (~~861.8~~ inches)}
7. Main Steam Isolation Valve - Closure (Per Steam Line)	1	F	SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≥ {~~85~~}% open

(a) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

Table 3.3.1.1-1 (page 2 of 2)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE~~SETTING BASIS~~
8. Drywell Pressure - High	1,2	G	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≤ {~~13.8~~ kPaG (~~2.0~~ psig)}
9. Suppression Pool Temperature - High	1,2	G	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≤ {~~48.9~~°C (~~120~~)°F}
10. Turbine Stop Valve Closure Trip	≥ {40}% RTP	D	SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≥ {~~85~~}% open
11. Turbine Control Valve Fast Closure Trip Oil Pressure - Low	≥ {40}% RTP	D	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≥ { Mpa G (psig)}
12. Main Condenser Pressure - High	1	G	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≤ { MPa G (psig)}
13. Power Generation Bus Loss	1	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.3 SR 3.3.1.1.4	≥ { } V

Table 3.3.1.4-1 (page 1 of 2)
Neutron Monitoring System (NMS) Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER REQUIRED DIVISION	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING BASIS~~
1. Startup Range Neutron Monitors (SRNM)					
a. Neutron Flux - High	2	2	E	SR 3.3.1.4.1 SR 3.3.1.4.3 SR 3.3.1.4.5 SR 3.3.1.4.7	≤ {~~45~~}% RTP
	6[(a)]	2	G	SR 3.3.1.4.1 SR 3.3.1.4.3 SR 3.3.1.4.5 SR 3.3.1.4.7	≤ { }% RTP
b. Neutron Flux - Short Period	2	2	E	SR 3.3.1.4.1 SR 3.3.1.4.3 SR 3.3.1.4.5 SR 3.3.1.4.7	≥ {~~10~~} second period
c. Inop	2	2	E	SR 3.3.1.4.3	N/A
	6[(a)]	2	G	SR 3.3.1.4.3	N/A

(a) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

Table 3.3.1.4-1 (page 2 of 2)
Neutron Monitoring System (NMS) Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER REQUIRED DIVISION	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING BASIS~~
2. Average Power Range Monitors					
a. Fixed Neutron Flux - High, Setdown	2	1	E	SR 3.3.1.4.1 SR 3.3.1.4.3 SR 3.3.1.4.4 SR 3.3.1.4.5 SR 3.3.1.4.7	≤ {~~15~~}% RTP
b. APRM Simulated Thermal Power - High	1	1	D	SR 3.3.1.4.1 SR 3.3.1.4.2 SR 3.3.1.4.3 SR 3.3.1.4.4 SR 3.3.1.4.5 SR 3.3.1.4.6 SR 3.3.1.4.7	≤ {~~115~~}% RTP
c. Fixed Neutron Flux - High	1	1	D	SR 3.3.1.4.1 SR 3.3.1.4.2 SR 3.3.1.4.3 SR 3.3.1.4.4 SR 3.3.1.4.5 SR 3.3.1.4.7	≤ {~~120~~}% RTP
d. Inop	1,2	1	E	SR 3.3.1.4.3	N/A
3. Oscillation Power Range Monitor - Upscale	1,2	1	F	SR 3.3.1.4.3 SR 3.3.1.4.5 SR 3.3.1.4.7	As specified in the COLR

Table 3.3.5.1-1 (page 1 of 1)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING BASIS~~
1. Reactor Vessel Water Level - Low, Level 1	1,2,3,4,5,6[(a)]	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.4	≥ {~~11.50~~ m (~~452.8~~ inches)}
2. Reactor Vessel Water Level - Low, Level 0.5	1,2,3,4	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.4	≥ {~~8.45~~ m (~~332.7~~ inches)}

(a) Except with the new fuel pool gate removed and water level ≥ 7.01 meters (23.0 feet) over the top of the reactor pressure vessel flange.

Table 3.3.5.3-1 (page 1 of 1)
Isolation Condenser System (ICS) Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING BASIS~~
1.	Reactor Vessel Steam Dome Pressure - High	1,2,3,4,5	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4	≤ {~~7.447~~ MPaG (~~1080~~) psig}
2.	Reactor Vessel Water Level - Low, Level 2	1,2,3,4,5	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4	≥ {~~16.05~~ m (~~631.9~~) inches}
3.	Reactor Vessel Water Level - Low, Level 1	1,2,3,4,5	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4	≥ {~~11.50~~ m (~~452.8~~) inches}
4.	Main Steam Isolation Valve - Closure	1	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4	≥ {~~92~~}% open
5.	Power Generation Bus Loss	1	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4	≥ { } V

Table 3.3.6.1-1 (page 1 of 1)
MSIV Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING BASIS~~
1. Reactor Vessel Water Level - Low, Level 2	1,2,3,4	E	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.4	≥ {~~16.05~~ m (~~631.9~~ inches)}
2. Reactor Vessel Water Level - Low, Level 1	1,2,3,4	E	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.4	≥ {~~11.50~~ m (~~452.8~~ inches)}
3. Main Steam Line Pressure - Low	1	D	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.4	≥ {~~5.17~~ MPaG (~~750~~ psig)}
4. Main Steam Line Flow - High (Per Steam Line)	1,2,3,4	E	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.4	≤ {~~140~~}%
5. Condenser Pressure - High	1,2[a],3[a],4[a]	E	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.4	≤ { MPaG (psig)}
6. Main Steam Tunnel Ambient Temperature - High	1,2,3,4	E	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.4	≤ { °C (°F)}
7. Main Steam Turbine Area Ambient Temperature - High	1,2,3,4	E	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.4	≤ { °C (°F)}

{(a) With any turbine stop valve not closed.}

Table 3.3.6.3-1 (page 1 of 2)
Isolation Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING BASIS~~
1. Reactor Vessel Water Level - Low, Level 2	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≥ {~~16.05~~ m (~~631.9~~ inches)}
	5,6	H	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≥ {~~16.05~~ m (~~631.9~~ inches)}
2. Reactor Vessel Water Level - Low, Level 1	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≥ {~~11.50~~ m (~~452.8~~ inches)}
3. Drywell Pressure - High	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	{≤ kPaG (psig)}
4. Main Steam Line Pressure - Low	1	E	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≥ {~~5.17~~ MPaG (~~750~~ psig)}
5. Main Steam Line Flow - High (Per Steam Line)	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ {~~140~~}%
6. Condenser Pressure - High	1,2[(a)],3[(a)],4[(a)]	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { MPaG (psig)}
7. Main Steam Tunnel Ambient Temperature - High	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { °C (°F)}

(a) With any turbine stop valve not closed.

Table 3.3.6.3-1 (page 2 of 2)
Isolation Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING BASIS~~
8. Main Steam Turbine Area Ambient Temperature - High	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { °C (°F)}
9. RWCU/SDC System Differential Mass Flow - High (Per RWCU/SDC subsystem)	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { kg/s (lbm/s)}
	5,6	H	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { kg/s (lbm/s)}
10. Isolation Condenser Steam Line Flow - High (Per Isolation Condenser)	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { }%
11. Isolation Condenser Condensate Return Line Flow - High (Per Isolation Condenser)	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { }%
12. Isolation Condenser Pool Vent Discharge Radiation - High (Per Isolation Condenser)	1,2,3,4	D	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { Bq/hr (mR/hr)}
13. {Feedwater Line Differential Pressure - High	1,2,3,4	F	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.3 SR 3.3.6.3.4	≤ { kPaD (psid)}}

Table 3.3.7.1-1 (page 1 of 1)
Control Room Habitability Area Heating, Ventilation, and Air Conditioning Subsystem (CRHAVS) Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE ~~SETTING~~ ~~BASIS~~
1. Control Room Air Intake Radiation – High (per train)	1,2,3,4,5[a],6[a]	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.3	≤ { } Bq/hr ({ } mR/hr)
2. Emergency Filter Unit (EFU) Air Flow - Low (per train)	1,2,3,4,5[a],6[a]	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.3	≥ { } l/s ({ } cfm)

(a) During operations with a potential for draining the reactor vessel (OPDRVs).

B 3.3 INSTRUMENTATION

B 3.3.1.1 Reactor Protection System (RPS) Instrumentation

BASES

BACKGROUND

The RPS is designed to initiate a reactor scram when one or more monitored parameters exceed their specified limit, to preserve the integrity of the fuel cladding and the Reactor Coolant System (RCS), and minimize the energy that must be absorbed following a loss of coolant accident (LOCA). This can be accomplished either automatically or manually.

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

Technical Specifications are required by 10 CFR 50.36 to contain LSSS defined by the regulation as "...settings for automatic protective devices related to those variables having significant safety functions." Where LSSS is specified for a variable on which a Safety Limit (SL) has been placed, the setting must be chosen such that automatic protective action will correct the abnormal situation before a SL is exceeded. The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. Where LSSS is specified for a variable having a significant safety function but which does not protect SLs, the setting must be chosen such that automatic protective actions will initiate consistent with the design basis. The Design Limit is the limit of the process variable at which a safety action is initiated to ensure that these automatic protective devices will perform their specified safety function. ~~These limits (i.e., Analytical Limit and Design Limit) constitute the Setting Basis specified in Table 3.3.1.1-1.~~

The actual settings for automatic protective devices must be chosen to be more conservative than the Analytical / Design Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The methodology for determining the actual settings, and the required tolerances to maintain these settings conservative to the Analytical / Design Limits, including the requirements for determining that the channel is OPERABLE, are defined in the Setpoint Control Program (SCP), in accordance with Specification 5.5.11, Setpoint Control Program (SCP)."

BASES

BACKGROUND (continued)

However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value is specified in the SCP, as required by Specification 5.5.11, in order to define OPERABILITY of the devices and is designated as the Allowable Value which is the least conservative value of the as-found setpoint that a channel can have during CHANNEL CALIBRATION. The actual NTSP values and Allowable Values, ~~(derived from the Setting Basis specified in Table 3.3.1.1-1)~~ and the methodology for calculating the "leave alone" and "as-found" tolerances will be maintained in the SCP, as required by Specification 5.5.11.

The Allowable Valuable is the least conservative value that the setpoint of the channel can have when tested such that a channel is OPERABLE if the setpoint is found conservative with respect to the Allowable Value during the CHANNEL CALIBRATION. Note that, although a channel is OPERABLE under these circumstances, the setpoint must be left adjusted to a value within the established "leave alone" tolerance of the NTSP and confirmed to be operating within the statistical allowances of the uncertainty terms assigned in the setpoint calculation. As such, the Allowable Value differs from the NTSP by an amount equal to or greater than the "as-found" tolerance value. In this manner, the actual setting of the device will ensure that a SL is not exceeded or that automatic protective actions will initiate consistent with the design basis at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. If the actual setting of the device is found to be non-conservative with respect to the Allowable Value the device would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

The RPS, as shown in Reference 1, is divided into four redundant divisions of sensor (instrument) channels, trip logics and trip actuators, and two divisions of manual scram controls and scram logic circuitry. The sensor channels, divisions of trip logic, divisions of trip actuators, and associated portions of the divisions of scram logic circuitry together constitute the RPS automatic scram and air header dump (backup scram) initiation logic. The divisions of manual scram controls and associated portions of the divisions of scram logic circuitry together constitute the RPS manual scram and air header dump initiation logic. The automatic and manual scram initiation logics are independent of each other and use diverse methods and equipment to initiate a reactor scram.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

RPS Instrumentation satisfies the requirements of Selection Criterion 3 of 10 CFR 50.36(c)(2)(ii). Functions not specifically credited in the accident analysis are retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

The OPERABILITY of the RPS is dependent on the OPERABILITY of the individual RPS instrumentation Functions specified in Table 3.3.1.1-1. Each Function must have the required number of OPERABLE channels, with their setpoints in accordance with the SCP, where appropriate. The actual setpoint is calibrated consistent with the SCP. Each channel must also respond within its assumed response time.

