B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Protection System (RPS) Instrumentation

BASES

BACKGROUND

The RPS initiates a reactor trip, if necessary, to protect against violating the core fuel design limits and the Reactor Coolant System (RCS) pressure boundary during ~~anticipated operational occurrences (AOOs)~~ abnormalities. By tripping the reactor, the RPS also assists the Engineered Safety Feature (ESF) Systems in mitigating accidents. (21) edit

The protection and monitoring systems have been designed to assure safe operation of the reactor. This is achieved by ~~specifying~~ identifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RPS, as well as the LCOs and administrative controls on other ~~reactor system~~ parameters and equipment performance. (21)

The LSSS, defined in this Specification as the Allowable Value, in conjunction with the LCOs, establishes the threshold for protective system action to prevent exceeding specified acceptable limits during Design Basis Accidents (DBAs). (21)

INSERT B 3.3-1A ~~During AOOs, which are those events expected to occur one or more times during the unit's life, the acceptable limit is:~~ edit

a. For accidents other than locked rotor, the departure from nucleate boiling ratio (DNBR) shall be maintained above the Safety Limit (SL) value; or

For the locked rotor accident, the minimum DNBR shall not be less than the applicable critical heat flux correlation limit, or fuel cladding shall be shown to experience no significant temperature excursions

b. Fuel centerline ~~melt shall not occur~~ temperature shall be maintained below the SL value; ~~and~~ (21)

c. The RCS pressure SL of 2750 psig shall not be exceeded; and

d. Reactor power shall not exceed 112% RTP.

Maintaining the parameters within the above values ensures that the offsite dose will be within the ~~10 CFR 20 and~~ 10 CFR 100 criteria during ~~AOOs~~ abnormalities. (21) edit

~~Accidents are events that are analyzed even though they are not expected to occur during the unit's life. The acceptable limit during accidents is that the offsite dose shall be maintained within 10 CFR 100 limits. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.~~ (21)

(continued)

<INSERT B3.3-1A>

Acceptable consequences for accidents are that the offsite dose shall be maintained within 10 CFR 100 limits or other limits approved by the NRC.

During abnormalities, one or more of the following limits is maintained:

BASES

BACKGROUND (continued)

RPS Overview

The RPS consists of four separate redundant protection channels that receive inputs of neutron flux, RCS pressure, RCS flow, ~~RCS~~ reactor outlet temperature, RCS pump status, reactor building (RB) pressure, main feedwater (MFW) pump turbine status, and main turbine status. 21

Figure ~~[ ]~~ 7.1, ~~F~~SAR, Chapter ~~[7]~~ (Ref. 1), shows the arrangement of ~~a typical~~ the RPS protection channels. A protection channel is composed of measurement channels, a manual trip channel, a reactor trip module (RTM), and ~~CONTROL ROD~~ control rod drive (CRD) trip devices. LCO 3.3.1 provides requirements for the individual measurement channels. These channels encompass all equipment and electronics from the point at which the measured parameter is sensed through the bistable relay contacts in the trip string. LCO 3.3.2, "Reactor Protection System (RPS) Manual Reactor Trip," LCO 3.3.3, "Reactor Protection System (RPS)—Reactor Trip Module (RTM)," and LCO 3.3.4, "C~~ONTROL~~ R~~OD~~ Drive (CRD) Trip Devices," discuss the remaining RPS elements. 21

The RPS instrumentation measures critical unit parameters and compares these to predetermined setpoints. If the setpoint is exceeded, a channel trip signal is generated. The generation of ~~any~~ two trip signals in any of the four RPS channels will result in the trip of the reactor. 21

The Reactor Trip System (RTS) contains multiple CRD trip devices, two AC trip breakers, and two DC trip breaker pairs that provide a path for power to the CRD System. In addition to the safety rods, ~~Additionally,~~ the power for ~~most of the CRDs passes through~~ the regulating rods and APSRs may be interrupted by the electronic trip assembly (ETA) relays. The system has two separate paths (or channels), with each path having either two breakers in series or a breaker and an ETA relay ~~in series~~. ~~Each~~ path provides independent power to the CRDs. Either path can provide sufficient power to operate all CRDs. Two separate power paths to the CRDs ensure that a single failure that opens one path will not cause an unwanted reactor trip. 21 controlled silicon controlled rectifier (SCR)

The RPS consists of four Each independent protection channels, each containing an RTM. ~~The~~ RTM receives signals from its own measurement channels that indicate a protection channel trip is required. The RTM transmits this signal to its own two-out-of-four trip logic and to the two-out-of-four logic edit

(continued)

BASES

BACKGROUND RPS Overview (continued)

of the RTMs in the other three RPS channels. Whenever any two RPS channels ~~transmit channel~~ trip ~~signals~~, the RTM ~~logic~~ in each channel actuates to remove 120 VAC power from its associated CRD trip breaker. and de-energizing ETA relays 21

The reactor is tripped by opening circuit breakers that interrupt the control power supply to the CRDs. Six breakers are installed to increase reliability and allow testing of the trip system. A one-out-of-two taken twice logic is used to interrupt power to the rods.

The RPS has two manual bypasses: a shutdown bypass and a channel bypass. Shutdown bypass allows the withdrawal of safety rods ~~for SDM~~ to provide the availability of rapidly insertable ~~and rapid~~ negative reactivity ~~insertion~~ during unit cooldowns or heatups. Channel bypass is typically used for maintenance and testing. Test circuits in the trip strings allow ~~complete~~ testing of ~~all~~ RPS trip Functions. 21

The RPS ~~operates~~ receives input from the instrumentation channels discussed next. The specific relationship between measurement channels and protection channels differs from parameter to parameter. INSERT B3.3-3A ~~Three basic configurations are used:~~

~~a. Four completely redundant measurements (e.g., reactor coolant flow) with one channel input to each protection channel;~~

~~b. Four channels that provide similar, but not identical, measurements (e.g., power range nuclear instrumentation where each RPS channel monitors a different quadrant), with one channel input to each protection channel; and~~

~~c. Redundant measurements with combinational trip logic outside of the protection channels and the combined output provided to each protection channel (e.g., main turbine trip instrumentation).~~ 21

These arrangements and the relationship of instrumentation channels to trip Functions are discussed ~~next~~ below to assist in understanding the overall effect of instrumentation channel failure. edit

(continued)

<INSERT B3.3-3A>

Also, an automatic bypass is provided at low power levels for the Main Turbine Trip and the Loss of Main Feedwater Pump Functions.

BASES

BACKGROUND (continued)

Power Range Nuclear Instrumentation

Power Range Nuclear Instrumentation channels provide inputs to the following RPS trip Functions: edit

1. Nuclear Overpower

   a. Nuclear Overpower—High Setpoint;

   b. Nuclear Overpower—Low Setpoint;

7. Reactor Coolant Pump to Power;

8. Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE (Power Imbalance Flow);

9. Main Turbine Trip (~~Control~~ Oil Pressure); and

10. Loss of Main Feedwater ~~(LOMFW)~~ Pumps (Control Oil Pressure). 21

INSERT B 3.3-4A

The power range instrumentation has four linear ~~level~~ channels, one for each core quadrant. Each channel feeds one RPS protection channel. Each channel originates in a detector assembly containing two uncompensated ion chambers. The ion chambers are positioned to represent the top half and bottom half of the core. The individual currents from the chambers are fed to individual linear amplifiers. The summation of the top and bottom is the total reactor power. The ~~difference of the~~ top minus the bottom neutron signal is the measured AXIAL POWER IMBALANCE of the reactor core. edit

Reactor ~~Coolant System~~ Outlet Temperature

The Reactor ~~Coolant System~~ Outlet Temperature provides input to the following Functions: 21

2. Reactor ~~RCS~~ ~~High~~ ~~Outlet~~ Temperature; and

5. RCS Variable Low Pressure.

The Reactor ~~RCS~~ Outlet Temperature is measured by two resistance elements in each hot leg, for a total of four. One temperature detector is associated with each protection channel.

(continued)

<INSERT B3.3-4A>

The Main Turbine Trip and Loss of Main Feedwater Pumps Functions utilize the Power Range Nuclear Instrumentation only for enabling/disabling the operating bypass at low power levels.

BASES

BACKGROUND (continued)

Reactor Coolant System Pressure

The Reactor Coolant System Pressure provides input to the following Functions:

3. RCS High Pressure;
4. RCS Low Pressure;
5. RCS Variable Low Pressure; and
11. Shutdown Bypass RCS High Pressure.

The RPS inputs of reactor coolant pressure are provided by two pressure transmitters in each hot leg, for a total of four. One sensor is associated with each protection channel.

Reactor Building Pressure

The Reactor Building Pressure measurements provide input only to the Reactor Building High Pressure trip, Function 6. There are four RB High Pressure sensors, one associated with each protection channel.

Reactor Coolant Pump Power Monitoring

Reactor coolant pump power monitors are inputs to the Reactor Coolant Pump to Power trip, Function 7. Each RCPs operating current ~~and voltage~~ is measured by ~~four current transformers and four potential transformers driving four overpower and four underpower relays. Each power monitoring channel consists of an overpower relay and an underpower relay. One channel for each pump is associated with each protection channel.~~

INSERT B3.3-5A

21

Reactor Coolant System Flow

The Reactor Coolant System Flow measurements are an input to the Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE trip, Function 8. The reactor coolant flow inputs to the RPS are provided by eight ~~high accuracy~~ differential pressure transmitters, four on each loop, which measure flow

edit

(continued)

<INSERT B3.3-5A>

a current transformer providing the current input to the associated RCP underpower relay, and the bus voltage is measured by a potential transformer providing the voltage input to the associated RCP underpower relays. Each RCP underpower relay provides individual RCP status to each protection channel.

BASES

BACKGROUND

Reactor Coolant System Flow (continued)

through calibrated flow tubes. One flow input in each loop is associated with each protection channel.

Main Turbine Automatic Stop Oil Pressure

Main Turbine Automatic Stop Oil Pressure is an input to the Main Turbine Trip (Control Oil Pressure) reactor trip, Function 9. Each of the four protection channels receives turbine status information from ~~the same~~ one of four pressure switches monitoring main turbine automatic stop oil pressure. ~~An open indication will be provided to the RPS on a turbine trip.~~ Contact buffers in each protection channel continuously monitor the status of the contact inputs and initiate an RPS trip when a main turbine trip is indicated. (21) edit (21)

Feedwater Pump Control Oil Pressure

Feedwater Pump Control Oil Pressure is an input to the Loss of Main Feedwater Pumps (Control Oil Pressure) trip, Function 10. Control oil pressure is measured by four switches on each feedwater pump. One switch on each pump is associated with each protection channel.

RPS Bypasses

The RPS is designed with two types of manual bypasses: channel bypass and shutdown bypass. (21)

Channel bypass provides a method of placing all Functions in one RPS protection channel in a bypassed condition, and shutdown bypass provides a method of leaving the safety rods withdrawn during cooldown and depressurization of the RCS. Each bypass is discussed next.

Channel Bypass

A channel bypass provision is provided to allow for maintenance and testing of the RPS. The use of channel bypass keeps the protection channel trip relay energized regardless of the status of the instrumentation channel or (21)

(continued)

BASES

BACKGROUND

Channel Bypass (continued)

the key switch must be operated, and

the bistable relay contacts. To place a protection channel in channel bypass, the other three channels must not be in channel bypass. This is ensured by contacts from the other channels being in series with the channel bypass relay. If any contact is open, the second channel cannot be bypassed. ~~The second condition is the closing of the key switch.~~ When the bypass relay is energized, the bypass contact closes, maintaining the channel trip relay in an energized condition. All RPS trips are reduced to a two-out-of-three logic in channel bypass. Only one channel bypass key is accessible for use in the control room. 21

An indicator light remains lit while the channel is in bypass.

Shutdown Bypass

allowable some

During unit cooldown, it is ~~desirable~~ to leave ~~the~~ safety rods withdrawn to provide shutdown capabilities in the event of unusual positive reactivity additions (moderator dilution, etc.). 21

However, the unit is also depressurized as coolant temperature is decreased. If the safety rods are withdrawn and coolant pressure is decreased, an RCS Low Pressure trip will occur at 1800 psig and the rods will fall into the core. To avoid this, the protection system allows the operator to bypass the low pressure trip and maintain shutdown capabilities. During the cooldown and depressurization, the safety rods are inserted prior to the low pressure trip of 1800 psig. The RCS pressure is decreased to less than 1720 psig, then each RPS channel is placed in shutdown bypass.

When an RPS channel is placed in shutdown bypass,

~~In shutdown bypass, a normally closed contact opens and the operator closes the shutdown bypass key switch. This action bypasses~~ the RCS Low Pressure trip, Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE trip, Reactor Coolant Pump to Power trip, and the RCS Variable Low Pressure trip, and ~~inserts~~ a ~~new~~ RCS High Pressure, ≤1720 ~~1850~~ psig trip. The operator can now withdraw the safety rods for additional ~~SDM~~ rapidly insertable negative reactivity 19

are bypassed

and a Nuclear Overpower Low setpoint trip, ≤ 5% RTP, are inserted.

The insertion of the ~~new~~ high pressure trip ~~performs two functions. First,~~ with a trip setpoint of ≤ 1720 psig, ~~the bistable~~ prevents operation at normal system pressure, approximately 2155 psig, with a portion of the RPS bypassed. ~~The second~~

(continued)

BASES

BACKGROUND

Shutdown Bypass (continued)

and ~~function is to~~ ensure(s) that the bypass is removed prior to normal operation. When the RCS pressure is increased during a unit heatup, the safety rods are inserted prior to reaching 1720 psig. The shutdown bypass is removed, which returns the RPS to normal, and system pressure is increased to greater than 1800 psig. ~~The~~ All or some of the safety rods are then withdrawn and normally remain at the full out condition for the rest of the heatup. (19) (21)

~~In addition to the Shutdown Bypass RCS High Pressure trip, the high flux trip setpoint is administratively reduced to 5% RTP while the RPS is in shutdown bypass. This~~ The insertion of the Nuclear Overpower Low Setpoint Trip provides a backup to the Shutdown Bypass RCS High Pressure trip ~~and allows low temperature physics testing~~ while preventing the generation of any significant amount of power. (19) (21)

Module Interlock and Test Trip Relay

Each channel and each trip module is capable of being individually tested. When a module is placed into the test mode, it causes the test trip relay to open and to indicate an RPS channel trip. Under normal conditions, the channel to be tested is placed in bypass before a module is tested.