~~The Setting Basis, from which the NTSPs and~~ Allowable Values are ~~derived is~~ specified for each RPS Function, where appropriate, in Table 3.3.1.1-1. NTSPs ~~and Allowable Values~~ are specified in the SCP, as required by Specification 5.5.11. The NTSPs are selected to ensure the actual setpoints are conservative with respect to the Allowable Value between successive CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the NTSP, but conservative with respect to its Allowable Value, is acceptable. A channel is inoperable if its actual trip setpoint is non-conservative with respect to its required Allowable Value.

NTSPs are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g., DTM) changes state. For those LSSS related to variables protecting SLs, the Analytical Limits are derived from the limiting values of the process parameters obtained from the safety analysis. For those LSSS related to variables having significant safety functions but which do not protect SLs, the Design Limits are those settings that must initiate automatic protective actions consistent with the design basis. The Allowable Values are derived from the Analytical / Design Limits, corrected for calibration, process and some of the instrument errors. The NTSPs are then determined, accounting for the remaining instrument errors (e.g., drift). The trip setpoints derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3. Control Rod Drive Accumulator Charging Water Header Pressure - Low

To maintain the continuous ability to scram, the charging water header maintains the hydraulic scram accumulators at a high pressure. The scram valves under this condition remain closed, so that no flow passes through the charging water header. Pressure in the charging water header is monitored. The Control Rod Drive Accumulator Charging Water Header Pressure - Low Function initiates a scram if a significant degradation in the charging water header pressure occurs. During a scram, the water discharge from the accumulators goes into the reactor, and thus against reactor pressure. Therefore, fully charged hydraulic control units (HCUs) are essential for assuring reactor scram. After a reactor scram, this Function can be bypassed from the operator's console to reset the RPS, allowing the scram valves to close and the HCUs to be re-pressurized.

Low charging header pressure signals are initiated from four pressure sensors located at the charging header. The Control Rod Drive Accumulator Charging Water Header Pressure—Low Allowable ValueAnalytical / Design Limit is chosen to provide sufficient margin to the capability to scram.

Three channels of Control Rod Drive Accumulator Charging Water Header Pressure - Low Function are required to be OPERABLE to ensure no single instrument failure will preclude a scram from this Function on a valid signal. The Function is required to be OPERABLE when the scram capability is required in MODES 1 and 2, and MODE 6 with any control rod withdrawn from a core cell containing one or more fuel assemblies.

4. Reactor Vessel Steam Dome Pressure - High

An increase in the Reactor Pressure Vessel (RPV) pressure during reactor operation compresses the steam voids and results in a positive reactivity insertion. This causes the neutron flux and THERMAL POWER transferred to the reactor coolant to increase, which could challenge the integrity of the fuel cladding and the integrity of the Reactor Coolant System (RCS) pressure boundary. No specific safety analysis takes direct credit for this Function. However, the Reactor Vessel Steam Dome Pressure - High Function initiates a scram for transients that result in a pressure increase, counteracting the pressure increase by rapidly reducing core power. For the overpressurization protection analysis, the APRM Fixed Neutron Flux - High Function is assumed to terminate the

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

MSIV Closure event and, along with the safety relief valves, limits the peak RPV pressure to less than the ASME Code limits.

High reactor pressure signals are initiated from four pressure transmitters that sense reactor pressure. The Reactor Vessel Steam Dome Pressure - High Allowable Value~~Analytical / Design Limit~~ is chosen to provide a sufficient margin to the ASME Section III Code limits during the event.

Three channels of Reactor Vessel Steam Dome Pressure - High Function are required to be OPERABLE to ensure no single instrument failure will preclude a scram from this Function on a valid signal. The Function is required to be OPERABLE in MODES 1 and 2 when the Reactor Coolant System is pressurized and the potential for pressure increase exists.

<u>5. Reactor Vessel Water Level - Low, Level 3</u>

Low Reactor Vessel (RPV) water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, a reactor scram is initiated at Level 3 to substantially reduce the heat generated in the fuel from fission. The Reactor Vessel Water Level - Low, Level 3 Function is assumed to be available in various design basis line break analyses and in loss of feedwater events, however it is a secondary scram signal to Loss of Power Generation Bus. The reactor scram reduces the amount of energy required to be absorbed and assures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Reactor Vessel Water Level - Low, Level 3, signals are initiated from four differential pressure transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

Three channels of Reactor Vessel Water Level - Low, Level 3, Function are required to be OPERABLE to ensure no single instrument failure will preclude a scram from this Function on a valid signal.

The Reactor Vessel Water Level - Low, Level 3 Allowable Value~~Analytical / Design Limit~~ is selected to ensure that for transients involving loss of all normal feedwater flow, the core will not be uncovered.

The Function is required in MODES 1 and 2 where considerable energy exists in the reactor coolant system resulting in the limiting transients and accidents.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

6. Reactor Vessel Water Level - High, Level 8

High RPV water level indicates a potential problem with the feedwater level control system, resulting in the addition of reactivity associated with the introduction of a significant amount of relatively cold feedwater. Therefore, a scram is initiated at Level 8 to ensure the safety analyses are met. The Reactor Vessel Water Level - High, Level 8 Function is directly assumed in the analysis of feedwater controller failure, maximum demand (Ref. 5).

Reactor Vessel Water Level - High, Level 8, signals are initiated from four differential pressure transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. The Reactor Vessel Water Level - High, Level 8 Allowable ValueAnalytical / Design Limit is specified to ensure the safety analyses criteria are met.

Three channels of the Reactor Vessel Water Level - High, Level 8, are required to be OPERABLE when THERMAL POWER is ≥ 25% RTP to ensure no single instrument failure will preclude a scram from this Function on a valid signal. With THERMAL POWER < 25% RTP, this Function is not required since MCPR is not a concern below 25% RTP.

7. Main Steam Isolation Valve - Closure (Per Steam Line)

Main Steam Isolation Valve (MSIV) closure results in loss of the main turbine and the condenser as a heat sink for the nuclear steam supply system and indicates a need to shut down the reactor to reduce heat generation. Therefore, a reactor scram is initiated on a MSIV closure signal before the MSIVs are completely closed in anticipation of the complete loss of the normal heat sink and subsequent overpressurization transient. However, for the overpressurization protection analysis of Reference 6, the Average Power Range Monitor Fixed Neutron Flux - High Function, along with the safety relief valves, limits the peak RPV pressure to less than the ASME Code limits. That is, the direct scram on position switches for MSIV closure events is not assumed in the overpressurization analysis. Additionally, MSIV closure is assumed in the transients analyzed in References 7 and 8 . The reactor scram reduces the amount of energy required to be absorbed and, along with the actions of the Isolation Condenser System (ICS), assures that the safety analyses assumptions are met.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

MSIV closure signals are initiated from position switches located on each of the eight MSIVs. On each MSL, two position switches are mounted on the inboard MSIV and two position switches are mounted on the outboard MSIV. Each of the position switches on any one MSL is associated with a different RPS divisional sensor channel. {The logic for the Main Steam Isolation Valve - Closure Function is arranged such that either the inboard or outboard valve on two or more of the main steam lines (MSLs) must close in order for a scram to occur.}

The Main Steam Isolation Valve - Closure (per Steam Line) Function Allowable Value~~Analytical / Design Limit~~ is specified to ensure that a scram occurs prior to a significant reduction in steam flow, thereby reducing the severity of the subsequent pressure transient.

Three channels of Main Steam Isolation Valve - Closure (per Steam Line) Function are required to be OPERABLE to ensure no single instrument failure will preclude the scram from this Function on a valid signal. This Function is only required in MODE 1 because with the MSIVs open and the heat generation rate high, a pressurization transient can occur if the MSIVs close. In MODE 2 the heat generation rate is low enough that the other diverse RPS Functions provide sufficient protection.

8. Drywell Pressure - High

High pressure in the drywell could indicate a break in the Reactor Coolant System pressure boundary. A reactor scram is initiated to minimize the possibility of fuel damage and to reduce the amount of energy being added to the coolant and to the drywell. The Drywell Pressure - High Function is assumed to be available for LOCA events inside the drywell and is credited in the inadvertent operation of a depressurization valve. High drywell pressure signals are initiated from four pressure transmitters that sense drywell pressure. The Allowable Value~~Analytical / Design Limit~~ was selected to be as low as possible and be indicative of a LOCA inside the drywell or an opened depressurization valve.

Three channels of Drywell Pressure - High Function are required to be OPERABLE to ensure no single instrument failure will preclude a scram from this Function on a valid signal. The Function is required in MODES 1 and 2 where considerable energy exists in the reactor coolant system resulting in the limiting transients and accidents.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

9. Suppression Pool Temperature - High

High temperature in the suppression pool could indicate a break in the RCS pressure boundary or an opened safety relief valve. A reactor scram is initiated to reduce the amount of energy being added to the containment. The Suppression Pool Temperature - High Function is taken credit for in the analysis of an inadvertent opening of a safety relief valve (Reference 9).

High suppression pool temperature signals are initiated from four divisions of temperature sensors located in the suppression pool. Four channels of safety-related divisional temperature signals, each formed by the average value of a group of thermocouples installed evenly inside the suppression pool, provide the suppression pool temperature data for automatic scram initiation. When the established limits of high temperature are exceeded in two of the four divisions, a scram initiation and indication signals are generated. The temperature sensors provide analog output signals to the RMU, which in turn provides the equivalent digital signal to the appropriate DTM. The temperature sensors are components of the Containment Monitoring System (CMS). The suppression pool water level signals are provided along with the suppression pool temperature signals. When water level drops below selected temperature sensors, the exposed sensors are logically bypassed such that only sensors below the water level are utilized to determine the averaged temperature signal to the RPS.

The Allowable Value~~Analytical / Design Limit~~ was selected considering the maximum operating temperature and to be indicative of an inadvertently opened safety relief valve.

Three channels of Suppression Pool Temperature - High Function are required to be OPERABLE to ensure no single instrument failure will preclude a scram from this Function on a valid signal. There are a total of sixty-four suppression pool temperature switches that make up the four channels of Suppression Pool Temperature - High Function (sixteen suppression pool temperature switches per channel). For a channel of the Suppression Pool Temperature - High Function to be OPERABLE, {12} of the sixteen assigned Suppression Pool Temperature switches must be OPERABLE. The Function is required in MODES 1 and 2 where considerable energy exists in the reactor coolant system.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

10. Turbine Stop Valve - Closure

Closure of the turbine stop valves (TSV) results in the loss of a heat sink that produces reactor pressure, neutron flux, and heat flux transients that must be limited. Therefore, a reactor scram is initiated at the start of TSV closure in anticipation of the transients that would result from the closure of these valves with insufficient turbine bypass valve capacity available. The Turbine Stop Valve - Closure Function is the primary scram signal for the turbine trip event analyzed in Reference 10. For this event, the reactor scram reduces the amount of energy required to be absorbed and ensures that the fuel cladding integrity Safety Limit is not exceeded.

Turbine Stop Valve - Closure signals are initiated by the separate valve stem position switches on each of the four turbine stop valves. Each position switch provides open/close contact output signal through hard-wired connection to the DTM in one of the four RPS sensor channels. The logic for the Turbine Stop Valve Closure Function is such that {three or more} TSVs must be closed to produce a scram. The Function is enabled at THERMAL POWER > {40}% RTP. This is accomplished automatically by an analog simulated thermal power signal from the NMS. This Function is also automatically bypassed if sufficient turbine bypass valves are open within a preset time delay after the initiation of the trip signal. The analog simulated thermal power signal from NMS is also used to determine the required bypass capacity.

The Turbine Stop Valve - Closure Allowable Value~~Analytical / Design Limit~~ is selected to be high enough to detect imminent TSV closure thereby reducing the severity of the subsequent pressure transient.

Three channels of Turbine Stop Valve - Closure Function are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function even if one TSV should fail to close. This Function is required, consistent with analysis assumptions, whenever THERMAL POWER is ≥ {40% RTP. This Function is not required when THERMAL POWER is < {40}% RTP since the Reactor Steam Dome Pressure - High and the Average Power Range Monitor Fixed Neutron Flux - High Functions are adequate to maintain the necessary safety margins.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

11. Turbine Control Valve Fast Closure, Trip Oil Pressure - Low

Fast closure of the turbine control valves (TCVs) results in the loss of a heat sink that produces reactor pressure, neutron flux, and heat flux transients that must be limited. Therefore, a reactor scram is initiated on TCV fast closure in anticipation of the transients that would result from the closure of these valves with insufficient turbine bypass valve capacity available. The Turbine Control Valve Fast Closure, Trip Oil Pressure - Low Function is the primary scram signal for the generator load rejection event analyzed in Reference 11. For this event, the reactor scram reduces the amount of energy required to be absorbed and ensures that the fuel cladding integrity Safety Limit is not exceeded.

Turbine Control Valve Fast Closure, Trip Oil Pressure - Low signals are initiated by the hydraulic trip system pressure at each control valve. There is one pressure transmitter associated with each control valve. Each pressure transmitter provides a signal through hard-wired connections to the DTM in each of the four RPS sensor channels. This Function must be enabled at THERMAL POWER ≥ {40}% RTP. This is accomplished automatically by an analog simulated thermal power signal from NMS. This Function is automatically bypassed if sufficient turbine bypass valves are open within a preset time delay after the initiation of the trip signal. The analog simulated thermal power signal from NMS is also used to determine the required bypass capacity.

The Turbine Control Valve Fast Closure, Trip Oil Pressure - Low Allowable Value~~Analytical / Design Limit~~ is selected high enough to detect imminent TCV fast closure.

Three channels of Turbine Control Valve Fast Closure, Trip Oil Pressure - Low Function, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. This Function is required, consistent with the analysis assumptions, whenever THERMAL POWER is ≥ {40}% RTP. This Function is not required when THERMAL POWER is < {40}% RTP since the Reactor Vessel Steam Dome Pressure - High and the Average Power Range Monitor Fixed Neutron Flux - High Functions are adequate to maintain the necessary safety margins.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

12. Main Condenser Pressure - High

The Main Condenser Pressure - High Function is provided to help ensure the fuel cladding integrity Safety Limit is not exceeded by reducing the core energy in anticipation that the high condenser pressure will also trip the main turbine and prevent bypass valve operation. The Main Condenser Pressure - High Function is the primary scram signal for the loss of condenser vacuum event analyzed in Reference 12. For this event, the reactor scram reduces the amount of energy required to be absorbed by the main condenser and helps to ensure the fuel cladding integrity Safety Limit is not exceeded by reducing the core energy prior to the fast closure of the turbine stop valves. The reactor scram at Main Condenser Pressure - High will initiate to shut off steam flow to the main condenser to protect the main turbine and to avoid the potential for rupturing the low-pressure turbine casing.

Main condenser pressure signals are derived from four pressure switches that sense the pressure in the condenser. Each pressure transmitter provides an analog output signal through hard-wired connections to the DTM in each of the four RPS sensor channels. The Allowable Value~~Analytical / Design Limit~~ was selected to reduce the severity of a loss of main condenser vacuum event by anticipating the transient and scramming the reactor at a higher vacuum than the setpoints that close the turbine stop valves and bypass valves.

Three channels of Main Condenser Pressure - High Function are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. The Function is required in MODE 1 2 since, in this MODE, a significant amount of core energy can be rejected to the main condenser.

13. Power Generation Bus Loss

The plant electrical system has four redundant power generation busses that operate at 13.8 kV. These busses supply power for the feedwater pumps and circulating pumps. In MODE 1, at least three of the four busses must be powered. Power generation bus loss signals are derived from four voltage sensors. If the voltage sensor (one per division) on each bus senses a low voltage below the required level, indicating that less than three buses are operating above the requirement level, a scram is initiated after a preset delay time. This delay time is to accommodate for the auto-transfer from the UAT transformer feed to the RAT transformer feed. When the power generation busses are not operating

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

at or above the required level, the feedwater pumps would be tripped and feedwater flow would be lost. Purpose of this scram on losing feedwater flow is to mitigate the reactor water level drop to Level 1 following the loss of feedwater pump function. This scram will terminate additional steam production within the vessel before Level 3 is reached.

The Allowable Value~~Analytical / Design Limit~~ was selected high enough to detect a loss of voltage in order to mitigate the reactor water level drop to Level 1 following the loss of feedwater pump function.

Three channels of Power Generation Bus Loss Function are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. The Function is required in MODE 1 where considerable energy exists in the reactor coolant system resulting in the limiting transients and accidents. During MODE 2, 3, 4, 5, and 6, the core energy is significantly lower.

ACTIONS

A Note has been provided to modify the ACTIONS related to RPS Instrumentation channels. Section 1.3, Completion Times, specifies once a Condition has been entered, subsequent divisions, subsystems, components or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the condition. However, the Required Actions for inoperable RPS Instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided which allows separate Condition entry for each inoperable RPS Instrumentation channel.

A.1

With one or more Functions with one required channel inoperable, the affected instrumentation division must be verified to be in trip. With the affected required instrumentation division in trip, all RPS Functions are in a one-out-of-two configuration.

Operation in the one-out-of-two configuration may continue indefinitely. In this configuration, the RPS is capable of performing its trip Function in the presence of any single random failure. The 12 hour Completion Time is sufficient to perform Required Action A.1 and has been shown to be acceptable by Reference 13.

B 3.3 INSTRUMENTATION

B 3.3.1.4 Neutron Monitoring System (NMS) Instrumentation

BASES

BACKGROUND

The NMS Instrumentation provides input to the Reactor Protection System (RPS) when sufficient instrumentation channels indicate a trip condition. The RPS is designed to initiate a reactor scram when one or more monitored parameters exceed their specified limit, to preserve the integrity of the fuel cladding and the Reactor Coolant System (RCS), and minimize the energy that must be absorbed following a loss of coolant accident (LOCA).

The protection and monitoring functions of the NMS have been designed to ensure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RPS, as well as LCOs on other reactor system parameters and equipment performance. Technical Specifications are required by 10 CFR 50.36 to contain LSSS defined by the regulation as "...settings for automatic protective devices related to those variables having significant safety functions." Where LSSS is specified for a variable on which a Safety Limit (SL) has been placed, the setting must be chosen such that automatic protective action will correct the abnormal situation before a SL is exceeded. The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. Where LSSS is specified for a variable having a significant safety function but which does not protect the SLs, the setting must be chosen such that automatic protective actions will initiate consistent with the design basis. The Design Limit is the limit of the process variable at which a safety function is initiated to ensure that these automatic protective devices will perform their specified safety function. ~~These limits (i.e., Analytical Limit and Design Limit) constitute the Setting Basis specified in Table 3.3.1.4-1.~~

The actual settings for automatic protective devices must be chosen to be more conservative than the Analytical / Design Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The methodology for determining the actual settings, and the required tolerances to maintain these settings conservative to the Analytical / Design Limits, including the requirements for determining that the channel is OPERABLE, are defined in the Setpoint Control Program (SCP), in accordance with Specification 5.5.11, "Setpoint Control Program (SCP)."

BASES

BACKGROUND (continued)

However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value is specified in the SCP, as required by Specification 5.5.11, in order to define OPERABILITY of the devices and is designated as the Allowable Value which is the least conservative value of the as-found setpoint that a channel can have during CHANNEL CALIBRATION. The actual NTSP values and Allowable Values, ~~(derived from the Setting Basis specified in Table 3.3.1.4-1)~~ and the methodology for calculating the "leave alone" and "as-found" tolerances will be maintained in the SCP, as required by Specification 5.5.11.

The Allowable Valuable is the least conservative value that the setpoint of the channel can have when tested such that a channel is OPERABLE if the setpoint is found conservative with respect to the Allowable Value during the CHANNEL CALIBRATION. Note that, although a channel is OPERABLE under these circumstances, the setpoint must be left adjusted to a value within the established "leave alone" tolerance of the NTSP and confirmed to be operating within the statistical allowances of the uncertainty terms assigned in the setpoint calculation. As such, the Allowable Value differs from the NTSP by an amount equal to or greater than the "as-found" tolerance value. In this manner, the actual setting of the device will ensure that a SL is not exceeded or that automatic protective actions will initiate consistent with the design basis at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. If the actual setting of the device is found to be non-conservative with respect to the Allowable Value the device would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

The NMS is composed of the startup range neutron monitor (SRNM) and the average power range monitor (APRM). SRNM trip signals and APRM trip signals from each of the four divisions of NMS equipment are provided to the four divisions of RPS trip logic (Ref. 1).

The SRNM provides trip signals to the RPS to cover the range of plant operation from source range through startup range (i.e., more than 10% of reactor rated power). Three SRNM conditions, monitored as a function of the NMS, comprise the SRNM trip logic output to the RPS. These conditions are as follows: SRNM Neutron Flux High (high count rate when selected to the non-coincidence mode or high flux level when selected to the coincidence mode); Neutron Flux Short (fast) Period; and

BASES

BACKGROUND (continued)

Digital Trip Modules and up to each of the NMS Trip Logic Units, which house the APRM/OPRM logic. LCO 3.3.1.5,"Neutron Monitoring System (NMS) Automatic Actuation" addresses OPERABILITY requirements for NMS automatic actuation for the SRNM and the APRM/OPRM.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The actions of the NMS in conjunction with RPS are assumed in the safety analyses of References 2 and 3.The NMS provides a trip signal to RPS when monitored parameter values exceed predetermined values specified in the SCP to preserve the integrity of the fuel cladding, preserve the integrity of the reactor coolant pressure boundary, and preserve the integrity of the containment by minimizing the energy that must be absorbed following a LOCA.

NMS Instrumentation satisfies the requirements of Selection Criterion 3 of 10 CFR 50.36(c)(2)(ii). Functions not specifically credited in the accident analysis are retained for the overall redundancy and diversity of the NMS and RPS as required by the NRC approved licensing basis.

The OPERABILITY of the NMS and RPS is dependent on the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.1.4-1. Each Function must have the required number of OPERABLE channels, with their setpoints in accordance with the SCP, where appropriate. The actual setpoint is calibrated consistent with the SCP. Each channel must also respond within its assumed response time.

~~The Setting Basis from which the NTSPs and~~ Allowable Values are ~~derived is~~ specified for each RPS Function, where appropriate, in Table 3.3.1.4-1. NTSPs ~~and Allowable Values~~ are specified in the SCP, as required by Specification 5.5.11. The NTSPs are selected to ensure the actual setpoints are conservative with respect to the Allowable Value between successive CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the NTSP, but conservative with respect to its Allowable Value, is acceptable. A channel is inoperable if its actual trip setpoint is non-conservative with respect to its required Allowable Value.

NTSPs are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g., digital trip module) changes state. For those

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Allowable Value ~~Analytical / Design Limit~~ for the Startup Range Neutron Monitor (SRNM) Neutron Flux -High and Neutron Flux - Short Period Functions is set to mitigate the consequences of a rod withdrawal error.

The SRNM Neutron Flux - High and the Neutron Flux - Short Period Functions must be OPERABLE during MODE 2 when control rods may be withdrawn and the potential for criticality exists. In MODE 1, the Average Power Range Monitor Fixed Neutron Flux - High Function and the automatic limit monitor (ATLM) provides protection against reactivity transients. The SRNM Neutron Flux - High Function is required to be OPERABLE in MODE 6 with any control rod withdrawn from a core cell containing one or more fuel assemblies. During normal operation in MODES 3, 4, and 5, all control rods are fully inserted and the Reactor Mode Switch - Shutdown Position control rod withdrawal block (LCO 3.3.2.1, "Control Rod Block Instrumentation") does not allow any control rod to be withdrawn. Control rods withdrawn from a core cell containing no fuel assemblies do not affect the reactivity of the core and therefore are not required to have the capability to scram. Provided all control rods otherwise remain inserted, the SRNM function is not required. In this condition the required SDM (LCO 3.1.1, "SHUTDOWN MARGIN") and refuel position one-rod /rod-pair-out interlock (LCO 3.9.2, "Refuel Position One-Rod/Rod-Pair-Out Interlock") ensures no event requiring RPS will occur. Under these conditions, the SRNM Function is not required to be OPERABLE.