Trip Setpoints/Allowable Value

The trip setpoints are the ~~normal~~ nominal values at which the bistables are set. Any bistable is considered to be properly adjusted when the "as left" value is within the band for CHANNEL CALIBRATION accuracy ~~(i.e., ± [rack calibration + comparator setting accuracy])~~. edit

The trip setpoints used in the bistables are based on the analytical limits ~~stated~~ used in the safety analysis described in ~~F~~SAR, Chapter ~~[14]~~ and Chapter 3A (Ref. 2). The selection of these trip setpoints is such that adequate protection is provided when ~~all~~ appropriate sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and ~~severe~~ environment errors ~~for those RPS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 3)~~, the Allowable Values specified in Table 3.3.1-1 ~~in the accompanying LCO~~ are equal to or conservatively (21)

(continued)

The explicit uncertainties are addressed in the individual design calculations as required

BASES

BACKGROUND

Trip Setpoints/Allowable Value (continued)

Guidance

the uncertainties associated with

adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the trip setpoints, ~~including their explicit uncertainties,~~ is provided in "[Unit Specific Setpoint Methodology]" (Ref. 4). The actual nominal trip setpoint entered into the bistable is more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST. One example of such a change in measurement error is drift during the Surveillance Frequency. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value. 3 21

Instrument Loop Error Analysis and Setpoint Methodology Manual, Design Guide, IDG-001

May be

as-found

instrument

edit

edit

Setpoints in accordance with the Allowable Value ensure that the limits of Chapter 2.0, "Safety Limits," in the Technical Specifications are not violated during AOOs and that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed. Note that in LCO 3.3.1 the Allowable Values listed in Table 3.3.1-1 are the LSSS. 21

abnormalities

abnormality

analyzed

trip setpoint

Each channel can be tested online to verify that the signal and setpoint accuracy are within the specified allowance requirements of Reference 4. Once a designated channel is taken out of service for testing, a simulated signal is injected in place of the field instrument signal. The process equipment for the channel in test is then tested, verified, and calibrated. Surveillances for the channels are specified in the SR section. 21

edit

Approved Calibration procedures

may be

may

be

~~The Allowable Values listed in Table 3.3.1-1 are based on the methodology described in "[Unit Specific Setpoint Methodology]" (Ref. 4), which incorporates all of the known uncertainties applicable for each channel. The magnitudes of those uncertainties are factored into the determination of each trip setpoint. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.~~ 21

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

A

~~Each of the~~ ~~a~~nalyzed accidents and transients can be detected by one or more RPS Functions. The accident analysis contained in ~~(Ref. [ ])~~ takes credit for most RPS trip Functions. Functions ~~not~~ specifically credited in the accident analysis were qualitatively credited in the safety ~~analysis and the~~ NRC staff approved licensing basis for the unit. These Functions are high RB pressure, high RCS temperature, turbine trip, ~~and~~ loss of main feedwater, These Functions may provide protection for conditions that do not require dynamic transient analysis to demonstrate Function performance. These Functions also serve as backups to Functions that were credited in the safety analysis. 21 21

the SAR, Chapter 14 and Chapter 3A, (Ref. 2),

the shutdown bypass nuclear overpower low setpoint, and shutdown bypass high pressure.

The LCO requires all instrumentation performing an RPS Function to be OPERABLE. Failure of any instrument renders the affected channel(s) inoperable. ~~and reduces the reliability of the affected Functions.~~ The four channels of each Function in Table 3.3.1-1 of the RPS instrumentation shall be OPERABLE ~~at all times the reactor is critical~~ to ensure that a reactor trip will be actuated if needed. Additionally, during shutdown bypass with any CRD trip breaker closed, the applicable RPS Functions must also be ~~available~~. This ensures the capability to trip the withdrawn CONTROL RODS exists at all times that rod motion is possible. The trip Function channels specified in Table 3.3.1-1 are considered OPERABLE when all channel components necessary to provide a reactor trip are functional and in service for the required MODE or Other Specified Condition listed in Table 3.3.1-1. 21

during its specified Applicability

OPERABLE

Required Actions allow maintenance (protection channel) bypass of individual channels, but the bypass activates interlocks that prevent operation with a second channel bypass. Bypass effectively places the unit in a two-out-of-three logic configuration that can still initiate a reactor trip, even with a single failure within the system.

or calibration procedures.

Only the Allowable Values are specified for each RPS trip Function in the LCO. ~~Nominal~~ trip setpoints are specified in the ~~unit specific~~ setpoint calculations. The ~~nominal~~ setpoints are selected ~~to ensure~~ that the setpoint measured by CHANNEL FUNCTIONAL TESTS ~~does not~~ exceed the Allowable Value if the bistable is performing as required. ~~Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable~~ 21

such

is not expected to

edit

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~provided that operation and testing are consistent with the assumptions of the unit specific setpoint calculations. Each Allowable Value specified is more conservative than instrument uncertainties appropriate to the trip Function. These uncertainties are defined in the "[Unit Specific Setpoint Methodology]" (Ref. 4).~~ edit

21

For most RPS Functions, the ~~trip setpoint~~ Allowable Value is to ensure that the departure from nucleate boiling (DNB) or RCS pressure SLs are not challenged. Cycle specific figures for use during operation are contained in the COLR.

Certain RPS trips function to indirectly protect the SLs by detecting specific conditions that do not immediately challenge SLs but will eventually lead to challenge if no action is taken. These trips function to minimize the consequences of unit transients caused by the specific conditions. The Allowable Value for these Functions is selected at the minimum specified deviation from normal values that will indicate the condition, without risking spurious trips due to normal fluctuations in the measured parameter. edit edit

The Allowable Values for bypass removal Functions are stated in the Applicable MODE or Other Specified Condition column of Table 3.3.1-1.

The safety analyses applicable to each RPS Function are discussed next.

1. <u>Nuclear Overpower</u>

   a. <u>Nuclear Overpower—High Setpoint</u>

      The Nuclear Overpower—High Setpoint trip provides protection for the design thermal overpower condition based on the measured out of core fast neutron leakage flux.

      The Nuclear Overpower—High Setpoint trip initiates a reactor trip when the neutron power reaches a predefined setpoint at the design overpower limit. Because THERMAL POWER lags the neutron power, tripping when the neutron power reaches the design overpower will limit THERMAL POWER to a maximum value of the design overpower.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

a. Nuclear Overpower—High Setpoint (continued)

Thus, the Nuclear Overpower—High Setpoint trip protects against violation of the DNBR and fuel centerline melt SLs. However, the RCS Variable Low Pressure, and Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE, also provide ~~more direct~~ protection. The role of the Nuclear Overpower—High Setpoint trip is to limit reactor THERMAL POWER below the highest power at which the other two trips are known to provide protection. 21

The Nuclear Overpower—High Setpoint trip also provides transient protection for rapid positive reactivity excursions during power operations. These events include the rod withdrawal accident, the rod ejection accident, and the steam line break accident. By providing a trip during these events, the Nuclear Overpower—High Setpoint trip protects the unit from excessive power levels and also serves to reduce reactor power to prevent violation of the RCS pressure SL.

Rod withdrawal accident analyses cover a large spectrum of reactivity insertion rates (rod worths), which exhibit slow and rapid rates of power increases. At high reactivity insertion rates, the Nuclear Overpower—High Setpoint trip provides the primary protection. At low reactivity insertion rates, the high pressure trip provides primary protection.

The specified Allowable at or Value is selected to initiate ~~ensure that~~ a trip ~~occurs~~ before reactor power exceeds the highest point at which the RCS Variable Low Pressure and the Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE trips are analyzed to provide protection against DNB and fuel centerline melt. The Allowable Value does not account for harsh environment induced errors, because the trip will actuate prior to degraded environmental conditions being reached. 21

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b. Nuclear Overpower—Low Setpoint

While in shutdown bypass, ~~with the Shutdown Bypass RCS High Pressure trip OPERABLE,~~ the Nuclear Overpower—Low Setpoint trip ~~must be reduced to~~ is instated with a trip setpoint of ≤ 5% RTP. The low power setpoint, in conjunction with the ~~lower~~ Shutdown Bypass RCS High Pressure setpoint, ~~ensure that~~ the unit ~~is protected~~ protect from excessive power conditions when other RPS trips are bypassed. 19 21

The ~~setpoint~~ Allowable Value was chosen to be as low as practical and still lie within the range of the out of core instrumentation. edit

2. ~~RCS~~ Reactor High Outlet Temperature

The ~~RCS~~ Reactor High Outlet Temperature trip, in conjunction with the RCS Low Pressure and RCS Variable Low Pressure trips, provides protection for the DNBR SL. A trip is initiated whenever the reactor ~~vessel~~ outlet temperature approaches the conditions necessary for DNB. Portions of each ~~RCS~~ High Outlet Temperature trip channel are common with the RCS Variable Low Pressure trip. The ~~RCS~~ High Outlet Temperature trip provides steady state protection for the DNBR SL. 21

The ~~RCS~~ High Outlet Temperature trip limits the maximum RCS temperature to below the highest value for which DNB protection by the Variable Low Pressure trip is ensured. The trip setpoint Allowable Value is selected to ~~ensure that~~ initiate a trip ~~occurs~~ before hot leg temperatures reach the point beyond which the RCS Low Pressure and Variable Low Pressure trips are analyzed. Above the high temperature trip, the variable low pressure trip need not provide protection, because the unit would have tripped already. The ~~setpoint~~ Allowable Value does not reflect errors induced by harsh environmental conditions that the equipment is expected to experience because the trip ~~is not required to mitigate accidents that create harsh conditions in the RB~~ will actuate prior to degraded environmental conditions being reached. 21

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3. RCS High Pressure

The RCS High Pressure trip works in conjunction with the pressurizer ~~and main steam~~ safety valves to prevent RCS overpressurization, thereby protecting the RCS High Pressure SL. 21

The RCS High Pressure trip has been credited in the accident analysis calculations for slow positive reactivity insertion transients (rod withdrawal accidents and moderator dilution) ~~and loss of feedwater accidents~~. The rod withdrawal accidents cover a large spectrum of reactivity insertion rates and rod worths that exhibit slow and rapid rates of power increases. At high reactivity insertion rates, the Nuclear Overpower—High Setpoint trip provides the primary protection. At low reactivity insertion rates, the RCS High Pressure trip provides the primary protection. 21

The ~~setpoint~~ Allowable Value is selected ~~to ensure~~ such that ~~the RCS~~ High Pressure SL is not ~~challenged~~ exceeded during steady state operation or slow power increasing transients. The ~~setpoint~~ Allowable Value does not reflect errors induced by harsh environmental conditions because ~~the equipment is not required to mitigate accidents that create harsh conditions in the RB~~. 21

Trip will actuate prior to degraded environmental conditions being reached

4. RCS Low Pressure

The RCS Low Pressure trip, in conjunction with the ~~RCS~~ Reactor High Outlet Temperature and Variable Low Pressure trips, provides protection for the DNBR SL. A trip is initiated ~~whenever the system pressure approaches~~ prior to reactor outlet temperature exceeding the conditions necessary for DNB. The RCS Low Pressure trip provides the DNB low pressure limit for the RCS Variable Low Pressure trip. 21 edit

The RCS Low Pressure ~~setpoint~~ Allowable Value is selected to ~~ensure that~~ initiate a reactor trip ~~occurs~~ before RCS pressure is reduced below the lowest point at which the RCS Variable Low Pressure trip is analyzed. The RCS Low Pressure trip provides protection for primary system depressurization events and has been 21

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

4. RCS Low Pressure (continued)

credited in the accident analysis calculations for small break loss of coolant accidents (LOCAs). Consequently, harsh RB conditions created by small break LOCAs can affect performance of the RCS pressure sensors and transmitters. Therefore, degraded environmental conditions are considered in the Allowable Value determination.

5. RCS Variable Low Pressure

The RCS Variable Low Pressure trip, in conjunction with the ~~RCS~~ Reactor High ~~Outlet~~ Temperature and RCS Low Pressure trips, provides protection for the DNBR SL. A trip is initiated ~~whenever~~ prior to the system parameters of pressure and temperature ~~approach~~ exceeding the conditions necessary for DNB. The RCS Variable Low Pressure trip provides a floating low pressure trip based on the ~~RCS High Outlet~~ reactor temperature expressed in degrees Fahrenheit within the range specified by the ~~RCS~~ Reactor High ~~Outlet~~ Temperature and RCS Low Pressure trips.

The RCS Variable Low Pressure ~~setpoint~~ Allowable Value is selected to ~~ensure that~~ initiate a trip ~~occurs when~~ prior to temperature and pressure ~~approach~~ exceeding the conditions necessary for DNB while operating in a temperature pressure region constrained by the low pressure and high temperature trips. The RCS Variable Low Pressure trip is not assumed for transient protection in the unit safety analysis; therefore, ~~determination of~~ the ~~setpoint~~ Allowable Value does not account for errors induced by a harsh RB environment.

21

edit

6. Reactor Building High Pressure

The Reactor Building High Pressure trip provides an early indication of a high energy line break (HELB) inside the RB. By detecting changes in the RB pressure, the RPS can provide a reactor trip before the other system parameters have varied significantly. Thus, this trip acts to minimize accident consequences. ~~It also provides a backup for RPS trip instruments exposed to an RB HELB environment.~~ 21

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

6. Reactor Building High Pressure (continued)

The Allowable Value for RB High Pressure trip is set at the lowest value consistent with avoiding spurious trips during normal operation. ~~The electronic components of the RB High Pressure trip are located in an area that is not exposed to high temperature steam environments during HELB transients. The components are exposed to high radiation conditions. Therefore, the determination of the setpoint Allowable Value accounts for errors induced by the high radiation.~~

INSERT B3.3-16A

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7. Reactor Coolant Pump to Power

The Reactor Coolant Pump to Power trip provides protection for changes in the reactor coolant flow due to the loss of multiple RCPs. Because the flow reduction lags loss of power indications due to the inertia of the RCPs, the trip initiates protective action earlier than a trip based on a measured flow signal.

The trip also prevents operation with both pumps in either coolant loop tripped. Under these conditions, may be core flow and core fluid mixing ~~are~~ insufficient for adequate heat transfer. Thus, the Reactor Coolant Pump to Power trip functions to protect the DNBR and fuel centerline ~~melt~~ temperature SLs.

21

The Reactor Coolant Pump to Power trip has been credited in the accident analysis calculations for the loss of four RCPs. The trip also provides ~~the primary~~ protection for the loss of a pump or pumps~~,~~ which would result in both pumps in a single steam generator loop being tripped.

edit

The Allowable Value for the Reactor Coolant Pump to Power trip setpoint is selected to prevent normal power operation unless at least ~~three RCPs are~~ one RCP is in each loop operating~~,~~. RCP status is monitored by power transducers ~~on~~ associated with each pump. These relays indicate a loss of an RCP ~~on overpower with an Allowable Value of ≥ 14,400 kW and~~ on underpower ~~with an Allowable Value of ≤ 1752 kW. The overpower Allowable Value is selected low enough to detect locked rotor conditions.~~

18

edit

21

(continued)

<INSERT B 3.3-16A>

Even in the case where this trip is a backup for other RPS trips for LOCA or MSLB, it is assumed to occur before degraded building conditions have an appreciable effect on RB High Pressure trip components. Therefore, determination of the Allowable Value does not account for errors induced by a harsh environment.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

7. Reactor Coolant Pump to Power (continued)

~~(although credit is not allowed for this capability) but high enough to avoid a spurious trip on the in rush current when the pumps start.~~ 21 The underpower Allowable Value is selected to reliably trip on loss of voltage to the RCPs. Neither the reactor power nor the pump power Allowable Value account for instrumentation errors caused by harsh environments because the trip Function is not required to respond to events that could create harsh environments around the equipment.

8. Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE

The Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE trip provides steady state protection for the ~~power imbalance~~ reactor core SLs. A reactor trip is initiated ~~when~~ prior to the core power, AXIAL POWER IMBALANCE, and reactor coolant flow conditions ~~indicate an approach to~~ exceeding the DNB or fuel centerline ~~melt~~ temperature limits. 21

This trip supplements the protection provided by the Reactor Coolant Pump to Power trip, through the power to flow ratio, for loss of reactor coolant flow events. The power to flow ratio provides direct protection for the ~~DNBR SL for~~ limiting loss of flow transient which is the loss of ~~a single RCP and for locked RCP rotor accidents.~~ two RCPs from four pump operation. The imbalance portion of the trip is credited for steady state protection only. 21

The power to flow ratio of the Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE trip also provides steady state protection to prevent reactor power from exceeding the allowable power when the primary system ~~flow rate is less than full four~~ is operating with two or three pump flow. Thus, the power to flow ratio prevents overpower conditions similar to the Nuclear Overpower trip. This protection ensures that during reduced flow conditions the core power is maintained below that required to begin DNB. 21

The Allowable Value is selected to ensure that a trip occurs ~~when the~~ prior to core power, axial power peaking, and 21

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

8. Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE (continued)

temperature

reaching

reactor coolant flow conditions ~~indicate an approach to~~ DNB or fuel centerline melt limits. ~~By measuring reactor coolant flow and by tripping only when conditions approach an SL, the unit can operate with the loss of one pump from a four pump initial condition.~~ The Allowable Value for this Function is given in the unit COLR because the cycle specific core peaking changes affect the Allowable Value.