1.c. SRNM - Inop

This trip signal provides assurance that a minimum number of SRNMs are OPERABLE. Anytime a SRNM detector high voltage drops below a preset level or when a module is disconnected an inoperative trip signal will occur unless the SRNM is bypassed.

This Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

Three divisional channels of the SRNM Inop Function, with two separate channels per division, are required to be OPERABLE to ensure no single instrument failure will preclude a scram from these Functions on a valid signal.

This Function is required to be OPERABLE when the SRNM Neutron Flux - High and the Neutron Flux - Short Period Functions are required.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.a. APRM Fixed Neutron Flux - High, Setdown

The APRM channels receive input signals from the LPRMs within the reactor core to provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than RATED THERMAL POWER. For operation at low power (i.e., MODE 2), the APRM Fixed Neutron Flux - High Setdown Function is capable of generating a trip signal that prevents fuel damage resulting from abnormal operating transients in this power range. For most operation at low power levels, the APRM Fixed Neutron Flux - High, Setdown Function will provide a secondary scram to the SRNM Neutron Flux - High Function because of the relative setpoints. With the SRNM near its high power range, it is possible that the APRM Fixed Neutron Flux - High, Setdown Function will provide the primary trip signal for a core wide increase in power.

The control rod withdrawal event during startup (Ref. 4) assumes the failure of the SRNM instrumentation and shows that the APRM Fixed Neutron Flux - High, Setdown Function is capable of maintaining the peak fuel enthalpy to within limits so that no fuel damage results. However, this Function indirectly ensures that before the reactor mode switch is placed in the run position, reactor power does not exceed {25%} RTP (Safety Limit 2.1.1.1) when operating at low reactor pressure and low core flow. It therefore indirectly prevents fuel damage during significant reactivity increases with THERMAL POWER < {25%} RTP.

Three channels of APRM Fixed Neutron Flux - High, Setdown are required to be OPERABLE to ensure no single failure will preclude a scram from this Function on a valid signal. In addition, to provide adequate coverage of the entire core, at least {40} LPRM inputs are required to be OPERABLE.

The Allowable Value ~~Analytical / Design Limit~~ is based on preventing significant increases in power when THERMAL POWER is < {25%} RTP.

The APRM Fixed Neutron Flux - High, Setdown Function must be OPERABLE during MODE 2 when control rods may be withdrawn. In MODE 1, the Average Power Range Monitor Fixed Neutron Flux - High Function and the automatic limit monitor (ATLM) provides protection against reactivity transients.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.b. APRM Simulated Thermal Power - High

The APRM Simulated Thermal Power - High Function monitors neutron flux to approximate the thermal power being transferred to the reactor coolant. The APRM simulated thermal power signal represents the APRM flux signal through a time constant representing the actual fuel time constant. The simulated thermal power signal accurately represents core thermal (as opposed to neutron flux) power and the heat flux through the fuel. The signal is fixed at an upper limit that is always lower than the APRM Fixed Neutron Flux - High Function Setpoint. The APRM Simulated Thermal Power - High Function provides protection against transients where thermal power increases slowly (such as the Loss of Feedwater Heating event) however this Function is not credited. During these events, the thermal power increase does not significantly lag the neutron flux response and, because of a lower trip setpoint, will initiate a scram before the high neutron flux scram. For rapid neutron flux increase events, the thermal power lags the neutron flux and the APRM Fixed Neutron Flux - High Function will provide a scram signal before the APRM Simulated Thermal Power - High Function setpoint is exceeded.

Three channels of APRM Simulated Thermal Power - High Function are required to be OPERABLE to ensure no single failure will preclude a scram from this Function on a valid signal.

The Allowable Value ~~Analytical / Design Limit~~ for the APRM Simulated Thermal Power - High Function is based on~~intended for~~ the mitigation of the Loss of Feedwater Heater event, however no credit is taken for this Function.

The thermal power time constant of less than seven seconds is based on the fuel heat transfer dynamics and provides a signal proportional to the thermal power.

The APRM Simulated Thermal Power - High Function is required to be OPERABLE in MODE 1 when there is the possibility of generating excessive thermal power and potentially exceeding the Safety Limit applicable to high pressure and core flow conditions (fuel cladding integrity Safety Limit). During MODES 2 and 6, other SRNM and APRM Functions provide protection for fuel cladding integrity.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.c. APRM Fixed Neutron Flux - High

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. For the overpressurization protection analysis of Reference 3, the APRM Fixed Neutron Flux - High Function is assumed to terminate the MSIV Closure event and, along with the safety/relief valves, limits the peak Reactor Pressure Vessel (RPV) pressure to less than the ASME Code limits. This Function is also credited in the pressure regulator failure event (Ref. 5)

Three channels of APRM Fixed Neutron Flux - High Function are required to be OPERABLE to ensure no single failure will preclude a scram from this Function on a valid signal. In addition, to provide adequate coverage of the entire core, at least {40} LPRM inputs are required to be OPERABLE.

The Allowable Value ~~Analytical / Design Limit~~ is ~~assumed in~~based on the overpressurization and pressure regulator failure event.

The APRM Fixed Neutron Flux - High Function is required to be OPERABLE in MODE 1 where the potential consequences of the analyzed transients could result in the Safety Limit (e.g., Reactor Vessel pressure) being exceeded. In MODE 2, the APRM Fixed Neutron Flux - High, Setdown Function and the SRNM trips provide adequate protection. Therefore, the APRM Fixed Neutron Flux - High Function is not required in MODE 2.

2.d. APRM - Inop

This signal provides assurance that a minimum number of APRMs are OPERABLE. {Anytime an APRM mode switch is moved to any position other than "Operate", an APRM module is disconnected, the electronics operating voltage is low, or the APRM has too few LPRM inputs (< {40}),} an inoperative trip signal will be received by the RPS, unless the APRM is bypassed.

This Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

Three channels of APRM - Inop are required to be OPERABLE to ensure no single failure will preclude a scram from this Function on a valid signal.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

There is no Allowable Value~~Analytical / Design Limit~~ for this Function.

This Function is required to be OPERABLE in the MODES where the APRM Functions are required.

3. Oscillation Power Range Monitor - Upscale

The Oscillation Power Range Monitor (OPRM) consists of four channels. The OPRM channel utilizes the same set of LPRM signals used by the associated APRM channel in which this OPRM channel resides and forms many OPRM cells to monitor the neutron flux behavior of all regions of the core. The LPRM signals assigned to each cell are summed and averaged to provide an OPRM signal for this cell. The OPRM trip protection algorithm detects thermal hydraulic instability (flux oscillation with unacceptable amplitude and frequency) and provides trip output to the RPS if the trip setpoint is exceeded.

Three channels of OPRM are required to be OPERABLE to ensure no single failure will preclude a scram from this Function on a valid signal. In addition, to provide adequate coverage of the entire core, at least {40} LPRM inputs are required to be OPERABLE.

The Allowable Value~~Analytical / Design Limit~~ specified in the COLR is based on preventing safety thermal limit violation and fuel damage in response to core neutron flux oscillation conditions and thermal-hydraulic instability.

The OPRM Function is required to be OPERABLE in MODES 1 and 2 to respond to core neutron flux oscillation conditions and thermal-hydraulic instability in time to prevent safety thermal limit violation and fuel damage. In MODES 3, 4, 5, and 6, core neutron flux oscillation conditions and thermal-hydraulic instability is not postulated to occur and therefore the monitors are not required to be OPERABLE.

ACTIONS

A Note has been provided to modify the ACTIONS related to NMS Instrumentation channels. Section 1.3, Completion Times, specifies once a Condition has been entered, subsequent divisions, subsystems, components or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies Required Actions of the Condition continue to apply for each additional failure, with Completion Times based

B 3.3 INSTRUMENTATION

B 3.3.5.1 Emergency Core Cooling System (ECCS) Instrumentation

BASES

BACKGROUND

The purpose of the ECCS instrumentation is to initiate appropriate responses from the ECCS to ensure that fuel is adequately cooled in the event of an anticipated operational occurrence or accident.

The ECCS instrumentation actuates the Automatic Depressurization System (ADS), the Gravity-Driven Cooling System (GDCS), and Standby Liquid Control (SLC). The equipment involved with ADS is described in the Bases for LCO 3.5.1, "ADS - Operating." The equipment involved with GDCS is described in the Bases for LCO 3.5.2, "GDCS - Operating." The equipment involved with SLC is described in the Bases for LCO 3.1.7, "Standby Liquid Control (SLC) System."

Technical Specifications are required by 10 CFR 50.36 to contain limiting safety system settings (LSSS) defined by the regulation as "...settings for automatic protective devices related to those variables having significant safety functions." Where LSSS is specified for a variable on which a Safety Limit (SL) has been placed, the setting must be chosen such that automatic protective action will correct the abnormal situation before a SL is exceeded. The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. Where LSSS is specified for a variable having a significant safety function but which does not protect SLs, the setting must be chosen such that automatic protective actions will initiate consistent with the design basis. The Design Limit is the limit of the process variable at which a safety action is initiated to ensure that these automatic protective devices will perform their specified safety function. ~~These limits (i.e., Analytical Limit and Design Limit) constitute the Setting Basis specified in Table 3.3.5.1-1.~~

The actual settings for automatic protective devices must be chosen to be more conservative than the Analytical / Design Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The methodology for determining the actual settings, and the required tolerances to maintain these settings conservative to the Analytical / Design Limits, including the requirements for determining that the channel is OPERABLE, are defined in the Setpoint Control Program (SCP), in accordance with Specification 5.5.11, Setpoint Control Program (SCP)."

BASES

BACKGROUND (continued)

Use of the NTSP to define "as-found" OPERABILITY under the expected circumstances described above would result in actions required by both the rule and Technical Specifications that are clearly not warranted. However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value is specified in the SCP, as required by Specification 5.5.11, in order to define OPERABILITY of the devices and is designated as the Allowable Value which is the least conservative value of the as-found setpoint that a channel can have during CHANNEL CALIBRATION. The actual NTSP values and Allowable Values, ~~(derived from the Setting Basis specified in Table 3.3.5.1-1)~~ and the methodology for calculating the "leave alone" and "as-found" tolerances will be maintained in the SCP, as required by Specification 5.5.11.

The Allowable Valuable is the least conservative value that the setpoint of the channel can have when tested such that a channel is OPERABLE if the setpoint is found conservative with respect to the Allowable Value during the CHANNEL CALIBRATION. Note that, although a channel is OPERABLE under these circumstances, the setpoint must be left adjusted to a value within the established "leave alone" tolerance of the NTSP and confirmed to be operating within the statistical allowances of the uncertainty terms assigned in the setpoint calculation. As such, the Allowable Value differs from the NTSP by an amount equal to or greater than the "as-found" tolerance value. In this manner, the actual setting of the device will ensure that a SL is not exceeded or that automatic protective actions will initiate consistent with the design basis at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. If the actual setting of the device is found to be non-conservative with respect to the Allowable Value the device would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

As described in Reference 1, the Safety System Logic and Control (SSLC) System controls the initiation signals and logic for ECCS. SSLC is a four-division, separated protection logic system designed to provide a very high degree of assurance to both ensure ECCS initiation when required and prevent inadvertent initiation.

BASES

BACKGROUND (continued)

The load driver arrangement for actuation of an SRV, DPV squib valve, GDCS secondary branch line squib valve, and suppression pool equalizer line squib valve are given in Reference 1.

Equipment within a single division is powered from the safety-related power source of the same division.

This Specification provides the OPERABILITY requirements for the ECCS instrumentation from the input variable sensors through the DTM function. Operability requirements for the ECCS actuation circuitry consisting of timers, VLUs, and load drivers are provided by LCO 3.3.5.2, "Emergency Core Cooling System (ECCS) Actuation." Operability requirements for actuated components (i.e., squibs and solenoid valves) are addressed in LCO 3.1.7, LCO 3.5.1, and LCO 3.5.2, as appropriate.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The actions of the ECCS are explicitly assumed in the safety analyses of Reference 2 and 3. The ECCS is initiated to preserve the integrity of the fuel cladding by limiting the post-LOCA peak cladding temperature to less than the 10 CFR 50.46 limits.