21

9. Main Turbine Trip (~~Control~~ Oil Pressure)

21

edit

tripped

The Main Turbine Trip Function trips the reactor when the main turbine is lost at high power levels. The Main Turbine Trip Function provides an early reactor trip in anticipation of the loss of heat sink associated with a turbine trip. The Main Turbine Trip Function was added to the B&W designed units in accordance with NUREG-0737 (Ref. 4) following the Three Mile Island Unit 2 accident. The trip lowers the probability of an RCS ~~power operated~~ relief valve (PORV) actuation for turbine trip cases. ~~This trip is activated at higher power levels, thereby limiting the range through which the Integrated Control System must provide an automatic runback on a turbine trip.~~

electromatic

(ERV)

21

Each of the four turbine oil pressure switches feeds ~~all~~ four protection channels through buffers that continuously monitors the status of the contacts. Therefore, failure of any pressure switch affects all protection channels.

One of the

a

only one

21

For the Main Turbine Trip (~~Control~~ Oil Pressure) bistable, the Allowable Value of 45 psig is selected to provide a trip whenever ~~feedwater pump control~~ oil pressure drops below the normal operating range. ~~To ensure that the trip is enabled as required by the LCO, the reactor power bypass is set with an Allowable Value of 45% RTP.~~ The turbine trip is not required to protect against events that can create a harsh environment in the turbine building. Therefore, errors induced by harsh environments are not included in the determination of the setpoint Allowable Value.

≥40.5

main turbine

21

<INSERT B3.3-18A>

RAI 3.3.1-02

(continued)

3.3.1-02

<INSERT B 3.3-18A>

The reactor power bypass is designed to automatically remove the turbine oil pressure trip function from the bypassed condition at < 45% RTP. Alarms are available to alert operators when the bypass function is enabled. Should the automatic bypass removal function fail such that the channel remains in the bypassed state, the channel must be considered inoperable at power levels of ≥ 45% RTP and the appropriate condition is entered. Failure of the automatic bypass removal feature alone or the inability to place the channel in a bypassed state when < 45% RTP does not constitute channel inoperability. The automatic bypass removal feature is tested to ensure its continued availability during the monthly CHANNEL FUNCTIONAL TEST.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

10. Loss of Main Feedwater Pumps (Control Oil Pressure)

edit - a loss of main feedwater

tripped

The Loss of Main Feedwater Pumps (Control Oil Pressure) trip provides a reactor trip at high power levels when both MFW pumps are ~~lost~~. The trip provides an early reactor trip in anticipation of the loss of heat sink associated with ~~the LOMFW~~. This trip was added in accordance with NUREG-0737 (Ref. ~~5~~ 4) following the Three Mile Island Unit 2 accident. This trip provides a reactor trip ~~at high power levels~~ for a ~~LOMFW~~ to minimize challenges to the ~~PO~~RV. E

loss of main feedwater

21

≥ 55.5

For the feedwater ~~pump~~ control oil pressure bistable, the Allowable Value of ~~55~~ psig is selected to provide a trip whenever feedwater pump control oil pressure drops below the normal operating range. ~~To ensure that the trip is enabled as required by the LCO, the reactor power bypass is set with an Allowable Value of 15% RTP.~~ The Loss of Main Feedwater Pumps (Control Oil Pressure) trip is not required to protect against events that can create a harsh environment in the turbine building. Therefore, errors caused by harsh environments are not included in the determination of the setpoint Allowable Value.

<INSERT B 3.3-19B>

21

R.I.I. 3.3.1-02

11. Shutdown Bypass RCS High Pressure

while operating below

The RPS Shutdown Bypass ~~RCS High Pressure~~ is provided to allow for withdrawing the CONTROL RODS ~~prior to reaching~~ the normal RCS Low Pressure trip setpoint. The shutdown bypass ~~provides trip protection during deboration and RCS heatup by allowing~~ the operator to withdraw the safety groups of CONTROL RODS. This makes their negative reactivity available to terminate inadvertent reactivity excursions. ~~Use of the shutdown bypass trip requires that the neutron power trip setpoint be reduced to 5% of full power or less. The Shutdown Bypass RCS High Pressure trip forces a reactor trip to occur whenever the unit switches from power operation to shutdown bypass or vice versa.~~ ~~This ensures that~~ the CONTROL RODS are all inserted. ~~and the flux distribution is known before power operation can begin. The operator is required to remove the shutdown bypass, reset the Nuclear~~

allows

<INSERT B 3.3-19A>

19

RPS trips cannot be bypassed unless

(continued)

<INSERT B 3.3-19A>

Because the shutdown bypass high pressure trip setpoint is below the normal RCS low pressure trip setpoint, the reactor must be tripped while passing between these two setpoints.

3.3.1-02

<INSERT B 3.3-19B>

The reactor power bypass is designed to automatically remove the main feedwater pump oil pressure trip function from the bypassed condition at < 10% RTP. Alarms are available to alert operators when the bypass function is enabled. Should the automatic bypass removal function fail such that the channel remains in the bypassed state, the channel must be considered inoperable at power levels of ≥ 10% RTP and the appropriate condition is entered. Failure of the automatic bypass removal feature alone or the inability to place the channel in a bypassed state when < 10% RTP does not constitute channel inoperability. The automatic bypass removal feature is tested to ensure its continued availability during the monthly CHANNEL FUNCTIONAL TEST.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

and Chapter 3A

include

11. Shutdown Bypass RCS High Pressure (continued)

~~Overpower—High Power trip setpoint, and again withdraw the safety rod groups before proceeding with startup.~~ 19

Accidents analyzed in the ~~F~~SAR, Chapter ~~[~~14~~]~~ (Ref. 2), do not ~~describe~~ events that occur during shutdown bypass operation~~, because the consequences of these events are enveloped by the events presented in the FSAR~~. 21

During shutdown bypass operation with the Shutdown Bypass RCS High Pressure trip active with a setpoint of ≤ ~~[~~1720~~]~~ psig and the Nuclear Overpower—Low Setpoint ~~set at or below~~ 5% RTP, the trips listed below ~~can be~~ bypassed. ~~Under these conditions, the Shutdown Bypass RCS High Pressure trip and the Nuclear Overpower—Low Setpoint trip act to prevent unit conditions from reaching a point where actuation of these Functions is necessary.~~ 19

active with a setpoint of ≤

are

~~1.a Nuclear Overpower—High Setpoint;~~

4. RCS Low Pressure;

5. RCS Variable Low Pressure;

7. Reactor Coolant Pump to Power; and

8. Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE.

Nuclear Overpower—Low Setpoint

initiate

The Shutdown Bypass ~~RCS High Pressure Function's~~ Allowable Value is selected to ~~ensure~~ a trip ~~occurs~~ before producing ~~THERMAL POWER~~. 19

significant

General Discussion

10CFR 50.36 (Ref. 5).

The RPS satisfies ~~Criterion 3 of the NRC Policy Statement.~~ 21

In MODES 1 and 2,

In MODES 3, 4, and 5 with any CRD trip breaker in the closed position and the CRD System capable of rod withdrawal, the RPS satisfies Criterion 4 of 10CFR50.36.

~~In MODES 1 and 2, the following trips shall be OPERABLE because the reactor is critical in these MODES. These trips are designed to take the reactor subcritical to maintain the SLs during AOOs and to assist the ESFAS in providing acceptable consequences during accidents.~~ 21

(continued)

BASES

21

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

11. Shutdown Bypass RCS High Pressure (continued)

INSERT B 3.3-21A

1.a Nuclear Overpower—High Setpoint;

2. RCS High Outlet Temperature;

3. RCS High Pressure;

4. RCS Low Pressure;

5. RCS Variable Low Pressure;

6. Reactor Building High Pressure;

7. Reactor Coolant Pump to Power; and

8. Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE.

Functions 1, 4, 5, 7, and 8 just listed may be bypassed in MODE 2 when RCS pressure is below [1720] psig, provided the Shutdown Bypass RCS High Pressure and the Nuclear Overpower—Low setpoint trip are placed in operation. Under these conditions, the Shutdown Bypass RCS High Pressure trip and the Nuclear Overpower—Low setpoint trip act to prevent unit conditions from reaching a point where actuation of these Functions is necessary.

21

Two ~~other~~ Functions are required to be OPERABLE only during portions of MODE 1. These are the Main Turbine Trip (~~Control~~ Oil Pressure) and the Loss of Main Feedwater Pumps (Control Oil Pressure) trip. These Functions are required to be OPERABLE at ≥ ~~above~~ [45]% RTP and ≥ 10% ~~[15]%~~ RTP, respectively. Analyses presented in BAW-1893 (Ref. 6) have shown that for operation below these power levels, these trips are not necessary to minimize challenges to the PORVs E as required by NUREG-0737 (Ref. ~~5~~ 4).

21

Because the ~~only~~ safety function of the RPS is to trip the CONTROL RODS, the RPS is not required to be OPERABLE in MODE 3, 4, or 5 either if the reactor trip breakers are open, or the CRD System is incapable of rod withdrawal. Similarly, the RPS is not required to be OPERABLE in MODE 6 because ~~when~~ the CONTROL RODS are normally ~~decoupled~~ from the CRDs.

(continued)

<INSERT B3.3-21A>

In MODE 1; in MODE 2, when not operating in shutdown bypass; and in MODE 3, when not operating in shutdown bypass but with any CRD trip breaker in the closed position and the CRD system capable of rod withdrawal, the following trips are required to be OPERABLE. These trips function to ensure that any withdrawn CONTROL RODS can be automatically inserted to make or maintain the reactor subcritical.

1.a. Nuclear Overpower-High Setpoint; and

3. RCS High Pressure.

In MODES 1 and 2, the following trips are required to be OPERABLE. These trips function as primary or as back-up trips to ensure that any withdrawn CONTROL RODS can be automatically inserted to make or maintain the reactor subcritical.

2. Reactor Outlet High Temperature: and

6. Reactor Building High Pressure.

In addition, Function 6, Reactor Building High Pressure, is required to be OPERABLE in MODE 3, whenever any CRD trip breaker is closed and the CRD system is capable of rod withdrawal. In this MODE, this Function serves purely as a back-up to other required Functions.

In MODE 1 and in MODE 2, when not in shutdown bypass operation, the following trips are required to be OPERABLE. These Functions operate to ensure that any withdrawn CONTROL RODS can be automatically inserted to make or maintain the reactor subcritical. These Functions are all bypassed when the channel is placed in a shutdown bypass condition. Therefore, they are not required to be OPERABLE during shutdown bypass operation.

4. RCS Low Pressure;

5. RCS Variable Low Pressure;

7. Reactor Coolant Pump to Power; and

8. Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE.

4

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

during shutdown bypass operation

However, in MODE 2, 3, 4, or 5, the Shutdown Bypass RCS High Pressure and Nuclear Overpower—Low setpoint trips are required to be OPERABLE if the CRD trip breakers are closed and the CRD System is capable of rod withdrawal. Under these conditions, the Shutdown Bypass RCS High Pressure and Nuclear Overpower—Low setpoint trips ~~are sufficient to prevent an approach to~~ sufficiently reduce the potential for conditions that could challenge SLs.

ACTIONS

Conditions A, B, and C are applicable to all RPS protection Functions. If a channel's trip setpoint is found nonconservative with respect to the required Allowable Value in Table 3.3.1-1, or the transmitter, instrument loop, signal processing electronics or bistable is found inoperable, the channel must be declared inoperable and all applicable Condition~~A or Conditions A and B~~ entered immediately.

5

~~When the number of inoperable channels in a trip Function exceed those specified in the related Conditions associated with a trip Function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 must be immediately entered if applicable in the current MODE of operation.~~ 2

~~[Reviewer's Note: If a unit is to take credit for topical reports as the basis for justifying Completion Times, the reports must be supported by an NRC Staff Safety Evaluation Report (SER) that establishes the acceptability of each topical report for that unit.]~~ EDIT

1

A.1 and A.2

If one or more Functions in one protection channel become inoperable, the affected protection channel must be placed in bypass or trip, or the bypass of the remaining channels prevented. If the channel is bypassed, all RPS Functions are placed in a two-out-of-three logic configuration and the bypass of any other channel is prevented. In this configuration, the RPS can still perform its safety function in the presence of a random failure of any single channel. Alternatively, the inoperable channel can be placed in trip. Tripping the affected protection channel places all RPS Functions in a one-out-of-three configuration. 1

(continued)

BASES

ACTIONS

INSERT B3.3-23A

A.1 and A.2 (continued)

Operation in ~~the two-out-of-three configuration or in the one-out-of-three configuration~~ these configurations may continue indefinitely ~~based on the NRC SER for BAW-10167, Supplement 2 (Ref. 7).~~ because ~~In this configuration,~~ the RPS is capable of performing its trip Function in the presence of any single random failure. The 1 hour Completion Time is sufficient to perform Required Action A.1 or Required Action A.2. (1)

B.1, B.2.1 and B.2.2

INSERT B3.3-23B

For Required Action B.1 and Required Action B.2, if one or more Functions in two protection channels become inoperable, either one of two inoperable protection channels must be placed in trip ~~and the other in bypass~~. These Required Actions place all RPS Functions in either a one-out-of-two logic configuration or a one-out-of-three ~~and prevent bypass of a second channel~~. In either of these ~~this~~ configurations, the RPS can still perform its safety functions in the presence of a random failure of any single channel. The 1 hour Completion Time is sufficient to perform Required Action B.1, Required Action B.2.1, and Required Action B.2.2. (1)

C.1

Required Action C.1 directs entry into the appropriate Condition referenced in Table 3.3.1-1. The applicable Condition referenced in the table is Function dependent. If the ~~Each time an inoperable channel has not met any~~ Required Actions of Condition A or B ~~, as applicable, and the~~ and associated Completion Times ~~has expired,~~ are not met or if more than two channels are inoperable, Condition C is entered ~~for that channel and~~ provide~~s~~ for transfer to the appropriate subsequent Condition. (2)

D.1 and D.2

If ~~the~~ Required Action C.1 ~~and associated Completion Time of Condition A or B are not met~~ and Table 3.3.1-1 direct~~s~~ entry into Condition D, the unit must be brought to a MODE in which the specified RPS trip Functions are not required to be OPERABLE. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 (21)

(continued)

<INSERT B3.3-23A>

Another option is to maintain the channel, which contains one or more inoperable Functions, in an untripped and unbypassed state. In this case, bypass of the remaining three channels must be prevented. This is accomplished by tagging them, under administrative controls, to prevent their being bypassed. This option assumes that the inoperability of the Function(s) does not require the channel containing the inoperable Function(s) to remain in a tripped condition, and that the channel contains other Functions which remain OPERABLE.

By maintaining the channel in an untripped and unbypassed state, the inoperable Function(s) are in a two-out-of-three logic configuration. This configuration is equivalent to bypassing the channel. However, by maintaining the channel in an untripped and unbypassed condition, the OPERABLE Functions within that channel remain in service in a normal two-out-of-four logic configuration.

<INSERT B3.3-23B>

The second inoperable channel may be bypassed or may be maintained in an untripped and unbypassed condition. If the channel is not bypassed, bypass of the remaining channels must be prevented. This is accomplished by tagging them, under administrative controls, to prevent their being bypassed. This option assumes that the inoperability of the Function(s) in the second channel does not require that channel to remain in a tripped condition, and that the channel contains one or more Function which remains OPERABLE.

BASES

ACTIONS

D.1 and D.2 (continued)

from full power conditions in an orderly manner and to open all CRD trip breakers without challenging ~~plant~~ unit systems. edit

E.1

If ~~the~~ C.1 Required Action ~~and associated Completion Time of Condition A or B are not met~~ and Table 3.3.1-1 direct~~s~~ entry into Condition E, the unit must be brought to a MODE in which the specified RPS trip Functions are not required to be OPERABLE. To achieve this status, all CRD trip breakers must be opened. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to open CRD trip breakers without challenging ~~plant~~ unit systems. 21 edit

F.1

If ~~the~~ C.1 Required Action ~~and associated Completion Time of Condition A or B are not met~~ and Table 3.3.1-1 direct~~s~~ entry into Condition F, the unit must be brought to a MODE in which the specified RPS trip Function is not required to be OPERABLE. To achieve this status, THERMAL POWER must be reduced to ~~<~~ ~~[~~45~~]~~% RTP. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach ~~[~~45~~]~~% RTP from full power conditions in an orderly manner without challenging ~~plant~~ unit systems. 21 edit edit

G.1

If ~~the~~ C.1 Required Action ~~and associated Completion Time of Condition A or B are not met~~ and Table 3.3.1-1 direct~~s~~ entry into Condition G, the unit must be brought to a MODE in which the specified RPS trip Function is not required to be OPERABLE. To achieve this status, THERMAL POWER must be reduced to < ~~[15]~~ 10% RTP. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach ~~[15]~~ 10% RTP from full power conditions in an orderly manner without challenging ~~plant~~ unit systems. 21 edit edit

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

The SRs for each RPS Function are identified by the SRs column of Table 3.3.1-1 for that Function. Most Functions are subject to CHANNEL CHECK, CHANNEL FUNCTIONAL TEST, and CHANNEL CALIBRATION~~, and RPS RESPONSE TIME~~ testing. 3 edit

The SRs are modified by a Note ~~. The [first] Note~~ which directs the reader to Table 3.3.1-1 to determine the correct SRs to perform for each RPS Function.

~~[Reviewer's Note: The CHANNEL FUNCTIONAL TEST Frequencies are based on approved topical reports. For a licensee to use these times, the licensee must justify the Frequencies as required by the NRC Staff SER for the topical report.]~~ edit

SR 3.3.1.1

Performance of the CHANNEL CHECK once every 12 hours ~~ensures that~~ provides reasonable assurance of prompt identification of a gross failure of instrumentation ~~has not occurred~~. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to ~~a similar~~ the same parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION. 21 edit

Agreement criteria are determined by the unit staff based on factors including a combination of ~~the~~ channel instrument uncertainties~~, including isolation, indication, and readability~~. If a channel is outside the criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction. Off scale low current loop channels are, where practical, verified to be reading at the bottom of the range and not failed downscale. 21 edit

ANO-332 <INSERT B3.3-25A>

The Frequency~~, about once every shift,~~ is based on operating experience that demonstrates channel failure is rare. Since 15 edit

(continued)

<INSERT B3.3-25A>

ANO-332

The agreement criteria includes an expectation of one decade of overlap when transitioning between neutron flux instrumentation. For example, during a power increase near the top of the scale for the intermediate range monitors, a power range monitor reading is expected with at least one decade overlap. Without such an overlap, the power range monitors are considered inoperable unless it is clear that an intermediate range monitor inoperability is responsible for the lack of the expected overlap.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1 (continued)

the probability of two random failures in redundant channels in any 12 hour period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal but more frequent checks of channel OPERABILITY during normal operational use of the displays associated with the LCO's required channels.

For Functions that trip on a combination of several measurements, such as the Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE Function, the CHANNEL CHECK must be performed on each input.

SR 3.3.1.2

≥ 20%

and once within 24 hours after a THERMAL POWER Change of ≥ 10% RTP in one direction,

96 5 32

This SR is the performance of a heat balance calibration for the power range channels every ~~24~~ hours when reactor power is ~~≥ 15%~~ RTP. The heat balance calibration consists of a comparison of the results of the calorimetric with the power range channel output. The outputs of the power range channels are ~~normalized~~ calibrated to the calorimetric. ~~If the calorimetric exceeds~~ absolute difference between the calorimetric and the Nuclear Instrumentation System (NIS) channel output ~~by~~ is > ≥ [2]% RTP, the NIS channel is not declared inoperable but must be adjusted. If the NIS channel cannot be properly adjusted, the channel is declared inoperable. Note 1 to the SR states A Note clarifies that this Surveillance is required only if reactor power is ≥ ~~15%~~ 20% RTP and that 24 hours is allowed for performing the first Surveillance after reaching ~~15%~~ 20% RTP. ~~At lower power levels, calorimetric data are inaccurate.~~

30 20% 21 32

INSERT B 3.3-26A

RAI 3.3.1-06

RAI 3.3.1-09

The power range channel's output shall be adjusted consistent with the calorimetric results if the absolute difference between the calorimetric ~~exceeds~~ and the power range channel's output ~~by~~ is > ≥ ~~[2]~~% RTP. The value of ~~[2]~~% is adequate because this value is assumed in the safety analyses of ~~F~~SAR, Chapter ~~[14]~~ (Ref. 2). These checks and, if necessary, the adjustment of the power range channels ensure that channel accuracy is maintained within the analyzed error margins. The ~~24~~ 96 hour Frequency is adequate, based on unit operating experience, which demonstrates the change in the difference between the power range indication and the calorimetric results rarely exceeds

30 5

(continued)

<INSERT B3.3-26A>

ANO-332

Two calorimetric calculations are routinely performed. One relies upon primary system parameters and the other relies upon secondary system parameters. The primary calorimetric is generally less accurate than the secondary calorimetric at higher power levels and more accurate at lower power levels. For comparison to the nuclear instrumentation, between 0 and 15% power, only the primary calorimetric (heat balance) is considered. From 15 to 100% power the calorimetric is weighted linearly with only the secondary heat balance being considered at 100% power.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2 (continued) (5)

~~a small fraction of~~ {2}% in any ~~24~~ 96 hour period. Furthermore, the control room operators monitor redundant indications and alarms to detect deviations in channel outputs.

SR 3.3.1.3

This SR is modified by two Notes. (32) (30) (6)

A comparison of power range nuclear ≥ 20% instrumentation channels against incore detectors shall be performed at a 31 day Frequency when reactor power is ~~{≥ 15%}~~ 20% RTP. A Note clarifies that 24 hours is allowed for performing the first Surveillance after reaching ~~15%~~ 20% RTP. Note 1 states if the absolute difference between the power range and incore AXIAL POWER IMBALANCE measurements is ≥ {2}% RTP, the power range channel is not inoperable, but ~~a CHANNEL CALIBRATION that adjusts~~ an adjustment of the measured imbalance to agree with the incore measurements is necessary. If the power range channel cannot be properly ~~recalibrated~~ adjusted, the channel is declared inoperable. The calculation of the Allowable Value envelope assumes a difference in out of core to incore measurements of 2.5%. (21) Additional inaccuracies beyond those that are measured are also included in the setpoint envelope calculation. The 31 day Frequency is adequate, considering that long term drift of the excore linear amplifiers is small and burnup of the detectors is slow. Also, the excore readings are a strong function of the power produced in the peripheral fuel bundles, and do not represent an integrated reading across the core. The slow changes in neutron flux during the fuel cycle can also be detected at this interval.

SR 3.3.1.4

A CHANNEL FUNCTIONAL TEST is performed ~~on each required RPS channel~~ to ensure that the entire channel will perform the intended function. Setpoints must be found within the Allowable Values specified in Table 3.3.1-1. Any setpoint adjustment shall be consistent with the assumptions of the current ~~unit specific~~ setpoint analysis. (21) edit

~~The as found and as left values must also be recorded and reviewed for consistency with the assumptions of the~~ (7)

RAI 3.3.1-06

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.4 (continued)

~~surveillance interval extension analysis. The requirements for this review are outlined in BAW-10167 (Ref. 8).~~ 7

~~The Frequency of [45] days on a STAGGERED TEST BASIS is consistent with the calculations of Reference 7 that indicate the RPS retains a high level of reliability for this test interval.~~

INSERT B3.3-28A

~~SR 3.3.1.5~~

~~This SR is the performance of a CHANNEL CALIBRATION every [92] days. This CHANNEL CALIBRATION normalizes the power range channel output to the calorimetric coincident with the imbalance output being normalized to the imbalance condition predicted by the incore neutron detector system.~~ 30

~~The calibration for both imbalance and total power is integrated in the power imbalance detector calibration procedure. The [92] day Frequency specified for the Nuclear Overpower trip string is consistent with the drift assumptions made in the "[Unit Specific Setpoint Methodology]" (Ref. 4). Furthermore, operating experience shows the reliability of the trip string is acceptable when calibrated on this interval. A Note clarifies that the neutron detectors are not required to be tested as part of the CHANNEL CALIBRATION. There is no adjustment that can be made to the detectors. Furthermore, adjustment of the detectors is unnecessary because they are passive devices with minimal drift. Slow changes in detector sensitivity are compensated for by performing the daily calorimetric calibration and the monthly axial channel calibration.~~

RAI 3.3.1-06

SR 3.3.1.~~6~~ 5 30

RAI 3.3.1-06

A Note to the Surveillance indicates that neutron detectors are excluded from CHANNEL CALIBRATION. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.

(continued)

<INSERT B3.3-28A>

The Frequency of 31 days is based on operating experience, which has demonstrated through high reliability of the instrumentation, that failure of more than one channel, of a given Function, in any 31 day interval is rare.

3.3.1-02

3.3.1-06

Testing in accordance with this SR is normally performed on a rotational basis, with one channel being tested each week. Testing one channel each week reduces the probability of an undetected failure existing within the system and minimizes the likelihood of the same systematic test errors being introduced into each redundant channel. The automatic bypass removal feature is verified for the turbine oil pressure trip and the main feedwater pump oil pressure trip functions during the CHANNEL FUNCTIONAL TEST.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.6 (continued)

A CHANNEL CALIBRATION is a complete check of the instrument channel, including the sensor. The test verifies that the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift to ensure that the instrument channel remains operational between successive tests. CHANNEL CALIBRATION shall find that ~~measurement errors and bistable setpoint~~ errors are within the assumptions of the unit specific setpoint analysis. CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the unit specific setpoint analysis.

instrument

INSERT B3.3-29A

21 edit

29

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

allowable

21

~~SR 3.3.1.7~~

~~This SR verifies individual channel actuation response times are less than or equal to the maximum values assumed in the accident analysis. Individual component response times are not modeled in the analyses. The analyses model the overall, or total, elapsed time from the point at which the parameter exceeds the analytical limit at the sensor to the point of rod insertion. Response time testing acceptance criteria for this unit are included in Reference 1.~~

~~A Note to the Surveillance indicates that neutron detectors are excluded from RPS RESPONSE TIME testing. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.~~

~~Response time tests are conducted on an [18] month STAGGERED TEST BASIS. Testing of the final actuation devices, which make up the bulk of the response time, is included in the testing of each channel. Therefore, staggered testing results in response time verification of these devices every [18] months. The [18] month Frequency is based on unit operating experience, which shows that random failures of~~

3

(continued)

<INSERT B3.3-29A>

Whenever a sensing element is replaced, the next required CHANNEL CALIBRATION of the resistance temperature (RTD) sensors is accomplished by an inplace cross calibration that compares the other sensing elements with the recently installed sensing element.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.7 (continued)

instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. 3

REFERENCES

1. ~~F~~SAR, Chapter ~~[7]~~ 8.
2. ~~F~~SAR, Chapter ~~[14]~~ and Chapter 3A.
3. ~~10 CFR 50.49~~
3 ~~4~~. ~~[Unit Specific Setpoint Methodology]~~ Instrument Loop Error Analysis and Setpoint Methodology Manual, Design Guide, IDG-001.
4 ~~5~~. NUREG-0737, "Clarification of TMI Action Plan Requirements," November ~~1979~~ 1980.
5. 10CFR 50.36
6. BAW-1893, "Basis for Raising Arming Threshold for Anticipatory Reactor Trip on Turbine Trip," October 1985
7. NRC SER for BAW-10167, Supplement 2, July 8, 1992. 1
8. ~~BAW-10167, May 1986.~~ 7

21

B 3.3 INSTRUMENTATION

B 3.3.2 Reactor Protection System (RPS) Manual Reactor Trip

BASES

BACKGROUND

, or coincident with,

The RPS Manual Reactor Trip provides the operator with the capability to trip the reactor from the control room in the absence of any other trip condition. Manual trip is provided by a trip push button on the main control board. This push button operates four electrically independent switches~~, one for each train~~. This trip is independent of the automatic trip system. ~~As shown in Figure [ ], FSAR, Chapter [7] (Ref. 1), power for the CONTROL ROD drive (CRD) breaker undervoltage coils and contactor coils comes from the reactor trip modules (RTMs). The manual trip switches are located between the RTM output and the breaker undervoltage coils. Opening of the switches opens the lines to the breakers, tripping them. The switches also energize the breaker shunt trip mechanisms. There is a separate switch in series, with the output of each of the four RTMs. All switches are actuated through a mechanical linkage from a single push button.~~

INSERT B3.3-31A

24

APPLICABLE SAFETY ANALYSES

The Manual Reactor Trip ensures that the control room operator can initiate a reactor trip at any time. The Manual Reactor Trip Function is required as a backup to the automatic trip functions~~, and allows operators to shut down the reactor whenever any parameter is rapidly trending toward its trip setpoint.~~

INSERT B3.3-31B

~~The Manual Reactor Trip Function satisfies Criterion 3 of the NRC Policy Statement.~~

24

LCO

The LCO on the RPS Manual Reactor Trip requires that the trip shall be OPERABLE whenever the reactor is critical or any time any ~~control rod~~ CRD breaker is closed and rods are capable of being withdrawn, including shutdown bypass. This enables the operator to terminate any reactivity excursion that in the operator's judgment requires protective action, even if no automatic trip condition exists.

24

(continued)

<INSERT B3.3-31A>

As shown in Figure 7.1, SAR, Chapter 7 (Ref. 1), control power for the control rod drive (CRD) breakers and electronic trip assembly (ETA) relays comes from the reactor trip modules (RTMs). The manual trip switches are located between the RTM output and the breaker undervoltage coils, breaker undervoltage relays, and ETA relays. The switches also initiate actuation of the breaker shunt trip mechanisms. These are separate switches which are actuated through a mechanical linkage from a single push button. Opening of the switches opens the circuits to the breakers, tripping them.

<INSERT B3.3-31B>

Operating experience has shown the Manual Reactor Trip Function to be significant to public health and safety, and therefore satisfy Criterion 4 of 10 CFR 50.36 (Ref. 2).

BASES

LCO (continued)

The Manual Reactor Trip Function is composed of four electrically independent trip switches sharing a common mechanical push button.

APPLICABILITY

The Manual Reactor Trip Function is required to be OPERABLE in MODES 1 and 2. It is also required to be OPERABLE in MODES 3, 4, and 5 if any CRD trip breaker is in the closed position and if the CRD System is capable of rod withdrawal. The ~~only~~ primary safety function of the RPS is to trip the CONTROL RODS; therefore, the Manual Reactor Trip Function is not needed in MODE 3, 4, or 5 if the reactor trip breakers are open or if the CRD System is incapable of rod withdrawal. (24) Similarly, the RPS Manual Reactor Trip is not needed in MODE 6 ~~when~~ because the CONTROL RODS are normally decoupled from the CRDs. (24)

ACTIONS

A.1

Condition A applies when the Manual Reactor Trip Function is found inoperable. One hour is allowed to restore the Function to OPERABLE status. The automatic functions and various alternative manual trip methods, such as removing power to the RTMs, are still available. The 1 hour Completion Time is sufficient time to correct minor problems. edit

B.1 and B.2

If the Required Action and associated Completion Time are not met ~~With the Manual Reactor Trip Function inoperable and unable to be returned to OPERABLE status within 1 hour~~ in MODE 1, 2, or 3, the unit must be placed in a MODE in which manual trip is not required. Required Action B.1 and Required Action B.2 place the unit in at least MODE 3 with all CRD trip breakers open within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. (24)

C.1

If the Required Action and associated Completion Time are not met ~~With the Manual Reactor Trip Function inoperable and unable to be returned to OPERABLE status within 1 hour~~ in MODE 4

(continued)

BASES

ACTIONS

C.1 (continued)

or 5, the unit must be placed in a MODE in which manual trip is not required. To achieve this status, all CRD trip breakers must be opened. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to open all CRD trip breakers without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.3.2.1

This SR requires the performance of a CHANNEL FUNCTIONAL TEST of the Manual Reactor Trip Function. This test verifies the OPERABILITY of the Manual Reactor Trip by actuation of the CRD trip breakers. The Frequency shall be once prior to each reactor startup if not performed within the preceding 7 days to ensure the OPERABILITY of the Manual Reactor Trip Function prior to achieving criticality. The Frequency was developed in consideration that ~~these~~ this Surveillance~~s~~ ~~are~~ is only performed during a unit outage. ed.