ECCS Instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). The OPERABILITY of the ECCS instrumentation is dependent on the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.5.1-1. An ECCS instrumentation channel constitutes all of the components within a division of channel sensors. Each Function must have the required number of OPERABLE channels, with setpoints in accordance with the SCP, where appropriate. The actual setpoint is calibrated consistent with the SCP. Each ECCS subsystem must also respond within its assumed response time. A channel is inoperable if its actual trip setpoint is non-conservative with respect to its required Allowable Value.

~~The Setting Basis, from which the NTSPs and~~ Allowable Values are ~~derived is~~ specified for each ECCS Function, where appropriate, in Table 3.3.5.1-1. NTSPs ~~and Allowable Values~~ are specified in the SCP, as required by Specification 5.5.11. The NTSPs are selected to ensure the actual setpoints are conservative with respect to the Allowable Value between successive CHANNEL CALIBRATIONS. Operations with a trip setpoint less conservative than the NTSP, but more conservative with respect to its Allowable Value, is acceptable. A channel is inoperable if

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1. Reactor Vessel Water Level - Low, Level 1

Reactor Vessel Water Level - Low, Level 1 is the primary signal for the initiation of the ECCS for a steam line break outside containment because fuel damage could result if RPV water level is too low. The Reactor Vessel Water Level - Low, Level 1 is assumed to be OPERABLE and capable of initiating the ADS, GDCS, and SLC during the accidents analyzed in References 2 and 3. The core cooling function of the ECCS, along with the scram action of the RPS, assures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Three channels of Reactor Vessel Water Level - Low, Level 1 Function are required to be OPERABLE to ensure that no single instrument failure can preclude ECCS initiation. The Level 1 signal is initiated from four wide range level sensors and transmitters.

2. Reactor Vessel Water Level - Low, Level 0.5

Reactor Vessel Water Level - Low, Level 0.5 signal is used in the ECCS logic as a permissive for actuation of the GDCS suppression equalizing lines valves, after a 30-minute time delay from the ECCS initial start signal. The Reactor Vessel Water Level - Low, Level 0.5 is assumed to be OPERABLE and capable of initiating the GDCS suppression pool equalizer line valves following boil-off of reactor pressure vessel inventory during the accidents analyzed in References 2 and 3. The core cooling function of the ECCS, along with the scram action of the RPS, assures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46. ~~Level 0.5 is defined as 1 meter above the TAF.~~

Three channels of Reactor Vessel Water Level - Low, Level 0.5 Function are required to be OPERABLE to ensure that no single instrument failure can preclude GDCS initiation. Reactor Vessel Water Level - Low, Level 0.5 signals are initiated from four fuel zone level transmitters.

ACTIONS

A Note has been provided to modify the ACTIONS related to ECCS instrumentation channels. Section 1.3, Completion Times, specifies once a Condition has been entered, subsequent divisions, subsystems, components or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies Required Actions of the Condition

B 3.3 INSTRUMENTATION

B 3.3.5.3 Isolation Condenser System (ICS) Instrumentation

BASES

BACKGROUND

The purpose of the ICS instrumentation is to initiate appropriate actions to ensure ICS operates following a reactor pressure vessel (RPV) isolation after a scram to provide adequate RPV pressure reduction to preclude safety relief valve operation, conserve RPV water level to avoid automatic depressurization caused by low water level. In addition, in the event of a loss of coolant accident (LOCA), the ICS instrumentation ensures the system operates to provide liquid inventory to the RPV. The equipment involved with ICS is described in the Bases for LCO 3.5.4, "Isolation Condenser System (ICS) - Operating."

Technical Specifications are required by 10 CFR 50.36 to contain limiting safety system settings (LSSS) defined by the regulation as "...settings for automatic protective devices related to those variables having significant safety functions." Where LSSS is specified for a variable on which a Safety Limit (SL) has been placed, the setting must be chosen such that automatic protective action will correct the abnormal situation before a SL is exceeded. The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. Where LSSS is specified for a variable having a significant safety function but which does not protect SLs, the setting must be chosen such that automatic protective actions will initiate consistent with the design basis. The Design Limit is the limit of the process variable at which a safety action is initiated to ensure that these automatic protective devices will perform their specified safety function. ~~These limits (i.e., Analytical Limit and Design Limit) constitute the Setting Basis specified in Table 3.3.5.3-1.~~

The actual settings for automatic protective devices must be chosen to be more conservative than the Analytical / Design Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The methodology for determining the actual settings, and the required tolerances to maintain these settings conservative to the Analytical / Design Limits, including the requirements for determining that the channel is OPERABLE, are defined in the Setpoint Control Program (SCP), in accordance with Specification 5.5.11, "Setpoint Control Program (SCP)."

BASES

BACKGROUND (continued)

Use of the NTSP to define "as-found" OPERABILITY under the expected circumstances described above would result in actions required by both the rule and Technical Specifications that are clearly not warranted. However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value is specified in the SCP, as required by Specification 5.5.11, in order to define OPERABILITY of the devices and is designated as the Allowable Value which is the least conservative value of the as-found setpoint that a channel can have during CHANNEL CALIBRATION. The actual NTSP values and Allowable Values, ~~(derived from the Analytical / Design Limits specified in Table 3.3.5.3-1)~~ and the methodology for calculating the "leave alone" and "as-found" tolerances will be maintained in the SCP, as required by Specification 5.5.11.

The Allowable Valuable is the least conservative value that the setpoint of the channel can have when tested such that a channel is OPERABLE if the setpoint is found conservative with respect to the Allowable Value during the CHANNEL CALIBRATION. Note that, although a channel is OPERABLE under these circumstances, the setpoint must be left adjusted to a value within the established "leave alone" tolerance of the NTSP and confirmed to be operating within the statistical allowances of the uncertainty terms assigned in the setpoint calculation. As such, the Allowable Value differs from the NTSP by an amount equal to or greater than the "as-found" tolerance value. In this manner, the actual setting of the device will ensure that a SL is not exceeded or that automatic protective actions will initiate consistent with the design basis at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. If the actual setting of the device is found to be non-conservative with respect to the Allowable Value the device would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

The ICS can be automatically or manually initiated. The ICS actuates automatically in response to signals from any of the following:

1. Reactor Steam Dome Pressure - High for 10 seconds,
2. RPV low water level (Level 2), with time delay,
3. RPV low low water level (Level 1),

BASES

BACKGROUND (continued)

drivers in series. Both VLU trips are required to prevent inadvertent actuation of the ECCS. It is undesirable to perform the VLU logic bypass activities with the RMU electrically connected to the valve. The keylock switch that bypasses (disables) the load driver actuation provides effective bypass function required at the actuator level.

The load driver arrangement for actuation of the ICS Condensate Return Valves are such that an actuation signal from two divisions of ICS actuation logic are required to actuate a condensate return flow path.

Equipment within a single division is powered from the safety-related power source of the same division.

This Specification provides Operability requirements for the ICS instrumentation from the input variable sensors through the DTM function. Operability requirements for the ICS actuation circuitry consisting of timers, VLUs, and load drivers are provided by LCO 3.3.5.4, " Isolation Condenser System (ICS) Actuation." Operability requirements for the actuated components are addressed in LCO 3.5.4.

APPLICABLE SAFETY ANALYSES, LCO and APPLICABILITY

The actions of the ICS are explicitly assumed in the safety analyses of Reference 1. The ICS is initiated to preserve the integrity of the fuel cladding by limiting the post-LOCA peak cladding temperature to less than the 10 CFR 50.46 limits. Actuation of the ICS precludes actuation of safety relief valves and limits the peak RPV pressure to less than the ASME Section III Code limits.

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

The OPERABILITY of the ICS is dependent on the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.5.3-1. Each Function must have the required number of OPERABLE channels, with their setpoints in accordance with the SCP, where appropriate. The actual setpoint is calibrated consistent with the SCP. Each channel must also respond within its assumed response time.

~~The Setting Basis, from which the NTSPs and~~ Allowable Values are ~~derived are~~ specified for each ICS Function, where appropriate, in Table 3.3.5.3-1. NTSPs ~~and Allowable Values~~ are specified in the SCP, as required by Specification 5.5.11. The NTSPs are selected to ensure the actual setpoints are conservative with respect to the Allowable Value between successive CHANNEL CALIBRATIONS. Operation with a trip

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1. Reactor Vessel Steam Dome Pressure - High

ICS is designed to operate following reactor pressure vessel (RPV) isolation to provide adequate RPV pressure reduction to preclude safety/relief valve operation and provide core cooling while conserving reactor water inventory. Therefore, Reactor Vessel Steam Dome Pressure - High Function existing for 10 seconds initiates an ICS actuation for transients that result in a pressure increase. Actuation of the ICS provides RPV pressure reduction to preclude safety relief valve operation and provide core cooling.

High reactor pressure signals are initiated from four pressure transmitters that sense reactor pressure. The Reactor Vessel Steam Dome Pressure - High Allowable Value~~Analytical / Design Limit~~ provides a sufficient margin to the ASME Section III Code limits during the event.

Three channels of Reactor Vessel Steam Dome Pressure - High Function are required to be OPERABLE to ensure no single instrument failure will preclude ICS actuation.

The Function is required to be OPERABLE in MODES 1, 2, 3, 4, and 5 .

2. Reactor Vessel Water Level - Low, Level 2

Low reactor vessel water level indicates the capability to cool the fuel may be threatened. Should reactor vessel water level decrease too far, fuel damage could result. Therefore, an ICS actuation is initiated at Level 2, with a 30-second time delay to provide a source of core cooling. The time delay provides an allowance for temporary transients that may reduce RPV level below the Level 2 setpoint. This Function is assumed to be available to support the transient and design basis analyses (Ref. 1).

Reactor Vessel Water Level - Low, Level 2, signals are initiated from four wide range level transmitters.

Three channels of Reactor Vessel Water Level Low, Level 2, Function are required to be OPERABLE to ensure no single instrument failure will prevent ICS actuation from this Function on a valid signal.

The Function is required to be OPERABLE in MODES 1, 2, 3, 4, and 5.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The MSIV - Closure Allowable Value~~Analytical / Design Limit~~ is specified to ensure that an ICS initiation occurs prior to a significant reduction in steam flow, thereby reducing the severity of the subsequent pressure transient.

Three channels of MSIV - Closure Function are required to be OPERABLE to ensure no single instrument failure will prevent the ICS actuation from this Function on a valid signal. {There are a total of sixteen MSIV position switches that make up the four channels of MSIV - Closure Function (four MSIV position switches per channel). For a channel of the MSIV - Closure Function to be OPERABLE, its four MSIV position switches must be OPERABLE.} This Function is only required in MODE 1 because with the MSIVs open and the heat generation rate high, a pressurization transient can occur if the MSIVs close.

5. Power Generation Bus Loss (Loss of Feedwater Flow)

The plant electrical system has four redundant power generation busses that operate at 13.8 kV. These busses supply power for the feedwater pumps and other pumps. In MODE 1, at least three of the four busses must be powered. If the voltage sensor (one per division) on each bus senses a low voltage below the required level, indicating that less than three buses are operating above the requirement level, a 2-out-of-4 logic will initiate ICS after a preset delay time. This delay time is to accommodate for the auto-transfer from the UAT transformer feed to the RAT transformer feed. When the power generation busses are not operating at or above the required level, the feedwater pumps would be tripped and feedwater flow would be lost. The purpose of ICS initiation on losing feedwater flow is to provide a source of core cooling following the loss of feedwater pump function.