REFERENCES

1. ~~F~~SAR, Chapter [7].
2. 10 CFR 50.36.

24

B 3.3 INSTRUMENTATION

B 3.3.3 Reactor Protection System (RPS)—Reactor Trip Module (RTM)

BASES

BACKGROUND

The RPS consists of four independent protection channels, each containing an RTM. Figure ~~[1]~~, FSAR, Chapter ~~[7]~~ 7.1 edit (Ref. 1), shows a typical RPS protection channel and the relationship of the RTM to the RPS instrumentation, manual trip, and CONTROL ROD drive (CRD) trip devices. edit The RTM receives bistable trip signals from the functions in its own channel and channel trip signals from the other three RPS—RTMs. The RTM provides these signals to its own two-out-of-four trip logic and transmits its own channel trip signal to the two-out-of-four logic of the RTMs in the other three RPS channels. Whenever any two RPS channels transmit channel trip signals, the RTM logic in each channel actuates to remove 120 VAC power from its associated CRD trip device.

The RPS trip scheme consists of series contacts that are operated by bistables. During normal unit operations, all contacts are closed and the RTM channel trip relay remains energized. However, if any trip parameter exceeds its setpoint, its associated contact opens, which de-energizes the channel trip relay.

When an RTM channel trip relay de-energizes, several things occur:

a. Each of the four (4) output logic relays "informs" its associated RPS channel that a reactor trip signal has occurred in the tripped RPS channel;

b. The contacts in the trip device circuitry, powered by the tripped channel, open, but the trip device remains energized through the closed contacts from the other RTMs. (This condition exists in each RPS—RTM. Each RPS—RTM controls power to a trip device.); and

c. The contact in parallel with the channel reset switch opens and the trip is sealed in. To re-energize the channel trip relay, the channel reset switch must be depressed after the trip condition has cleared.

(continued)

BASES

BACKGROUND (continued)

When the second RPS channel senses a reactor trip condition, the output logic relays for the second channel de-energize and open contacts that supply power to the trip devices. With contacts opened by two separate RPS channels, power to the trip devices is interrupted and the CONTROL RODS fall into the core.

A minimum of two out of four RTMs must sense a trip condition to cause a reactor trip. Also, ~~because the bistable relay contacts for each function are in series with the channel trip relays,~~ two channel trips caused by different trip functions can result in a reactor trip. edit

APPLICABLE SAFETY ANALYSES

Accident analyses rely on a reactor trip for protection of reactor core integrity, reactor coolant pressure boundary integrity, and reactor building OPERABILITY. A reactor trip must occur when needed to prevent accident conditions from exceeding those calculated in the accident analyses. More detailed descriptions of the applicable accident analyses are found in the bases for each of the RPS trip Functions in LCO 3.3.1, "Reactor Protection System (RPS) Instrumentation."

~~RTM response time is included in the overall required response time for each RPS trip and is not specified separately.~~ 3

In MODES 1 and 2, ~~The~~ the RTMs satisfy Criterion 3 of ~~the NRC Policy Statement~~ 10 CFR 50.36 (Ref. 2). 25

In MODES 3, 4, and 5 with any CRD trip breaker in the closed position and the CRD System capable of rod withdrawal, the RTMs satisfy Criterion 4 of 10 CFR 50.36.

LCO

The RTM LCO requires all four RTMs to be OPERABLE. Failure of any RTM renders a portion of the RPS inoperable~~, and reduces the reliability of the affected Functions~~.

~~Four RTMs must be OPERABLE to ensure that a reactor trip would occur if needed any time the reactor is critical. OPERABILITY is defined as the RTM being~~ To be considered OPERABLE, an RTM must be able to receive and interpret trip signals from its own and other OPERABLE RPS channels and to open its associated trip device. 25

The requirement ~~of~~ for four channels to be OPERABLE ensures that a minimum of two RPS channels will remain OPERABLE if a single failure has occurred in one channel and if a second

(continued)

BASES

LCO (continued)

channel has been bypassed ~~for surveillance or maintenance~~. This two-out-of-four trip logic also ensures that a single RPS channel failure will not cause an unwanted reactor trip. Violation of this LCO could result in a trip signal not causing a reactor trip when needed. 25

APPLICABILITY

The RTMs are required to be OPERABLE in MODES 1 and 2. They are also required to be OPERABLE in MODES 3, 4, and 5 if any CRD trip breakers are in the closed position and the CRD System is capable of rod withdrawal. The RTMs are designed to ensure a reactor trip would occur, if needed ~~any time the reactor is critical~~. This ~~condition can~~ exist in ~~all~~ any of these MODES; therefore, the RTMs must be need may OPERABLE. 25

ACTIONS

A.1.1, A.1.2, and A.2

When an RTM is inoperable, the associated CRD trip breaker must then be placed in a condition that is equivalent to a tripped condition for the RTM. Required Action A.1.1 or Required Action A.1.2 requires this either by tripping the CRD trip breaker or by removing power to the CRD trip device. Tripping one RTM or removing power opens one set of CRD trip devices. Power to hold up CONTROL RODS is still provided via the parallel CRD trip device(s). Therefore, a reactor trip will not occur until a second protection channel trips.

edit
Opening

To ensure the trip signal is registered in the other channels, Required Action A.2 requires that the inoperable RTM be removed from the cabinet. This action causes the electrical interlocks to indicate a tripped channel in the remaining three RTMs. Operation in this condition is allowed indefinitely because the actions put the RPS into a one-out-of-three configuration. The 1 hour Completion Time is sufficient time to perform the Required Actions.

two or more RTMs are inoperable in MODE 1, 2, or 3, or if

B.1, B.2.1, and B.2.2

and associated Completion Time 20

Condition B applies if the Required Actions of Condition A are not met ~~within the required Completion Time~~ in MODE 1, 2, or 3. In this case, the unit must be placed in a MODE in 25

(continued)

BASES

ACTIONS

B.1, B.2.1, and B.2.2 (continued)

trip breakers

which the LCO does not apply. This is done by placing the unit in at least MODE 3 with all CRD trip breakers open or with all power to the CRD System removed within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. 31

C.1 and C.2

20

two or more RTMs are inoperable in MODE 4 or 5, or if

and associated Completion Times

Condition C applies if the Required Actions ~~of Condition A~~ are not met ~~within the required Completion Time~~ in MODE 4 or 5. In this case, the unit must be placed in a MODE in which the LCO does not apply. This is done by opening all CRD trip breakers or removing all power ~~to the~~ CRD ~~System~~. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to open all CRD trip breakers or remove all power to the CRD System without challenging unit systems.

trip breakers

from

25

31

SURVEILLANCE REQUIREMENTS

SR 3.3.3.1

~~The Note defines a channel as being OPERABLE for up to 8 hours while bypassed for Surveillance testing. The Note allows channel bypass for testing without defining it as inoperable although during this time period it cannot actuate a reactor trip. This allowance is based on the assumption of the RPS reliability analysis in BAW-10167 (Ref. 2) that 8 hours is the average time required to perform channel Surveillance. The analysis demonstrated that the 8 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary. It is not acceptable to routinely remove channels from service for more than 8 hours to perform required Surveillance testing. Such a practice would be contrary to the assumptions of the reliability analysis that justified the LCO's Completion Times.~~ 22

~~[Reviewer's Note: The CHANNEL FUNCTIONAL TEST frequency is based on an approved topical report. For a licensee to use~~ - EDIT

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.3.1 (continued)

~~this Frequency, the licensee must justify the Frequency as required by the NRC Staff SER for the topical report.~~ edit

92 The SRs include performance of a CHANNEL FUNCTIONAL TEST every [45] days ~~on a STAGGERED TEST BASIS~~. This test shall verify the OPERABILITY of the RTM and its ability to receive and properly respond to channel trip and reactor trip signals. ~~Calculations have shown that the Frequency (45 days) maintains a high level of reliability of the Reactor Trip System in BAW-10167 (Ref. 2).~~ 33

<INSERT B 3.3-38A>

REFERENCES

1. ~~F~~SAR, Chapter ~~[7]~~.

~~2. BAW-10167, May 1986.~~ 2. 10CFR 50.36 25

3. BAW-10167A, "Justification for Increasing the Reactor Trip System On-line Test Intervals," Supplement [illegible], Justification for Increasing the Trip Device Test [illegible], February [illegible]98 33

<INSERT B3.3-38A>

The Frequency of 92 days is based on operating experience, which has demonstrated through high reliability of the instrumentation, that failure of more than one RTM in any 92 day interval is rare (Ref. 3).

Testing in accordance with this SR is normally performed on a rotational basis, with one RTM being tested each 23 days. Testing one RTM each 23 days reduces the probability of an undetected failure existing within the system and minimizes the likelihood of the same systematic test errors being introduced into each redundant RTM.

B 3.3 INSTRUMENTATION

B 3.3.4 CONTROL ROD Drive (CRD) Trip Devices

edit

BASES

BACKGROUND

ten

functionally in series with five

The Reactor Protection System (RPS) contains multiple CRD trip devices: two AC trip breakers, two DC trip breaker pairs, and ~~eight~~ electronic trip assembly (ETA) relays. The system has two separate paths (or channels), with each path having one AC breaker ~~in series with either~~ a pair of DC breakers or ~~four~~ ETA relays in parallel. Each path provides independent power to the CRDs. Either path can provide sufficient power to operate the entire CRD System. 26

7-10

Figure ~~1-4~~, FSAR, Chapter ~~[7]~~ (Ref. 1), illustrates the configuration of CRD trip devices. To trip the reactor, power to the CRDs must be removed. Loss of power causes the CRD's mechanisms to release the CONTROL RODS, which then fall by gravity into the core.

controlled

holding

Power to CRDs is supplied from two separate unit sources through the AC trip circuit breakers. These breakers are designated A and B, and their undervoltage and shunt trip coils are ~~powered~~ by RPS channels A and B, respectively. From the circuit breakers, the CRD power travels through voltage regulators and stepdown transformers. These devices in turn supply redundant buses that feed the DC power supplies and the regulating rod ~~power supplies~~.

APSR and auxiliary

CC

half of the

two

The DC power supplies rectify the AC input and supply power to hold the safety rods in their fully withdrawn position. One of the redundant power sources supplies phase A; the other, phase ~~B~~. Either phase being energized is sufficient to hold the rod. Two breakers are located on the output of each power supply. Each breaker controls power to ~~one~~ of the four safety rod groups. The undervoltage and shunt trip coils on the two circuit breakers on the output of one of the power supplies is controlled by RPS channel C. The other two breakers are controlled by RPS channel D. 26

holding

rod, APSR

<INSERT B3.3-39A>

In addition to the DC power supplies, the redundant buses also supply power to the ~~regulating~~ and auxiliary power supplies. ~~These power supplies consist of ETAs that are gated on by programming lamps. Programming lamp power is controlled by contactors (E and F), which are controlled by~~

(continued)

<INSERT B3.3-39A>

These power supplies contain silicon controlled rectifiers (SCRs), which are gated on and off to provide power to, and remove power from, the phases of the CRD mechanisms. The gating control signal for these SCRs is supplied through the closed contacts of the ETA relays. These contacts are referred to as E and F contactors, and are controlled by the C and D RPS channels, respectively.

BASES

BACKGROUND (continued)

~~RPS power. One of the redundant programming lamp supplies is controlled by RPS channel C; the other, by RPS channel D.~~

The AC breaker and DC breakers, or gated SCRs, are in series in one of the power supplies; whereas, the redundant AC breaker and DC breakers or gated SCRs are in series in the other power supply to the CONTROL RODS. The logic required to cause a reactor trip is the opening of a circuit breaker or ETA relay in each of the redundant power supplies. (The pair of DC circuit breakers on the output of the power supply are treated as one breaker.) This is known as a one-out-of-two taken twice logic. The following examples illustrate the operation of the reactor trip circuit breakers. 26

a. If the A AC circuit breaker opens:

1. the input power to associated DC power supply is lost, and

2. the SCR supply from the associated power source is lost.

b. If the D DC circuit breaker(s) and F contactors open:

1. the output of the redundant DC power supply is lost and the safety rods de-energize, and 26

2. when the F contactor opens, SCR gating ~~programming lamp~~ power is lost and the regulating rods will be de-energized.

c. The combination of (a) and (b) causes a reactor trip.

Any other combination of at least one circuit breaker opening in each power supply will cause a reactor trip.

In summary, two tripped RPS channels will cause a reactor trip. For example, a reactor trip occurs if RPS channel B senses a low Reactor Coolant System (RCS) pressure condition and if RPS channel C senses a variable low RCS pressure condition. When the channel B bistable relay de-energizes, the channel trip relay de-energizes and opens its associated contacts. The same thing occurs in channel C, except the variable low~~er~~ pressure bistable relay de-energizes ~~the~~ channel C trip relay. When the output logic relays in channels B and C de-energize, the B and C contacts in the ~~undervoltage and~~ trip logic of each channel's reactor trip module (RTM) open causing an undervoltage to each trip breaker. 26

(continued)

and the ETA relay contactors

BASES

BACKGROUND (continued)

All trip

~~and~~ ~~contacts~~ ~~de-energize.~~ ~~All circuit~~ breakers open, and ~~programming lamp~~ power is removed. All rods fall into the core, resulting in a reactor trip. from all CRD mechanisms (26)

APPLICABLE SAFETY ANALYSES

Accident analyses rely on a reactor trip for protection of reactor core integrity, reactor coolant pressure boundary integrity, and reactor building OPERABILITY. A reactor trip must occur when needed to prevent accident consequences from exceeding those calculated in the accident analyses. The control rod insertion limits ensure that adequate rod worth is available upon reactor trip to shut down the reactor to the required SDM. Further, OPERABILITY of the CRD trip devices ensures that all CONTROL RODS ~~(except Group 8)~~ will trip when required. More detailed descriptions of the applicable accident analyses are found in the Bases for each of the individual RPS trip Functions in LCO 3.3.1, "Reactor Protection System (RPS) Instrumentation." (26)

In MODES 1 and 2,

~~The~~ CRD trip devices satisfy Criterion 3 of ~~the NRC Policy Statement.~~ 10CFR 50.36 (Ref. 2). (26)

In MODES 3, 4 and 5 with any CRD trip breaker in the closed position and the CRD System capable of rod withdrawal, the CRD trip devices satisfy Criterion 4 of 10CFR 50.36.

LCO

The LCO requires all of the specified CRD trip devices to be OPERABLE. Failure of any required CRD trip device renders a portion of the RPS inoperable~~, and reduces the reliability of the affected Functions~~. Without reliable CRD reactor trip circuit breakers and associated support circuitry, a reactor trip ~~cannot~~ may not occur when initiated either automatically or manually.

All required CRD trip devices shall be OPERABLE to ensure that the reactor remains capable of being tripped any time it is critical. OPERABILITY is defined as the CRD trip device being able to receive a reactor trip signal and to respond to this trip signal by interrupting ~~AC~~ power to the CRDs. Both of ~~the AC~~ a CRD trip breaker's diverse trip devices and the breaker itself must be functioning properly for the ~~AC~~ breaker to be OPERABLE.

<INSERT 3.3-41A>

Requiring all breakers and ETA relays to be OPERABLE ensures that at least one device in each of the two power paths to the CRDs will remain OPERABLE even with a single failure. (26)

in MODES 1 and 2, and in MODES 3, 4 and 5 when any CRD trip breaker is in the closed position and the CRD system is capable of rod withdrawal

(continued)

<INSERT B3.3-41A>

Both ETA relays associated with each of the three regulating rod groups and the two ETA relays associated with the auxiliary power supply must be OPERABLE to satisfy the LCO. The ETA relays associated with the APSR power supply are not required to be OPERABLE because the APSRs are not designed to fall into the core upon initiation of a reactor trip.