Power Generation Bus Loss signals are derived from four voltage sensors. A voltage sensor (one per division) on each bus senses a low voltage below the required level, indicating that less than three buses are operating above the requirement level, a 2-out-of-4 logic will initiate a scram after a preset delay time. The Allowable Value~~Analytical / Design Limit~~ was selected high enough to detect a loss of voltage in order to mitigate the reactor water level drop to Level 1 following the loss of feedwater pump function.

Three channels of Power Generation Bus Loss Function are required to be OPERABLE to ensure that no single instrument failure will prevent the

B 3.3 INSTRUMENTATION

B 3.3.6.1 Main Steam Isolation Valve (MSIV) Instrumentation

BASES

BACKGROUND

The isolation instrumentation contained in this specification provides the capability to generate isolation signals to isolate the MSIVs. The function of the MSIVs, in combination with other accident mitigation systems, is to limit fission product release during and following postulated Design Basis Accidents (DBAs).

Technical Specifications are required by 10 CFR 50.36 to contain limiting safety system settings (LSSS) defined by the regulation as "...settings for automatic protective devices related to those variables having significant safety functions." Where LSSS is specified for a variable on which a Safety Limit (SL) has been placed, the setting must be chosen such that automatic protective action will correct the abnormal situation before a SL is exceeded. The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. Where LSSS is specified for a variable having a significant safety function but which does not protect SLs, the setting must be chosen such that automatic protective actions will initiate consistent with the design basis. The Design Limit is the limit of the process variable at which a safety action is initiated to ensure that these automatic protective devices will perform their specified safety function. ~~These limits (i.e., Analytical Limit and Design Limit) constitute the Setting Basis specified in Table 3.3.6.1-1.~~

The actual settings for automatic protective devices must be chosen to be more conservative than the Analytical / Design Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The methodology for determining the actual settings, and the required tolerances to maintain these settings conservative to the Analytical / Design Limits, including the requirements for determining that the channel is OPERABLE, are defined in the Setpoint Control Program (SCP), in accordance with Specification 5.5.11, Setpoint Control Program (SCP)."

The Nominal Trip Setpoint (NTSP) is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the Analytical / Design Limit and thus ensuring that the SL would not be exceeded (i.e., for Analytical Limits), or that automatic protective actions occur consistent with the design basis (i.e.,

BASES

BACKGROUND (continued)

value of the as-found setpoint that a channel can have during CHANNEL CALIBRATION. The actual NTSP values and Allowable Values, ~~(derived from the Analytical / Design Limits specified in Table 3.3.6.1-1)~~ and the methodology for calculating the "leave alone" and "as-found" tolerances will be maintained in the SCP, as required by Specification 5.5.11.

The Allowable Valuable is the least conservative value that the setpoint of the channel can have when tested such that a channel is OPERABLE if the setpoint is found conservative with respect to the Allowable Value during the CHANNEL CALIBRATION. Note that, although a channel is OPERABLE under these circumstances, the setpoint must be left adjusted to a value within the established "leave alone" tolerance of the NTSP and confirmed to be operating within the statistical allowances of the uncertainty terms assigned in the setpoint calculation. As such, the Allowable Value differs from the NTSP by an amount equal to or greater than the "as-found" tolerance value. In this manner, the actual setting of the device will ensure that a SL is not exceeded or that automatic protective actions will initiate consistent with the design basis at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. If the actual setting of the device is found to be non-conservative with respect to the Allowable Value the device would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

The MSIV Isolation circuitry, as shown in Reference 1, is divided into four redundant divisions of sensor (instrument) channels, four trip logics, and the hard wired MSIV solenoid logic circuitry. The MSIV Isolation circuitry is contained in the Reactor Trip and Isolation Function (RTIF) portion of the Safety-related Distributed Control and Information System (Q-DCIS) along with the Reactor Protection System (RPS). Functional diversity is provided by monitoring a wide range of dependent and independent parameters. The input parameters to the MSIV logic are from instrumentation that monitors (a) reactor vessel water level (Level 1 and Level 2), (b) main steam line pressure, main steam line flow, condenser pressure, main steam tunnel ambient temperature, main steam turbine area ambient temperature. The plant parameters that are required to be monitored for MSIV logic are each measured, independently, by four sensors. Each sensor is assigned to one of the four redundant instrument channels, which are in turn associated with four divisions of logic. For any monitored parameter, the sensor signals of at least two of

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~The Setting Basis, from which the NTSPs and~~ Allowable Values are ~~derived is~~ specified for each MSIV isolation Function, where appropriate, in Table 3.3.6.1-1. NTSPs ~~and Allowable Values~~ are specified in the SCP, as required by Specification 5.5.11. The NTSPs are selected to ensure the setpoints are conservative with respect to the Allowable Value between successive CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the NTSP, but conservative with respect to its Allowable Value, is acceptable. A channel is inoperable if its actual trip setpoint is non-conservative with respect to its required Allowable Value.

NTSPs are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g.,DTM) changes state. For those LSSS related to variables protecting SLs the Analytical Limits are derived from the limiting values of the process parameters obtained from the safety analysis. For those LSSS related to variables having significant safety functions but which do not protect the SLs, the Design Limits are those settings that must initiate automatic protective actions consistent with the design basis. The Allowable Values are derived from the Analytical / Design Limits, corrected for calibration, process and some of the instrument errors. The NTSPs are then determined accounting for the remaining instrument errors (e.g., drift). The trip setpoints derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for.

In general, the individual monitored process parameters are required to be OPERABLE in MODES 1, 2, 3, and 4 consistent with the Applicability of LCO 3.6.1.3. Functions that have different Applicabilities are discussed below in the individual Functions discussion.

Although there are four channels of MSIV instrumentation for each function, only three channels of MSIV instrumentation for each function are required to be OPERABLE. The three required channels are those channels associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating." This is acceptable because the single-failure criterion is met with three OPERABLE MSIV instrumentation channels, and because

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

each MSIV instrumentation division is associated with and receives power from only one of the four electrical divisions.

The specific Applicable Safety Analyses, LCO and specific Applicability discussions are provided below on a Function basis.

1. Reactor Vessel Water Level - Low, Level 2

Low reactor pressure vessel (RPV) water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. The isolations of the MSIVs limit the release of fission products to help ensure that offsite does limits are not exceeded. The Reactor Vessel Water Level - Low, Level 2 is explicitly credited in the LOCA inside containment radiological analysis (Ref. 4)

Reactor Vessel Water Level - Low, Level 2 signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column (reference leg) of water and the pressure due to the actual water level (variable leg) in the vessel. Three channels of Reactor Vessel Water Level - Low, Level 2 Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

The Reactor Vessel Water Level - Low, Level 2 Allowable ValueAnalytical / Design Limit was chosen to be the same as the Isolation Condenser Reactor Vessel Water Level - Low, Level 2 Allowable ValueAnalytical / Design Limit.

2. Reactor Vessel Water Level - Low, Level 1

Low RPV water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. The isolations of the MSIVs limit the release of fission products to help ensure that offsite does limits are not exceeded. The Reactor Vessel Water Level - Low, Level 1 channels are provided as a backup to the Reactor Vessel Water Level - Low, Level 2 channels and is not credited in the safety analysis. These channels are hardwired into the logic.

Reactor Vessel Water Level - Low, Level 1 signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column (reference leg) of water and the pressure due to the actual water level (variable leg) in the vessel. Three channels of Reactor Vessel Water Level - Low, Level 1 Function are required to be

OPERABLE to ensure no single instrument failure can preclude the isolation function.

The Reactor Vessel Water Level - Low, Level 1 Allowable Value~~Analytical / Design Limit~~ was chosen to be the same as the Automatic Depressurization Reactor Vessel Water Level - Low, Level 1 Allowable Value~~Analytical / Design Limit~~.

<u>3. Main Steam Line Pressure - Low</u>

Low main steam line pressure indicates that there may be a problem with the turbine pressure regulation that could result in a condition that the Reactor Pressure Vessel (RPV) is cooling down more than 55°C/hr (100°F/hr) if the pressure loss is allowed to continue. The Main Steam Line Pressure - Low Function is directly assumed in the analysis of the pressure regulator failure (Ref. 5). For this event the closure of the MSIVs ensures that the RPV temperature change limit 55°C/hr (100°F/hr) is not reached.

The main steam line low-pressure signals are initiated from four transmitters that sense the pressure downstream of the outboard MSIVs. The transmitters are arranged such that, even though physically separated from each other, each transmitter is able to detect low main steam line pressure. Three channels of Main Steam Line Pressure - Low Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function. The Allowable Value~~Analytical / Design Limit~~ was selected to be high enough to prevent excessive RPV depressurization.

The Main Steam Line Pressure - Low Function is only required to be OPERABLE in MODE 1 since this is when the assumed transient can occur (Ref. 5).

<u>4. Main Steam Line Flow - High</u>

Main Steam Line Flow - High is provided to detect a break of the main steam line (MSL) and to initiate closure of the MSIVs. If the steam was allowed to continue flowing out the break, the reactor would depressurize and the core could uncover. If the RPV water level decreases too far, fuel damage could occur. Therefore, the isolation is initiated on high flow to prevent or minimize core damage. The Main Steam Line Flow - High

BASES

Function is directly assumed in the analysis of the MSL break (Ref. 6). The isolation action, along with the scram function of the RPS and the operation of the ECCS and Safety Relief Valves assures that the fuel

peak cladding temperature remains below the limits of 10 CFR 50.46 and off-site dose limits.

The MSL flow signals are initiated from 16 differential pressure transmitters that are connected to the four MSLs, four per steam line. The differential pressure transmitters are arranged such that, even though physically separated from each other, all four connected to one MSL would be able to detect the high flow in that steam line. High MSL flow in any steam line will result in isolation of all MSLs. Three channels of Main Steam Line Flow - High Function for each main steam line are are required to be OPERABLE so that no single instrument failure will preclude detecting a break in any individual main steam line.

The Allowable Value~~Analytical / Design Limit~~ is chosen to ensure that off-site dose limits are not exceeded due to the break.

5. Condenser Pressure - High

The Condenser Pressure - High Function is provided to prevent overpressurization of the main condenser in the event of a loss of main condenser vacuum. Since, the integrity of the condenser is an assumption in off-site dose calculations, the Condenser Pressure - High Function is assumed to be OPERABLE and capable of initiating closure of the MSIVs. The closure of the MSIVs is initiated to prevent the addition of steam that would lead to additional condenser pressurization and possible rupture of the diaphragm installed to protect the turbine exhaust hood, thereby preventing a potential radiation leakage path following an accident. The Condenser Pressure - High Function is credited in the transients in References 7 and 8.

Condenser pressure signals are derived from four pressure transmitters that sense the pressure in the condenser. Three channels of Condenser Pressure - High Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

The Allowable Value~~Analytical / Design Limit~~ is chosen to prevent damage to the condenser due to pressurization, thereby ensuring its integrity for off-site dose analysis.

BASES

As noted, the Condenser Pressure - Low Function is not required to be OPERABLE in MODES 2, 3, and 4 when all turbine stop valves are closed since the potential for condenser overpressurization is minimized.

Switches are provided to manually bypass the channels when all turbine stop valves are closed.

6, 7. Main Steam Tunnel and Turbine Area Ambient Temperature - High

Main Steam Tunnel and Turbine Area Ambient Temperature - High Functions are provided to detect a leak in the reactor coolant pressure boundary and provides diversity to the MSL high flow instrumentation. The isolation occurs when a very small leak has occurred. If the small leak is allowed to continue without isolation, off-site dose limits may be reached. However, credit for these instruments is not taken in any transient or accident analysis because bounding analyses are performed for large breaks such as a MSL break.

Ambient temperature signals are initiated from thermocouples located away from the main steam lines so they are only sensitive to ambient air temperature. Three channels of Main Steam Tunnel Temperature - High Function are available and required to be OPERABLE to ensure no single instrument failure can preclude the isolation function. Three channels of Turbine Area Ambient Temperature - High Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

{The ambient temperature monitoring Allowable Value~~Analytical / Design Limit~~ is chosen to detect a leak equivalent to 1.577 liters/second (25 gpm).}

ACTIONS

A Note has been provided to modify the ACTIONS related to Isolation Instrumentation channels. Section 1.3, Completion Times, specifies once a Condition has been entered, subsequent divisions, subsystems, components or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable MSIV Instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided which allows separate Condition entry for each inoperable MSIV Instrumentation channel.