BASES

LCO (continued)

~~Requiring all devices OPERABLE also ensures that a single failure will not cause an unwanted reactor trip.~~ 26

APPLICABILITY

The CRD trip devices ~~shall~~ are required to be OPERABLE in MODES 1 and 2, and in MODES 3, 4, and 5 when any CRD trip breaker is in the closed position and the CRD System is capable of rod withdrawal. edit

The CRD trip devices are designed to ensure that a reactor trip would occur if needed ~~any time the reactor is critical~~. Since ~~this condition can exist~~ a trip may be required in all of these MODES, the CRD trip devices ~~shall~~ must be OPERABLE. 26 edit

ACTIONS

A Note has been added to the ACTIONS indicating separate Condition entry is allowed for each CRD trip device.

~~Condition A~~ 26

Condition A represents reduced redundancy in the CRD trip Function. Condition A applies when:

- One diverse trip Function (undervoltage or shunt trip device) is inoperable in one or more CRD trip breaker(s) ~~[or breaker pair]~~; or
- One diverse trip Function is inoperable in both DC trip breakers associated with one protection channel. In this case, the inoperable trip Function does not need to be the same for both breakers.

A.1 and A.2

If one of the diverse trip Functions on a CRD trip breaker ~~[or breaker pair]~~ becomes inoperable, actions must be taken to preclude the inoperable CRD trip device from preventing a reactor trip when needed. This is done by manually ~~tripping~~ opening the inoperable CRD trip breaker or by removing power from the ~~channel containing the~~ inoperable CRD trip breaker. 26 Either of these actions places the affected CRDs in a one-out-of-two trip configuration, which precludes a single

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

failure, which in turn could prevent tripping of the reactor. The 48 hour Completion Time has been shown to be acceptable through operating experience.

~~Condition B~~

Condition B represents a loss of redundancy for the CRD trip Function. Condition B applies when

- ~~One or more CRD trip breaker(s) [or breaker pair] will not function on either undervoltage or shunt trip Functions; or~~
- Both diverse trip Functions are inoperable in one or ~~both DC trip breakers associated with one protection channel.~~ more trip breaker(s) or breaker pairs.

2b

B.1 and B.2

Required Action B.1 and Required Action B.2 are the same as Required Action A.1 and Required Action A.2, but the Completion Time is shortened. The 1 hour Completion Time allowed to ~~trip~~ open or remove power from the CRD trip breaker allows the operator to take all the appropriate actions for the inoperable breaker and still ensures that the risk involved is acceptable.

edit

C.1 ~~and~~, C.2, C.3 and C.4

8

Condition C represents a loss of redundancy for the CRD trip Function. Condition C applies when one or more ETA relays are inoperable. The preferred action is to restore the ETA relay to OPERABLE status. If this cannot be done, the operator can perform one of ~~two~~ four ~~actions to~~ eliminate reliance on the failed ETA relay. The first option is to switch the affected ~~control rod~~ CONTROL ROD group to an alternate power supply, which has two OPERABLE or one OPERABLE and one open ETA relay. This removes the failed ETA relay from the trip sequence, and the unit can operate indefinitely. {INSERT B 3.3-43A} The ~~second~~ fourth option is to ~~trip~~ open the corresponding AC CRD trip breaker. This also results in the safety function being performed, thereby eliminating the failed ETA relay from the trip sequence.

8

(continued)

<INSERT B3.3-43A>

The second option is to transfer the affected CONTROL ROD group to a DC holding power supply. This option is only available if the affected group is a safety rod group and the affected power supply is the auxiliary power supply. The third option is to open the inoperable ETA contacts. This option results in the safety function being performed.

BASES

ACTIONS

C.2, C.3

C.1 and C.2 4 (continued)

edit

The 1 hour Completion Time is sufficient to perform the Required Action.

26

and associated Completion Times

D.1, D.2.1, and D.2.2

If the Required Actions of Condition A, B, or C are not met ~~within the required Completion Time~~ in MODE 1, 2, or 3, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3, with all CRD trip breakers open or with ~~all~~ power to ~~the~~ CRD ~~System~~ removed within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems.

all

trip breakers

31

E.1 and E.2

and associated Completion Times

26

If the Required Actions of Condition A, B, or C are not met ~~within the required Completion Time~~ in MODE 4 or 5, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, all CRD trip breakers must be opened or all power to ~~the~~ CRD ~~System~~ removed within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to open all CRD trip breakers or remove ~~all~~ power ~~to the~~ CRD ~~System~~ without challenging unit systems.

trip breakers

from all

31

SURVEILLANCE REQUIREMENTS

SR 3.3.4.1

33

SR 3.3.4.1 is to perform a CHANNEL FUNCTIONAL TEST every ~~31~~ days. This test verifies the OPERABILITY of the trip devices by actuation of the end devices. Also, this test independently verifies the undervoltage and shunt trip mechanisms of the ~~AC~~ breakers. The Frequency of ~~31~~ days is based on operating experience, which has demonstrated that failure of more than one channel of a given function in any ~~31~~ day interval is a rare event. (Ref. 3)

92

92

trip

26

< INSERT B 3.3-44A >

REFERENCES

1. ~~F~~SAR, Chapter ~~[7]~~ 7.

2. 10CFR 50.36

EDIT

3. BAW-10167A, "Justification for Increasing the Reactor Trip System On-line Test Intervals," Supplement 3, "Justification for Increasing the Trip Device Test Interval" February 1998.

33

<INSERT B3.3-44A>

Testing in accordance with this SR is normally performed on a rotational basis, with one channel being tested each 23 days. Testing one channel each 23 days reduces the probability of an undetected failure existing within the system and minimizes the likelihood of the same systematic test errors being introduced into each redundant trip device.

B 3.3 INSTRUMENTATION

B 3.3.9 Source Range Neutron Flux

BASES

BACKGROUND

The source range neutron flux channels provide the operator with an indication of the approach to criticality ~~at lower power levels than can be seen on the intermediate range neutron flux instrumentation~~. These channels also provide the operator with a flux indication that reveals changes in reactivity ~~and helps to verify that SDM is being maintained~~. 23

The source range instrumentation has two redundant count rate channels originating in two high sensitivity ~~proportional counters~~ fission chambers. Two source range detectors are externally located on opposite sides of the core (180°). These channels are used over a counting range of 0.1 cps to ~~1E6~~ 1E5 cps and are displayed on the operator's control console in terms of log count rate. The channels also measure the rate of change of the neutron flux level, which is displayed for the operator in terms of startup rate from ~~-0.5~~ -1 decades to ~~+5~~ +7 decades per minute. An interlock provides a control rod withdraw "inhibit" on a high startup rate of +2 decades per minute in either channel. This interlock is bypassed when the intermediate range neutron flux channels reach 1E-9 amps or power range neutron flux channels reach 10% RTP. 23

~~The proportional counters of the source range channels are BF_3 chambers. The detector high voltage is automatically turned off when the flux level is approximately one decade above the useful operating range. Conversely, the high voltage is turned on automatically when the flux level returns to within approximately one decade of the detectors' maximum useful range. High voltage will be turned off automatically when the flux level is above 1E-10 amp in both intermediate range channels, or 10% power in power range channels.~~ 23

APPLICABLE SAFETY ANALYSES

The source range neutron flux channels are necessary to monitor core reactivity changes. They are ~~It is~~ the primary means for detecting reactivity changes and triggering operator actions to respond to reactivity transients initiated from conditions in which the Reactor Protection System (RPS) is not required to be OPERABLE. ~~It~~ They also trigger~~s~~ operator actions to anticipate RPS actuation in the event of reactivity transients starting from shutdown or low power conditions. 23

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

The source range neutron flux channels satisfy Criterion ~~2~~ 4 of ~~the NRC Policy Statement.~~ 10 CFR 50.36 (Ref. 1). 23

LCO

9

~~Two~~ One source range neutron flux channel~~s~~ shall be OPERABLE ~~whenever the control rods are capable of being withdrawn~~ to provide the operator with ~~redundant~~ source range neutron instrumentation. The source range instrumentation ~~is the~~ provides primary power indication at ~~low power levels~~ ≤ 1E-10 amp on intermediate range instrumentation and must remain OPERABLE for the operator to continue increasing power. 23 12

~~A Note has been added allowing detector high voltage to be de-energized above 1E-10 amp on the intermediate range channels. Above this point, the source range instrumentation is no longer the primary power indicator. As such, the high voltage to the source range detectors may be de-energized.~~ 11

APPLICABILITY

~~Two~~ One source range neutron flux channel~~s~~ shall be OPERABLE in MODE 2 to provide ~~redundant~~ indication during an approach to criticality. Neutron flux level is sufficient for monitoring on the intermediate range and on the power range instrumentation prior to entering MODE 1; therefore, source range instrumentation is not required in MODE 1. 9

In MODES 3, 4, and 5, source range neutron flux instrumentation shall be OPERABLE to provide the operator with a means of monitoring ~~changes in SDM~~ neutron flux and to provide an early indication of reactivity changes. 23

The requirements for source range neutron flux instrumentation during MODE 6 refueling operations are addressed in LCO 3.9.2~~a~~b, "Nuclear Instrumentation." edit

ACTIONS

~~A.1~~

~~The Required Action for one channel of the source range neutron flux indication inoperable with THERMAL POWER ≤ 1E-10 amp on the intermediate range neutron flux~~ 9

(continued)

BASES

ACTIONS

A.1 (continued)

instrumentation is to delay increasing reactor power until the channel is repaired and restored to OPERABLE status. This limits power increases in the range where the operators rely solely on the source range instrumentation for power indication. The Completion Time ensures the source range is available prior to further power increases. Furthermore, it ensures that power remains below the point where the intermediate range channels provide primary protection until both source range channels are available to support the overlap verification required by SR 3.3.9.4. (9)

A A A A
B.1, B.2, B.3, and B.4 (9)

the required
With both source range neutron flux channels inoperable with THERMAL POWER ≤ 1E-10 amp on the intermediate range neutron flux instrumentation, the operators must place the reactor in the next lowest condition for which source range instrumentation is not required. This is done by immediately suspending positive reactivity additions, initiating action to insert all CONTROL RODS, and opening the CONTROL ROD drive trip breakers within 1 hour. Periodic SDM verification of ≥ 1% Δk/k is then required to provide a means for detecting the slow reactivity changes that could be caused by mechanisms other than control rod withdrawal or operations involving positive reactivity changes. Since the source range instrumentation provides the only reliable direct indication of power in this condition, the operators must continue to verify the SDM every 12 hours until at least one channel of the source range instrumentation is returned to OPERABLE status. Required Action B.1, Required Action B.2, and Required Action B.3 preclude rapid positive reactivity additions. The 1 hour Completion Time for Required Action B.3 and Required Action B.4 provides sufficient time for operators to accomplish the actions. The 12 hour Frequency for performing the SDM verification ensures that the reactivity changes possible with CONTROL RODS inserted are detected before SDM limits are challenged.

take actions to limit the possibilities for adding positive reactivity.

<INSERT B 3.3-82B>

(12) (23) (34) (28) edit

CONTROL ROD

these MODES

edit

A (9)

A

provides reasonable assurance

(23)

<INSERT B 3.3-82A> (23)

B
B.1 (9)

With reactor power > 1E-10 amp in MODE 2, 3, 4, or 5 on the intermediate range neutron flux instrumentation, continued (12)

ANO-333

(continued)

<INSERT B3.3-82A>

If no indication of intermediate range flux is available, these Required Actions are also appropriate.

ANO-333

<INSERT B3.3-82B>

RCS temperature changes are permitted, however, provided the effects of such temperature changes are accounted for in the SDM calculations.

BASES

ACTIONS

~~2~~ 3.1 (continued)

9

operation is allowed with ~~one or more~~ the required source range neutron flux channel~~s~~ inoperable. The ability to continue operation is justified because the instrumentation does not provide a safety function during high power operation. However, actions are initiated within 1 hour to restore the required channel~~(s)~~ to OPERABLE status for future availability. The Completion Time of 1 hour is sufficient to initiate the action. The action must continue until the channel~~s~~ ~~are~~ is restored to OPERABLE status. 9

SURVEILLANCE REQUIREMENTS

SR 3.3.9.1

Performance of the CHANNEL CHECK once every 12 hours ~~ensures that~~ provides reasonable assurance of prompt identification of a gross failure of instrumentation ~~has not occurred~~. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to ~~a similar~~ the same parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION. 23 edit

Agreement criteria are determined by the unit staff, based on a combination of ~~the~~ factors including channel instrument uncertainties. ~~including isolation, indication, and readability~~. If a channel is outside the criteria, it may be an indication that the ~~transmitter or the~~ signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction. ~~Off scale low current loop channels are verified to be reading at the bottom of the range and not failed downscale.~~ 23 23 23

<INSERT B3.3-83A> The Frequency~~, about once every shift,~~ is based on operating experience that demonstrates channel failure is rare. Since 15 edit

AND-332

(continued)

<INSERT B3.3-83A>

ANO-332

The agreement criteria includes an expectation of one decade of overlap when transitioning between neutron flux instrumentation. For example, during a power reduction near the bottom of the scale for the intermediate range monitors, a source range monitor reading is expected with at least one decade overlap. Without such an overlap, the source range monitors are considered inoperable unless it is clear that an intermediate range monitor inoperability is responsible for the lack of the expected overlap.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.9.1 (continued)

the probability of two random failures in redundant channels in any 12 hour period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO's required channels. When operating ~~in Required Action A.1~~, CHANNEL CHECK is still required. However, in this condition, a redundant source range ~~is not~~ available for comparison. CHANNEL CHECK may still be performed via comparison with intermediate range detectors, if available, and verification that the OPERABLE source range channel is energized and indicating a value consistent with current unit status.

with only one channel OPERABLE

may not be

9

SR 3.3.9.2

a

For source range neutron flux channels, CHANNEL CALIBRATION is a complete check and readjustment of the channels from the preamplifier input to the indicators. This test verifies the channel responds to measured parameters within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel ~~adjusted to account~~ for instrument drift to ensure that the instrument channel remains operational between successive tests.

at a setpoint which accounts

The SR is modified by a Note excluding neutron detectors from CHANNEL CALIBRATION. It is not necessary to test the detectors because generating a meaningful test signal is difficult. ~~The~~ detectors are of simple construction, and any failures in the detectors will be apparent as change in channel output.

, and there is no adjustment that can be made to the detectors. Furthermore, adjustment of the detectors is unnecessary because they are passive devices with minimal drift. Finally, the

edit

The Frequency of ~~{~~18~~}~~ months is based on demonstrated instrument CHANNEL CALIBRATION reliability over an ~~{~~18~~}~~ month interval, such that the instrument is not adversely affected by drift.

~~SR 3.3.9.3~~

~~SR 3.3.9.3 is the verification of one decade of overlap with the intermediate range neutron flux instrumentation prior to~~

15

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~SR 3.3.9.3 (continued)~~

~~source range count rate exceeding 10^5 cps if not performed within 7 days prior to reactor startup. This ensures a continuous source of power indication during the approach to criticality. Failure to perform this Surveillance leaves the unit in a safe, subcritical condition until the verification can be made. The test may be omitted if performed within the previous 7 days based on operating experience, which shows that source range and intermediate range instrument overlap does not change appreciably within this test interval.~~ 15

REFERENCES

1. 10CFR 50.36 23

None.

B 3.3 INSTRUMENTATION

B 3.3.10 Intermediate Range Neutron Flux

BASES

BACKGROUND

The intermediate range neutron flux channels provide the operator with an indication of reactor power at higher power levels than the source range instrumentation and lower power levels than the power range instrumentation.

The intermediate range instrumentation has two Log NI channels originating in two ~~electrically identical~~ gamma compensated ion chambers. Each channel provides eight decades of flux level information in terms of the log of ion chamber current from ~~1E-10~~ 1E-11 amp to ~~1E-2~~ 1E-3 amp. The channels also measure the rate of change of the neutron flux level, which is displayed for the operator in terms of startup rate from -0.5 decades to +5 decades per minute. A high startup rate of +3 decades per minute in either channel will initiate a control rod withdrawal inhibit while below 10% RTP. — 27

The intermediate range compensated ion chambers are of the electrically adjustable gamma compensating type. Each detector has a separate adjustable high voltage power supply and an adjustable compensating voltage supply.

APPLICABLE SAFETY ANALYSES

Intermediate range neutron flux channels provide ~~are~~ necessary to monitor core reactivity changes and ~~are~~ the primary indication to trigger operator actions to anticipate Reactor Protection System actuation in the event of reactivity transients starting from low power conditions. edit

The intermediate range neutron flux channels satisfy Criterion ~~2~~ 4 of ~~the NRC Policy Statement~~ 10 CFR 50.36 (Ref. 1). — 27

LCO

~~Two~~ One intermediate range neutron flux instrumentation channel~~s~~ shall be OPERABLE to provide the operator with ~~redundant~~ neutron flux indication. ~~These enable~~ This enables operators to control the increase in power and to detect neutron flux transients. This indication is used until the power range instrumentation is on scale. Violation of this requirement could prevent the operator from detecting and controlling — 10

(continued)

BASES

LCO (continued)

neutron flux transients that could result in reactor trip during power escalation.

required 10

APPLICABILITY

with

The ~~intermediate~~ range neutron flux channel(s) shall be OPERABLE in MODE 2 and ~~when~~ any CONTROL ROD drive (CRD) trip breaker (is) in the closed position and the CRD System (is) capable of rod withdrawal. in MODES 3, 4, and 5 17

The intermediate range instrumentation is designed to detect power changes ~~during initial criticality and power escalation~~ when the power range and source range instrumentation cannot provide reliable indications, e.g., Since those conditions can exist in, or propagate from, all of these MODES, the intermediate range instrumentation must be OPERABLE. 27

ACTIONS

~~A.1~~

~~If one intermediate range channel becomes inoperable when the channels indicate 1E-10 amp, the unit is exposed to the possibility that a single failure will disable all neutron monitoring instrumentation. To avoid this, the inoperable channel must be repaired or power must be reduced to the point where source range channels can provide neutron flux indication. Completion of Required Action A.1 places the unit in this state, and LCO 3.3.9, "Source Range Neutron Flux," requires OPERABILITY of two source range detectors once this state is reached. If the one channel failure occurs when indicated power is < 1E-10 amp, the Required Action prohibits increases in power above the source range capability.~~

~~The 2 hour Completion Time allows controlled reduction of power into the source range and is based on unit operating experience that demonstrates the improbability of the second intermediate range channel failing during the allowed interval.~~

A A

~~B~~.1 and ~~B~~.2 10

the required

With ~~two~~ intermediate range neutron flux channel(s) inoperable when THERMAL POWER is ≤ 5% RTP, the operators must place the

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

reactor in the next lowest condition for which the intermediate range instrumentation is not required. This involves providing power level indication on the source range instrumentation by immediately suspending operations involving positive reactivity changes and, within 1 hour, placing the reactor in the tripped condition with the CRD trip breakers open. RCS temperature changes are permitted provided the effects of such changes are accounted for in the SDM calculations. The Completion Times are based on unit operating experience and allow the operators sufficient time to manually insert the CONTROL RODS prior to opening the CRD breakers.

AND-333

SURVEILLANCE REQUIREMENTS

SR 3.3.10.1

edit

Performance of the CHANNEL CHECK once every 12 hours ~~ensures~~ provides reasonable assurance of promt identification that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to ~~a similar~~ the same parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

27

edit

Agreement criteria are determined by the unit staff based on a combination of factors including ~~the~~ channel instrument uncertainties, ~~including isolation, indication, and readability~~. If a channel is outside the criteria, it may be an indication that ~~the transmitter or~~ the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE. Off scale low current loop channels are verified, where practical to be reading at the bottom of the range and not failed low.

27

~~The Frequency, about once every shift, is based on operating~~ experience that demonstrates channel failure is rare. Since the probability of two random failures in redundant channels in any 12 hour period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protective function due to

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.10.1 (continued)

AND-33Z

failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO's required channels. 15

<INSERT B3.3-89B>

When operating with only one channel OPERABLE ~~in Required Action A.1~~, CHANNEL CHECK is still required. However, in this condition, a redundant intermediate range is not available for comparison. CHANNEL CHECK may still be performed via comparison with power or source range detectors, if available, and verification that the OPERABLE intermediate range channel is energized and indicates a value consistent with current unit status. 10

<INSERT B3.3-89A> 14

SR 3.3.10.3

For intermediate range neutron flux channels, CHANNEL CALIBRATION is a complete check and readjustment of the channels, from the preamplifier input to the indicators. This test verifies the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel at a setpoint which accounts ~~adjusted to account~~ for instrument drift to ensure that the instrument channel remains operational between successive tests. 27

The SR is modified by a Note excluding neutron detectors from CHANNEL CALIBRATION. It is not necessary to test the detectors because generating a meaningful test signal is difficult. In addition, the detectors are of simple construction, and any failures in the detectors will be apparent as a change in channel output. The Frequency is based on operating experience and consistency with the typical industry refueling cycle and is justified by demonstrated instrument reliability over an ~~[18]~~ month interval such that the instrument is not adversely affected by drift.

AND-33Z

~~SR 3.3.10.3~~

~~SR 3.3.10.3 is the verification within 7 days prior to reactor startup of one decade of overlap with the power range neutron flux instrumentation prior to intermediate range indication exceeding 1E-6 amp. This ensures a~~ 15

(continued)

<INSERT B3.3-89A>

SR 3.3.10.2

A CHANNEL FUNCTIONAL TEST, of the required intermediate range instrument channel, verifies proper operation of the channel each 31 days. Monthly testing provides reasonable assurance that the instrument channel will function, if required, to provide indication during MODE 2 and during unanticipated reactivity excursions from MODES 3, 4, or 5.

<INSERT B3.3-89B>

ANO-332

The agreement criteria includes an expectation of one decade of overlap when transitioning between neutron flux instrumentation. For example, during a power increase near the top of the scale for the source range monitors, an intermediate range monitor reading is expected with at least one decade overlap. Without such an overlap, the intermediate range monitors are considered inoperable unless it is clear that a source range monitor inoperability is responsible for the lack of the expected overlap. Further, during a power reduction near the bottom of the scale for the power range monitors, an intermediate range monitor reading is expected with at least one decade overlap. Without such an overlap, the intermediate range monitors are considered inoperable unless it is clear that a power range monitor inoperability is responsible for the lack of the expected overlap.

AN0-332

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.10.3 (continued)

continuous source of power indication during the approach to criticality. Failure to perform this Surveillance leaves the unit in a condition where the intermediate range channels provide adequate protection until the verification can be made.

The test may be omitted if performed within the previous 7 days based on operating experience, which shows that intermediate range instrument overlap does not change appreciably within this test interval.

15

REFERENCES

1. 10CFR 50.36

~~None.~~

EDIT

3.3 INSTRUMENTATION

3.3.5 Engineered Safeguards Actuation System (ESAS) Instrumentation

LCO 3.3.5 Three ESAS analog instrument channels for each Parameter in Table 3.3.5-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.5-1.

ACTIONS

--NOTE--
Separate Condition entry is allowed for each Parameter.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Parameters with one analog instrument channel inoperable.	A.1 Place analog instrument channel in trip.	1 hour
B. One or more Parameters with more than one analog instrument channel inoperable. <u>OR</u> Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u>	
	B.2 --------------NOTE-------------- Only required for RCS Pressure - Low setpoint. ------------------------------------ Reduce RCS pressure < 1750 psig.	36 hours
	<u>AND</u>	
	B.3 -------------NOTE-------------- Only required for Reactor Building Pressure High setpoint and High High setpoint. ------------------------------------ Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.5.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.5.2	Perform CHANNEL FUNCTIONAL TEST.	31 days
SR 3.3.5.3	Perform CHANNEL CALIBRATION.	18 months

Table 3.3.5-1 (page 1 of 1)
Engineered Safeguards Actuation System Instrumentation

PARAMETER	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	ALLOWABLE VALUE
1. Reactor Coolant System Pressure - Low Setpoint	≥ 1750 psig	≥ 1585 psig
2. Reactor Building (RB) Pressure - High Setpoint	1,2,3,4	≤ 18.7 psia
3. RB Pressure - High High Setpoint	1,2,3,4	≤ 44.7 psia

3.3 INSTRUMENTATION

3.3.6 Engineered Safeguards Actuation System (ESAS) Manual Initiation

LCO 3.3.6 Two manual initiation channels of each one of the ESAS Functions below shall be OPERABLE:

a. High Pressure Injection (channels 1 and 2);

b. Low Pressure Injection (channels 3 and 4);

c. Reactor Building (RB) Cooling (channels 5 and 6);

d. RB Spray (channels 7 and 8); and

e. Spray Additive (channels 9 and 10).

APPLICABILITY: MODES 1 and 2,
MODES 3 and 4 when associated engineered safeguards equipment is required to be OPERABLE.

ACTIONS

--NOTE--
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more ESAS Functions with one channel inoperable.	A.1 Restore channel to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.6.1	Perform CHANNEL FUNCTIONAL TEST.	18 months

3.3 INSTRUMENTATION

3.3.7 Engineered Safeguards Actuation System (ESAS) Actuation Logic

LCO 3.3.7 The ESAS digital actuation logic channels shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODES 3 and 4 when associated engineered safeguards equipment is required to be OPERABLE.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each digital actuation logic channel.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more digital actuation logic channels inoperable.	A.1 Place associated component(s) in engineered safeguards configuration.	1 hour
	<u>OR</u>	
	A.2 Declare the associated component(s) inoperable.	1 hour

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.7.1 Perform digital actuation logic CHANNEL FUNCTIONAL TEST.	31 days

B 3.3 INSTRUMENTATION

B 3.3.5 Engineered Safeguards Actuation System (ESAS) Instrumentation

BASES

BACKGROUND

The ESAS initiates necessary safety systems, based on the values of selected unit Parameters, to protect against violating core design limits and to mitigate accidents.

The ESAS operates in a distributed manner to initiate the appropriate systems. The ESAS does this by determining the need for actuation in each of three analog instrument channels monitoring each actuation Parameter. Once the need for actuation is determined, the condition is transmitted to digital actuation logic channels, which perform the two-out-of-three logic to determine the actuation of each end device.

Three Parameters are used for actuation:

- Low Reactor Coolant System (RCS) Pressure;
- High Reactor Building (RB) Pressure; and
- High High RB Pressure.

LCO 3.3.5 covers only the analog instrument channels that measure these Parameters. These channels include the equipment necessary to produce an actuation signal input to the digital actuation logic channels. This includes sensors, bistable devices, operational bypass circuitry, and logic buffer modules. LCO 3.3.6, "Engineered Safeguards Actuation System (ESAS) Manual Initiation," and LCO 3.3.7, "Engineered Safeguards Actuation System (ESAS) Actuation Logic," provide requirements on the manual initiation and digital actuation logic Functions.

The ESAS monitors three parameters via analog instrument channels. Each analog instrument channel provides input to the appropriate digital actuation logic channels that initiate equipment with a two-out-of-three coincidence logic on each digital channel. Each digital actuation logic channel includes bistable inputs from all three analog instrument channels of one parameter, i.e., either Low RCS Pressure, High RB Pressure, or High High RB Pressure. The digital actuation logic combines the analog instrument channel trips to actuate the individual Engineered Safeguards (ES) components needed to initiate each ES System. Figure 7.6, SAR, Chapter 7 (Ref. 1), also illustrates how analog instrument channel trips combine to cause digital actuation logic channel trips.

The ESAS is divided into five Functions actuated by ten digital actuation logic channels.

The ESAS High Pressure Injection (HPI) Function is actuated by ESAS digital actuation logic channels 1 and 2 and includes the following system actuations: HPI, a subset of RB isolation valves, diesel generators (DGs), and ES electrical alignment. Digital actuation logic channels 1 and 2 are actuated by two-out-of-three RCS Pressure—Low analog instrument channels, or two-out-of-three RB Pressure—High analog instrument channels.

The ESAS Low Pressure Injection (LPI) Function is actuated by ESAS digital actuation logic channels 3 and 4 and includes the following system actuations: LPI, a subset of RB isolation valves, and emergency feedwater (EFW) through an ESAS signal provided to the Emergency Feedwater Initiation and Control (EFIC) Instrumentation System. Digital actuation logic channels 3 and 4 are actuated by two-out-of-three RCS Pressure—Low analog instrument channels, or two-out-of-three RB Pressure—High analog instrument channels.

The ESAS RB Cooling Function is actuated by ESAS digital actuation logic channels 5 and 6 and includes the following system actuations: RB cooling, a subset of RB isolation valves, and RB penetration room ventilation system. Digital actuation logic channels 5 and 6 are actuated by two-out-of-three RB Pressure—High analog instrument channels.

The ESAS RB Spray Function is actuated by ESAS digital actuation logic channels 7 and 8 and includes the following system actuations: RB spray. Digital actuation logic channels 7 and 8 are actuated by two-out-of-three RB Pressure—High High analog instrument channels.

The ESAS Spray Additive Function is actuated by ESAS digital actuation logic channels 9 and 10 and includes the following system actuations: spray additive. Digital actuation logic channels 9 and 10 are actuated by two-out-of-three RB Pressure—High High analog instrument channels.

The following matrix identifies the ESAS digital actuation logic channels and the systems actuated by each Parameter.

ESAS Digital Actuation Logic Channels	Actuated Systems	Parameter		
		RCS Press. Low	RB Press. High	RB Press. High High
1 and 2	Subset of RB Isolation, ES Electrical Alignment, HPI, and DG Start	X	X	
3 and 4	Subset of RB isolation, LPI, and EFIC EFW	X	X	
5 and 6	Subset of RB Isolation, RB Cooling, and Penetration Room Ventilation		X	
7 and 8	RB Spray			X
9 and 10	Spray Additive			X

The ES equipment is divided between the two redundant actuation trains. The division of the equipment between the two actuation trains is based on the equipment redundancy and function and is accomplished in such a manner that the failure of one of the digital actuation logic channels and the related safeguards equipment will not inhibit the overall ES Functions. Redundant ES pumps are controlled from separate and independent digital actuation logic channels.

The actuation of ES equipment is also available by manual actuation switches located on the control room console.

The ESAS, in conjunction with the actuated equipment, provides protective functions necessary to mitigate Design Basis Accidents (DBAs), specifically the loss of coolant accident (LOCA), RB DBA, and as a backup to mitigate the steam line break (SLB) event (Ref. 2). The ESAS relies on the OPERABILITY of the digital actuation logic channels to perform the actuation of the selected systems.

Engineered Safeguards Actuation System Bypasses

No provisions are made for maintenance bypass of ESAS instrumentation channels. Operational bypass of certain channels is necessary to allow accident recovery actions to continue and, for some channels, to allow reactor shutdown without ESAS actuation.

The ESAS RCS pressure analog instrument channels include permissive bistables that allow manual bypass when reactor pressure is below the point at which the low pressure trip is required to be OPERABLE. Once permissive conditions are sensed, the RCS pressure trips may be manually bypassed. Bypasses are automatically removed when bypass permissive conditions are exceeded. Failure of the automatic bypass removal feature or the inability to bypass the RCS pressure function when below 1750 psig does not constitute channel inoperability. However, a channel that remains bypassed when pressure is raised above 1750 psig will be considered inoperable and appropriate conditions will be entered.

This bypass provides an operational provision only outside the Applicability for this Parameter, and provides no safety function. The automatic bypass removal feature is verified during the monthly CHANNEL FUNCTIONAL TEST.