B 3.3 INSTRUMENTATION

B 3.3.6.3 Isolation Instrumentation

BASES

BACKGROUND

The isolation instrumentation contained in this specification provides the capability to generate isolation signals to the containment isolation valves, the reactor building boundary isolation dampers{, feedwater isolation valves and feedwater pump breakers}. The function of the isolation valves and dampers, in combination with other accident mitigation systems, is to limit fission product release during and following postulated Design Basis Accidents (DBAs). {The function of the feedwater isolation valves and feedwater pump breaker trip is to limit the mass addition of water into containment during and following a design basis feedwater line rupture inside containment.} The function of the reactor water cleanup/shutdown cooling (RWCU/SDC) isolation valves in MODES 5 and 6 is to protect the core by isolating the RWCU/SDC system from the reactor pressure vessel and minimizing a potential loss of coolant resulting from a line break in the RWCU/SDC system.

Technical Specifications are required by 10 CFR 50.36 to contain limiting safety system settings (LSSS) defined by the regulation as "...settings for automatic protective devices related to those variables having significant safety functions." Where LSSS is specified for a variable on which a Safety Limit (SL) has been placed, the setting must be chosen such that automatic protective action will correct the abnormal situation before a SL is exceeded. The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. Where LSSS is specified for a variable having a significant safety function but which does not protect SLs, the setting must be chosen such that automatic protective actions will initiate consistent with the design basis. The Design Limit is the limit of the process variable at which a safety action is initiated to ensure that these automatic protective devices will perform their specified safety function. ~~These limits (i.e., Analytical Limit and Design Limit) constitute the Setting Basis specified in Table 3.3.6.3-1.~~

The actual settings for automatic protective devices must be chosen to be more conservative than the Analytical / Design Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The methodology for determining the actual settings, and the required tolerances to maintain these settings conservative to the Analytical / Design Limits, including the requirements

BASES

BACKGROUND (continued)

Use of the NTSP to define "as-found" OPERABILITY under the expected circumstances described above would result in actions required by both the rule and Technical Specifications that are clearly not warranted. However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value is specified in the SCP, as required by Specification 5.5.11, in order to define OPERABILITY of the devices and is designated as the Allowable Value which is the least conservative value of the as-found setpoint that a channel can have during CHANNEL CALIBRATION. The actual NTSP values and Allowable Values, ~~(derived from the Analytical / Design Limits specified in Table 3.3.6.3-1)~~ and the methodology for calculating the "leave alone" and "as-found" tolerances will be maintained in the SCP, as required by Specification 5.5.11.

The Allowable Valuable is the least conservative value that the setpoint of the channel can have when tested such that a channel is OPERABLE if the setpoint is found conservative with respect to the Allowable Value during the CHANNEL CALIBRATION. Note that, although a channel is OPERABLE under these circumstances, the setpoint must be left adjusted to a value within the established "leave alone" tolerance of the NTSP and confirmed to be operating within the statistical allowances of the uncertainty terms assigned in the setpoint calculation. As such, the Allowable Value differs from the NTSP by an amount equal to or greater than the "as-found" tolerance value. In this manner, the actual setting of the device will ensure that a SL is not exceeded or that automatic protective actions will initiate consistent with the design basis at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. If the actual setting of the device is found to be non-conservative with respect to the Allowable Value the device would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

The containment isolation function is performed by the Leak Detection and Isolation (LD&IS) portion of the Logic and Control (SSLC) System. Functional diversity is provided by monitoring a wide range of independent parameters. Containment isolation occurs in response to signals from any of the following:

1. Reactor Vessel Water Level - Low, Level 2,
2. Reactor Vessel Water Level - Low, Level 1,
3. Drywell Pressure - High,

BASES

BACKGROUND (continued)

addressed in LCO 3.6.1.3, "Containment Isolation Valves (CIVs)," and LCO 3.6.3.1, "Reactor Building."

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The containment isolation signals generated by the isolation instrumentation are implicitly assumed in the safety analyses of References 1 and 2 to initiate closure of containment isolation valves and reactor building boundary isolation dampers to limit off-site doses. Refer to LCO 3.6.1.3, "Containment Isolation Valves (CIVs), "Applicable Safety Analyses Bases, for more detail on containment isolation valves and LCO 3.6.3.1, "Reactor Building," Applicable Safety Analyses Bases for more detail on reactor building boundary isolation dampers.

The RWCU/SDC isolation signals generated by the isolation instrumentation are implicitly assumed in the analyses of Reference 3 to initiate closure of the RWCU/SDC isolation valves to protect the core by minimizing a potential loss of reactor pressure vessel coolant inventory in MODES 5 and 6.

{The feedwater isolation and feedwater pump breaker trip signals generated by the isolation instrumentation are implicitly assumed in the safety analyses of References 1 and 2 to initiate closure of feedwater isolation valves and trip of the feedwater pump breakers to limit mass water additions to the containment during and following a design basis feedwater line rupture inside containment.}

Isolation instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). However, certain monitored instrumentation parameters are retained for other reasons and are described below in the individual process parameter discussion.

The OPERABILITY of the isolation instrumentation is dependent on the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.6.3-1. Each Function must have the required number of OPERABLE channels, with their setpoints in accordance with the SCP, where appropriate. Each channel must also respond within its assumed response time, where appropriate. ~~The Setting Basis, from which the NTSPs and~~ Allowable Values are ~~derived is~~ specified for each Function, where appropriate, in Table 3.3.6.3-1. NTSPs ~~and Allowable Values~~ are specified in the SCP, as required by Specification 5.5.11. The NTSPs are selected to ensure the setpoints are conservative with respect to the Allowable Value between successive CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the NTSP, but

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1. Reactor Vessel Water Level - Low, Level 2

Low reactor pressure vessel (RPV) water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. The isolations of valves whose penetration communicate with the containment or the reactor vessel and the isolation of the reactor building boundary isolation dampers limit the release of fission products to help ensure that offsite does limits are not exceeded. The Reactor Vessel Water Level - Low, Level 2 is credited in the LOCA inside containment radiological analysis (Ref. 4)

In MODES 5 and 6, low RPV water level may indicate a loss of coolant. Should RPV water level decrease too far, the ability to cool the core may be threatened. Closure of the RWCU/SDC isolation valves isolates the system from the RPV, minimizing the potential loss of coolant inventory. The Reactor Vessel Water Level - Low, Level 2 is implicitly credited in the shutdown probabilistic risk assessment (Ref. 3), and therefore satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

Reactor Vessel Water Level - Low, Level 2 signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column (reference leg) of water and the pressure due to the actual water level (variable leg) in the vessel. Three channels of Reactor Vessel Water Level - Low, Level 2 Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

The Reactor Vessel Water Level - Low, Level 2 Allowable Value~~Analytical / Design Limit~~ was chosen to be the same as the IC Reactor Vessel Water Level - Low, Level 2 Allowable Value~~Analytical / Design Limit~~.

This Function isolates the main steam drain lines, RWCU/SDC lines, fission product sampling lines, drywell low conductivity waste sump drain line, drywell high conductivity waste sump drain line, containment purge and vent lines, chilled water system lines to the drywell air coolers, fuel and auxiliary pools cooling process lines, and the reactor building boundary isolation dampers.

BASES

2. Reactor Vessel Water Level - Low, Level 1

Low RPV water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. The isolations of valves whose penetration communicate with the

containment or the reactor vessel and the isolation of the reactor building boundary isolation dampers limit the release of fission products to help ensure that offsite does limits are not exceeded. The Reactor Vessel Water Level - Low, Level 1 channels are provided as a backup to the Reactor Vessel Water Level - Low, Level 2 channels and is not credited in the safety analysis. These channels are hardwired into the logic.

Reactor Vessel Water Level - Low, Level 1 signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column (reference leg) of water and the pressure due to the actual water level (variable leg) in the vessel. Three channels of Reactor Vessel Water Level - Low, Level 1 Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

The Reactor Vessel Water Level - Low, Level 1 Allowable Value~~Analytical / Design Limit~~ was chosen to be the same as the Automatic Depressurization System Reactor Vessel Water Level - Low, Level 1 Allowable Value~~Analytical / Design Limit~~.

This Function isolates the main steam drain lines, RWCU/SDC lines, fission product sampling lines, drywell low conductivity waste sump drain line, drywell high conductivity waste sump drain line, containment purge and vent valves, chilled water system lines to the drywell air coolers, fuel and auxiliary pools cooling process lines, and the reactor building boundary isolation dampers.

3. Drywell Pressure - High

High drywell pressure can indicate a break in the reactor coolant pressure boundary. The isolations of valves whose penetration communicate with the containment and the isolation of the reactor building boundary isolation dampers limit the release of fission products to help ensure that offsite does limits are not exceeded. The Drywell Pressure -High channels are not explicitly credited in the safety analyses but retained for the overall redundancy and diversity of the isolation instrumentation.

BASES

High drywell pressure signals are initiated from four pressure transmitters that sense the pressure in the drywell. Three channels of Drywell Pressure—High are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Drywell Pressure - High Allowable Value~~Analytical / Design Limit~~ was chosen to be the same as the Reactor Protection System Drywell Pressure - High Allowable Value~~Analytical / Design Limit~~.

This Function isolates the fission product sampling lines, drywell low conductivity waste sump drain line, drywell high conductivity waste sump drain line, containment purge and vent lines, chilled water system lines to the drywell air coolers, fuel and auxiliary pools cooling system process lines, and the reactor building boundary isolation dampers. {In addition, this Function, in conjunction with Feedwater Line Differential Pressure - High, isolates the feedwater lines and trips the feedwater pump breakers.}

4. Main Steam Line Pressure - Low

Low main steam line pressure indicates that there may be a problem with the turbine pressure regulation that could result in a condition that the Reactor Pressure Vessel (RPV) is cooling down more than 55°C/hr (100°F/hr) if the pressure loss is allowed to continue. The Main Steam Line Pressure - Low Function is directly assumed in the analysis of the pressure regulator failure (Ref. 5). For this event the closure of the main steam drain lines helps to ensures that the RPV temperature change limit 55°C/hr (100°F/hr) is not reached.

The main steam line low-pressure signals are initiated from four transmitters that sense the pressure downstream of the outboard MSIVs. The transmitters are arranged such that, even though physically separated from each other, each transmitter is able to detect low main steam line pressure. Three channels of Main Steam Line Pressure - Low Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

The Allowable Value~~Analytical / Design Limit~~ was selected to be high enough to prevent excessive RPV depressurization.

The Main Steam Line Pressure - Low Function is only required to be OPERABLE in MODE 1 since this is when the assumed transient can occur (Ref. 5).

This Function isolates the main steam drain lines.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5. Main Steam Line Flow - High

Main Steam Line Flow - High is provided to detect a break of the main steam line (MSL) and to initiate closure of main steam drain valves. If the steam was allowed to continue flowing out the break, the reactor would depressurize and the core could uncover. If the RPV water level decreases too far, fuel damage could occur. Therefore, the isolation is initiated on high flow to prevent or minimize core damage. The Main Steam Line Flow - High Function is directly assumed in the analysis of the MSL break (Ref. 6). The isolation action, along with the scram function of the RPS and the operation of the ECCS and Safety Relief Valves assures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46 and off-site dose limits.

The MSL flow signals are initiated from 16 differential pressure transmitters that are connected to the four MSLs, four per steam line. The differential pressure transmitters are arranged such that, even though physically separated from each other, all four connected to one MSL would be able to detect the high flow in that steam line. High MSL flow in any steam line will result in isolation of the drain lines. Three channels of Main Steam Line Flow - High Function for each main steam line are required to be OPERABLE so that no single instrument failure will preclude detecting a break in any individual main steam line.

The Allowable Value~~Analytical / Design Limit~~ is chosen to ensure that off-site dose limits are not exceeded due to the break.

This Function isolates the main steam drain lines.

6. Condenser Pressure - High

The Condenser Pressure - High Function is provided to prevent overpressurization of the main condenser in the event of a loss of main condenser vacuum. Since, the integrity of the condenser is an assumption in off-site dose calculations, the Condenser Pressure - High Function is assumed to be OPERABLE and capable of initiating closure of the main steam drain valves. The closure of the main steam drain valves is initiated to prevent the addition of steam that would lead to additional condenser pressurization and possible rupture of the diaphragm installed to protect the turbine exhaust hood, thereby preventing a potential radiation leakage path following an accident. The

BASES

Condenser Pressure - High Function is credited in the transients in References 7 and 8.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Condenser pressure signals are derived from four pressure transmitters that sense the pressure in the condenser. Three channels of Condenser Pressure - High Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

The Allowable Value~~Analytical / Design Limit~~ is chosen to prevent damage to the condenser due to pressurization, thereby ensuring its integrity for off-site dose analysis.

As noted, the channels are not required to be OPERABLE in MODES 2, 3, and 4 when all turbine stop valves are closed since the potential for condenser overpressurization is minimized. Switches are provided to manually bypass the channels when all turbine stop valves are closed.

This Function isolates the main steam drain lines.

7, 8. Main Steam Tunnel and Turbine Area Ambient Temperature - High

Main Steam Tunnel and Turbine Area Ambient Temperature - High Functions are provided to detect a leak in the reactor coolant pressure boundary and provides diversity to the MSL high flow instrumentation. The isolation occurs when a very small leak has occurred. If the small leak is allowed to continue without isolation, off-site dose limits may be reached. However, credit for these instruments is not taken in any transient or accident analysis because bounding analyses are performed for large breaks such as a MSL break.

Temperature signals are initiated from thermocouples located away from the main steam lines so they are only sensitive to ambient air temperature. Three channels of Main Steam Tunnel Temperature - High Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function. Three channels of Turbine Area Ambient Temperature - High Function are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

{The ambient temperature monitoring Allowable Value~~Analytical / Design Limit~~ is chosen to detect a leak equivalent to 1.577 liters/second (25 gpm).}

BASES

Three channels of the RWCU/SDC System Differential Mass Flow - High Function per RWCU/SDC subsystem are required to be OPERABLE to ensure no single instrument failure can preclude the isolation function.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The RWCU/SDC System Differential Mass Flow - High Allowable Value~~Analytical / Design Limit~~ ensures that a leak or a line break of the RWCU/SDC piping is detected.

{The time delay was chosen to be long enough to prevent false isolations due to system starts but not so long as to impact offsite dose calculations.}

This Function isolates the RWCU/SDC lines.

<u>10, 11, and 12. Isolation Condenser Steam and Condensate Return Line Flow -High and Pool Vent Discharge Radiation - High</u>

The Isolation Condenser Steam Line Flow High, Condensate Return Line Flow - High, and Pool Vent Discharge Radiation -High Functions are provided to monitor the pressure boundary status of each individual Isolation Condenser (IC) subsystem. The Isolation Condenser Steam Line Flow High and Condensate Return Line Flow - High Functions will isolate the associated subsystem when a leak or a break has occurred while the Pool Vent Discharge Radiation -High Function will isolate the associated subsystem when leakage is detected outside the drywell. These Functions are not assumed in any transient or accident analysis since bounding analyses are performed for large breaks such as MSL breaks.

The isolation signals can be initiated from a total of 12 instruments per IC subsystem, with each IC subsystem having four differential pressure transmitters per IC subsystem steam line, four differential pressure transmitters per IC subsystem condensate line, and four radiation detectors located in its associated IC subsystem vent discharge into the pool area. The flow instrumentation is designed to detect leakage both inside and outside of the drywell. The radiation detectors are designed to detect leakage outside of containment. Three channels of each monitored parameter for each IC subsystem are required to be OPERABLE to ensure no single instrument failure can preclude the isolation functions.

BASES

The Allowable Value~~Analytical / Design Limit~~ is chosen to be low enough to ensure that the isolation occurs to prevent fuel damage and maintains the MSL break event as the bounding event.

These Functions isolate the associated IC System lines.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

13. {Feedwater Line Differential Pressure - High

The Feedwater Line Differential Pressure - High signal is provided to detect a break in the feedwater lines inside containment. Should the feedwater continue to flow into containment, containment integrity could be challenged as a result of the mass and energy addition to the containment drywell from the external feedwater system. Therefore, isolation of the feedwater system flow and a trip of the affected feedwater pump breaker(s) is initiated when Feedwater Line Differential Pressure - High is sensed in conjunction with Drywell Pressure - High to protect containment integrity. This Function is directly assumed in the { Ref. X).}

Each feedwater line includes { }

Three channels of the Feedwater Line Differential Pressure - High Function are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The Feedwater Line Differential Pressure - High Allowable Value~~Analytical / Design Limit~~ ensures that a leak or a line break of the feedwater piping is detected.

This Function in conjunction with the Drywell Pressure - High Function isolates the feedwater flow and trips the feedwater pump breaker(s).}

ACTIONS

The ACTIONS are modified by two NOTES. Note 1 allows penetration flow path(s) to be unisolated intermittently under administrative controls. These controls consist of stationing a dedicated operator at the controls of the valve, who is in continuous communication with the control room. In this way, the penetration flow path can be rapidly isolated when a need for isolation is indicated. Note 2 has been provided to modify the ACTIONS related to Isolation Instrumentation channels. Section 1.3, Completion Times, specifies once a Condition has been entered, subsequent divisions, subsystems, components or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies

BASES

BACKGROUND (continued)

CRHAVS operation in maintaining CRHA habitability is discussed in Section 6.4 and Section 9.4.1 (Refs. 1 and 2, respectively).

Technical Specifications are required by 10 CFR 50.36 to contain Limiting Safety System Settings (LSSS) defined by the regulation as "...settings for automatic protective devices related to those variables having significant safety functions." Where LSSS is specified for a variable on which a Safety Limit (SL) has been placed, the setting must be chosen such that automatic protective action will correct the abnormal situation before a SL is exceeded. The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. Where LSSS is specified for a variable having a significant safety function but which does not protect SLs, the setting must be chosen such that automatic protective actions will initiate consistent with the design basis. The Design Limit is the limit of the process variable at which a safety action is initiated to ensure that these automatic protective devices will perform their specified safety function. ~~These limits (i.e., Analytical Limit and Design Limit) constitute the Setting Basis specified in Table 3.3.7.1-1.~~

The actual settings for automatic protective devices must be chosen to be more conservative than the Analytical / Design Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The methodology for determining the actual settings, and the required tolerances to maintain these settings conservative to the Analytical / Design Limits, including the requirements for determining that the channel is OPERABLE, are defined in the Setpoint Control Program (SCP), in accordance with Specification 5.5.11, "Setpoint Control Program (SCP)."

The Nominal Trip Setpoint (NTSP) is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the Analytical / Design Limit and thus ensuring that the SL would not be exceeded (i.e., for Analytical Limits), or that automatic protective actions occur consistent with the design basis (i.e., for Design Limits). As such, the NTSP accounts for uncertainties in setting the device (e.g., calibration), uncertainties in how the device might actually perform (e.g., repeatability), changes in the point of action of the device over time (e.g., drift during surveillance intervals), and any other factors that may influence its actual performance (e.g., harsh accident

BASES

BACKGROUND (continued)

environments). In this manner, the NTSP ensures that SLs are not exceeded and that automatic protective devices will perform their specified safety function. As such, the NTSP meets the definition of an LSSS.

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

Use of the NTSP to define "as-found" OPERABILITY under the expected circumstances described above would result in actions required by both the rule and Technical Specifications that are clearly not warranted. However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value is specified in the SCP, as required by Specification 5.5.11, in order to define OPERABILITY of the devices and is designated as the Allowable Value, which is the least conservative value of the as-found setpoint that a channel can have during CHANNEL CALIBRATION. The actual NTSP values and Allowable Values, ~~(derived from the Setting Basis, as specified in Table 3.3.7.1-1)~~ and the

BASES

BACKGROUND (continued)

CRHAVS actuation, and N-DCIS electrical load de-energization logic are required to actuate each damper, fan, or breaker.}

This Specification provides OPERABILITY requirements for the CRHA isolation, CRHAVS actuation, and N-DCIS electrical load de-energization instrumentation from the input variable sensors through the DTM function. OPERABILITY requirements for the CRHA isolation, CRHAVS actuation, and N-DCIS electrical load de-energization instrumentation circuitry consisting of VLUs and load drivers are provided by LCO 3.3.7.2, "Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS) Actuation." OPERABILITY requirements for the actuated components are addressed in LCO 3.7.2, "Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS)."

APPLICABLE SAFETY ANALYSES, LCO and APPLICABILITY

The ability of the CRHAVS to maintain habitability of the CRHA is an explicit assumption for the safety analyses presented in Chapter 6 and Chapter 15, (Refs. 1 and 3, respectively). The isolation mode of the CRHAVS is assumed to operate following a design basis accident (DBA). The radiological dose to control room personnel as a result of various DBAs is summarized in Reference 3. No single active or passive failure will cause the loss of outside air from the CRHA.

CRHAVS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

The OPERABILITY of the CRHAVS instrumentation is dependent on the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.7.1-1. Each Function must have the required number of OPERABLE channels, with their setpoints in accordance with the SCP, where appropriate.

~~The Setting Basis, from which the NTSPs and~~ Allowable Values are ~~derived, is~~ specified for each Function, where appropriate, in Table 3.3.7.1-1. NTSPs ~~and Allowable Values~~ are specified in the SCP, as required by Specification 5.5.11. The NTSPs are conservative with respect to the Allowable Value between successive CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the NTSP, but conservative with respect to its Allowable Value, is acceptable. A channel is inoperable if its actual trip setpoint is non-conservative with respect to its required Allowable Value.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

{1. Control Room Air Intake Radiation – High (per train)

The Control Room Air Intake Radiation Monitoring System within the PRMS consists of four channels per CRHAVS train, or eight total channels. Two sets of four Radiation Detection Assemblies are mounted external to the normal outside air intake duct for the CRHAVS. The Radiation Detection Assemblies continuously monitor the gamma radiation levels in the outside air intake, and a Control Room Air Intake Radiation - High signal from either CRHAVS train will cause automatic actuation of the normal selected CRHAVS train to supply filtered makeup air to the CRHA by opening the normal selected EFU outside air inlet damper, stopping both outside air intake fans, closing the normal outside air intake and both outside air intake fan outlet dampers, and automatically starting the normal selected EFU. In addition, there are eight CRHA isolation dampers in total located as close as possible to the CRHA boundary, including two dampers in series in the single outside air intake line to the CRHA, two dampers in series in the single restroom exhaust line from the CRHA, two dampers in series in the single smoke purge supply line to the CRHA, and two dampers in series in the single smoke purge exhaust line from the CRHA. These eight CRHA isolation dampers close on a Control Room Air Intake Radiation - High signal from either CRHAVS train. The Control Room Air Intake Radiation - High Allowable Value~~Analytical / Design Limit~~ is chosen to ensure sufficient emergency filtration exists to ensure adequate radiological conditions in the CRHA during the emergency filtration mode of operation.

Three channels of Control Room Air Intake Radiation - High Function per CRHAVS train are required to be OPERABLE to ensure no single instrument failure will preclude CRHA isolation and actuation of CRHAVS in the emergency filtration mode of operation.

In MODES 1, 2, 3, and 4 the Control Room Air Intake Radiation - High signal must be OPERABLE to maintain habitability of the control room following a DBA, since the DBA could lead to a fission-product release.

In MODES 5 and 6, the probability and consequences of a DBA are reduced due to the pressure and temperature limitations in these MODES. Therefore, maintaining the Control Room Air Intake Radiation - High signal OPERABLE is not required in MODES 5 or 6, except for other situations under which significant radioactive releases can be postulated, i.e., during operations with a potential for draining the reactor vessel (OPDRVs).