Reactor Coolant System Pressure

The RCS pressure is monitored by three independent pressure transmitters located in the RB. These transmitters are separate from the transmitters that feed the Reactor Protection System (RPS). Each of the pressure signals generated by these transmitters is monitored by two bistables to provide a trip signal at $\geq$ 1585 psig and a bypass permissive signal at $\leq$ 1750 psig.

The outputs of the three low RCS pressure trip bistables drive relays in two sets of identical and independent digital instrument channels. These two sets of channels each use two-out-of-three coincidence digital logic for actuation.

Each analog channel can be tested online to verify that the signal and trip setpoint are within the specified allowance requirements of approved calibration procedures. The built-in test facilities permit an electrical trip test of each analog instrument string by the substitution of signals at the buffer amplifiers. When an analog instrument string is placed in test, all associated analog subsystem outputs go to the trip state. This assures that all protective action cannot be defeated by placing analog instrument strings in test.

Reactor Building Pressure

The RB pressure is monitored by three independent pressure transmitters located inside the RB. These transmitters are separate from the transmitters that feed the Reactor Protection System (RPS). Each of the pressure signals generated by these transmitters is monitored by two bistables to provide trip signals. The outputs of the bistables, associated with the RB Pressure—High and RB Pressure—High High trips, drive relays in two sets of identical and independent digital instrument channels. These two sets of channels each use two-out-of-three coincidence digital logic for automatic actuation.

Each channel can be tested online to verify that the signal and trip setpoint are within the specified allowance requirements of approved calibration procedures. The built-in test facilities permit an electrical trip test of each analog instrument string by the substitution of signals at the buffer amplifiers. When an analog instrument string is placed in test, all associated analog subsystem outputs go to the trip state. This assures that all protective action cannot be defeated by placing analog instrument strings in test.

APPLICABLE SAFETY ANALYSES

The following ESAS Functions have been assumed within the accident analyses.

High Pressure Injection

The ESAS actuation of HPI has been assumed for core cooling in the LOCA analysis and is available for boron addition in the SLB analysis.

Low Pressure Injection

The ESAS actuation of LPI has been assumed for large break LOCAs.

Reactor Building Spray, Reactor Building Cooling, and Reactor Building Isolation

The ESAS actuation of the RB coolers and RB Spray have been credited in the RB analysis for LOCAs. Accident dose calculations have credited RB Penetration Room Ventilation, RB Isolation, and RB Spray. The MSLB analysis also credits ESAS actuation of the RB Cooling and RB Spray.

<u>Emergency Power</u>

The ESAS initiated DG Start and ES electrical equipment alignment have been included in the design to ensure that emergency power is available throughout the limiting LOCA scenarios.

The small and large break LOCA analyses (Ref. 2) assume a conservative delay time for the actuation of HPI and LPI. This delay time includes allowances for DG starting, DG loading, Emergency Core Cooling Systems (ECCS) pump starts, and valve alignment. Similarly, the RB Cooling, RB Isolation, and RB Spray have been analyzed with delays appropriate for the entire system analyzed.

Accident analyses rely on automatic ESAS actuation for protection of the core temperature and containment pressure limits and for limiting off site dose levels following an accident. These include LOCA, SLB, and other events that result in RCS inventory reduction or severe loss of RCS cooling.

The ESAS instrumentation satisfies Criterion 3 of 10 CFR 50.36 (Ref. 3) for operation in MODE 1. There are no specific safety analyses for operation in MODES 2, 3 and 4. However, industry operating experience has identified the ESAS instrumentation as significant to public health and safety during these operating conditions. Therefore, the ESAS instrumentation satisfies Criterion 4 of 10 CFR 50.36 for operation in MODES 2, 3 and 4.

LCO

The LCO requires three ESAS analog instrument channels for each Parameter in Table 3.3.5-1 to be OPERABLE. Failure of any instrument renders the affected analog instrument channel(s) inoperable and reduces the reliability of the affected Functions.

Only the Allowable Value is specified for each ESAS Function in the LCO. Trip setpoints are provided in the calibration procedures. The trip setpoints are selected to ensure the setpoints measured by CHANNEL FUNCTIONAL TESTS do not exceed the Allowable Value if the bistable is performing as required. Each Allowable Value specified is equal to or more conservative than any analytical limit assumed in the safety analysis to account for instrument uncertainties appropriate to the trip Parameter. Guidance used to calculate the uncertainties associated with the trip setpoints is contained in Instrument Loop Error Analysis Setpoint Methodology, Design Guide, IDG-001 (Ref. 3).

The values for bypass removal functions are stated in the Applicable MODES or Other Specified Condition column of Table 3.3.5-1.

Three ESAS analog instrument channels shall be OPERABLE to ensure that a single failure in one channel will not result in loss of the ability to automatically actuate the required safety systems.

Reactor Coolant System Pressure

Three channels of RCS Pressure - Low are required OPERABLE. Each channel includes a sensor, trip bistable, bypass bistable, bypass relays, and output relays. Failure of a bypass bistable or bypass circuitry, such that an analog instrument channel cannot be bypassed, does not render the channel inoperable since the channel is still capable of performing its safety function, i.e., this is not a safety related bypass function.

The trip setpoints are the nominal values at which the bistables are set. For the RCS Pressure—Low, the limiting safety analysis assumes the HPI, LPI, EFIC EFW, ES electrical alignment, and two subsets of RB isolation actuate at ≥ 1520 psig (≥ 1535 psia). The Allowable Value of ≥ 1585 psig includes considerations for instrumentation error and an allowance for margin. Allowances for instrument drift and additional margin are included in the trip setpoint.

Guidance used to calculate the uncertainties associated with the trip setpoints is provided in Instrument Loop Error Analysis and Setpoint Methodology Manual, Design Guide, IDG-001 (Ref. 4). The explicit uncertainties associated with each setpoint are addressed in the individual design calculations or calibration procedures. Setpoints in accordance with the Allowable Value in conjunction with the LCOs and administrative controls ensure that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the DBA and the equipment functions as analyzed. An analog instrument channel is inoperable if its actual trip setpoint is not within its required Allowable Value.

Reactor Building Pressure

Three channels of RB Pressure—High and RB Pressure—High High are required to be OPERABLE. Each channel includes a pressure switch, bypass relays, and output relays.

The trip setpoints are the nominal values at which the bistables are set. Credit is taken in the safety analyses for RB Pressure—High trip for the actuation of selected systems. The safety analyses for reactor building performance and equipment environmental qualification (pressure and temperature envelope definition) conservatively assume the RB cooling is not initiated until well beyond the expected actual automatic actuation time frame. Therefore, no additional consideration of the instrumentation uncertainties is warranted.

Credit is taken in the safety analyses for RB Pressure—High High trip for the actuation of selected systems. The safety analyses for reactor building performance and equipment environmental qualification (pressure and temperature envelope definition) conservatively assumes the RB spray is not initiated until well beyond the expected actual automatic actuation time frame. Therefore, no additional consideration of the instrumentation uncertainties is warranted.

Therefore, the bistable is considered to be properly adjusted when the "as left" value is consistent with the identified Allowable Value, i.e., for this parameter the trip setpoint and the Allowable Value are the same. Guidance used to calculate the uncertainties associated with the trip setpoints is provided in Instrument Loop Error Analysis and Setpoint Methodology Manual, Design Guide, IDG-001 (Ref. 4). Setpoints in accordance with the Allowable Value ensure that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the DBA and the equipment functions as analyzed. An analog instrument channel is inoperable if its actual trip setpoint is not within its required Allowable Value.

APPLICABILITY

Three ESAS analog instrument channels for each of the following Parameters shall be OPERABLE.

1. Reactor Coolant System Pressure - Low Setpoint

The RCS Pressure - Low Setpoint actuation Parameter shall be OPERABLE during operation at or above 1750 psig. This requirement ensures the capability to automatically actuate safety systems and components during conditions indicative of a LOCA or secondary unit overcooling. Below 1750 psig, the low RCS Pressure actuation Parameter can be bypassed to avoid actuation during normal unit cooldowns when safety systems actuations are not required.

The allowance for the bypass is consistent with the transition of the unit to a lower energy state, where there is more margin to safety limits. The unit response to any event, given that the reactor is already tripped, will be less severe and allows more time for operator action to provide manual safety system actuations than in higher energy states. This is even more appropriate during unit heatups when the primary system and core energy content is low, prior to power operation.

In MODES 5 and 6, there is more time for the operator to evaluate unit conditions and respond by manually starting individual systems, pumps, and other equipment to mitigate the consequences of an abnormal condition or accident than in higher MODES. RCS pressure and temperature are very low, and many ES components are administratively controlled or otherwise prevented from actuating to prevent inadvertent overpressurization of unit systems.

2., 3. Reactor Building Pressure - High Setpoint and Reactor Building Pressure - High High Setpoint

The RB Pressure - High and RB Pressure - High High actuation Functions of ESAS shall be OPERABLE in MODES 1, 2, 3, and 4 when the potential for a HELB exists. In MODES 5 and 6, there is more time for the operator to evaluate unit conditions and respond by manually starting individual systems, pumps, and other equipment to mitigate the consequences of an abnormal condition or accident than in higher MODES. Plant pressure and temperature are very low and many ES components are administratively controlled or otherwise prevented from actuating to prevent inadvertent overpressurization of unit systems.

ACTIONS

Required Actions A and B apply to the ESAS instrumentation Parameters listed in Table 3.3.5-1.

A Note has been added to the ACTIONS indicating separate Condition entry is allowed for each Parameter.

If an analog instrument channel's trip setpoint is found nonconservative with respect to the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or ESAS bistable is found inoperable, then all affected functions provided by that channel should be declared inoperable and the unit must enter the Conditions for the particular protection Parameter affected.

A.1

Condition A applies when one analog instrument channel becomes inoperable in one or more Parameters. If one ESAS analog instrument channel is inoperable, placing it in a tripped condition leaves the system in a one-out-of-two condition for actuation. Thus, if another analog instrument channel were to fail, the ESAS instrumentation could still perform its actuation functions. This action is completed when all of the affected output relays are tripped. This can normally be accomplished by tripping the affected bistables.

The 1 hour Completion Time is sufficient time to perform the Required Action.

B.1, B.2, and B.3

Condition B applies when Required Action A.1 and its associated Completion Time are not met, or when one or more parameters have more than one analog instrument channel inoperable. If Condition B applies, the unit must be brought to a condition in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours. Additionally, for the RCS Pressure—Low parameter, the unit must be brought to < 1750 psig within 36 hours, and for the RB Pressure—High and High High parameters, the unit must be brought to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

The ESAS Parameters listed in Table 3.3.5-1 are subject to CHANNEL CHECK, CHANNEL FUNCTIONAL TEST, and CHANNEL CALIBRATION.

SR 3.3.5.1

Performance of the CHANNEL CHECK every 12 hours provides reasonable assurance for prompt identification of a gross failure of instrumentation. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between CHANNEL CALIBRATIONs.

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

The Frequency is based on operating experience that demonstrates channel failure is rare. Since the probability of two random failures in redundant channels in any 12 hour period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but potentially more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO's required channels.

SR 3.3.5.2

A CHANNEL FUNCTIONAL TEST is performed on each required ESAS analog instrument channel to ensure the entire channel will perform the intended functions. Any setpoint adjustment shall be consistent with the assumptions of the setpoint calculations.

The Frequency of 31 days is based on unit operating experience, with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given function in any 31 day interval is a rare event. The RCS low pressure automatic bypass removal feature is verified during its CHANNEL FUNCTIONAL TEST.

SR 3.3.5.3

CHANNEL CALIBRATION is a complete check of the analog instrument channel, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift to ensure that the analog instrument channel remains OPERABLE between successive tests. CHANNEL CALIBRATION shall find that measurement errors and bistable setpoint errors are within the assumptions of the setpoint calculations. CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the setpoint calculations.

This Frequency is justified by the assumption of at least an 18 month calibration interval to determine the magnitude of equipment drift in the setpoint calculations.

REFERENCES

1. SAR, Chapter 7.
2. SAR, Chapter 14 and Chapter 3A.
3. 10 CFR 50.36.
4. Instrument Loop Error Analysis and Setpoint Methodology Manual, Design Guide, IDG-001.

B 3.3 INSTRUMENTATION

B 3.3.6 Engineered Safeguards Actuation System (ESAS) Manual Initiation

BASES

BACKGROUND

The ESAS manual initiation capability allows the operator to actuate ESAS Functions from the control room in the absence of any other initiation condition. This ESAS manual initiation capability is provided in the event the operator determines that an ESAS Function is needed and has not been automatically actuated. Furthermore, the ESAS manual initiation capability allows operators to rapidly initiate Engineered Safeguards (ES) Functions if the trend of unit parameters indicates that ES actuation will be needed.

LCO 3.3.6 covers only the system level manual initiation of these Functions. LCO 3.3.5, "Engineered Safeguards Actuation System (ESAS) Instrumentation," and LCO 3.3.7, "Engineered Safeguards Actuation System (ESAS) Actuation Logic," provide requirements on the portions of the ESAS that automatically initiate the Functions described earlier.

The ESAS manual initiation Function relies on the OPERABILITY of the digital actuation logic channels (LCO 3.3.7) to perform the actuation of the systems. A manual trip push button is provided on a control room console for each of the digital actuation logic channels. Operation of the push button energizes relays whose contacts perform a logical "<u>OR</u>" function with the automatic actuation.

The ESAS manual initiation channel is defined as the console switch and the instrumentation from the console switch to, but not including, the digital actuation logic channels, which actuate the end devices. Other means of manual initiation, such as controls for individual ES devices, may be available in the control room and other unit locations. These alternative means are not required by this LCO, nor may they be credited to fulfill the requirements of this LCO.

APPLICABLE SAFETY ANALYSES

The ESAS, in conjunction with the actuated equipment, provides protective functions necessary to mitigate Design Basis Accidents, specifically, the loss of coolant accident (LOCA), RB DBA and as a backup to mitigate the steam line break event.

The ESAS manual initiation ensures that the control room operator can rapidly initiate ES Functions. The manual initiation trip Function is required as a backup to automatic trip functions and allows operators to initiate ESAS whenever any parameter is rapidly trending toward its trip setpoint.

Operating experience has shown the ESAS manual initiation function to be significant to public health and safety, and therefore satisfy Criterion 4 of 10 CFR 50.36 (Ref. 1).

LCO

Two ESAS manual initiation channels of each ESAS Function shall be OPERABLE whenever conditions exist that could require ES protection of the reactor or RB. Two OPERABLE channels ensure that no single random failure will prevent system level manual initiation of any ESAS Function. The ESAS manual initiation Function allows the operator to initiate protective action prior to automatic initiation or in the event the automatic initiation does not occur.

The ESAS is divided into five Functions actuated by ten manual initiation channels as indicated in the following table:

Function	Associated Channels
High Pressure Injection	1 & 2
Low Pressure Injection	3 & 4
RB Cooling	5 & 6
RB Spray	7 & 8
Spray Additive	9 & 10

The ESAS High Pressure Injection (HPI) Function is actuated by ESAS Manual Initiation channels 1 and 2 and includes the following system actuations: HPI, a subset of reactor building (RB) isolation valves, diesel generators, and ES electrical alignment.

The ESAS Low Pressure Injection (LPI) Function is actuated by ESAS Manual Initiation channels 3 and 4 and includes the following system actuations: LPI, a subset of RB isolation valves, and emergency feedwater (EFW) through an ESAS signal provided to the Emergency Feedwater Isolation and Control (EFIC) System.

The ESAS RB Cooling Function is actuated by ESAS Manual Initiation channels 5 and 6 and includes the following system actuations: RB cooling, a subset of RB isolation valves, and RB penetration room ventilation system.

The ESAS RB Spray Function is actuated by ESAS Manual Initiation channels 7 and 8 and includes the following system actuations: RB spray.

The ESAS Spray Additive Function is actuated by ESAS Manual Initiation channels 9 and 10 and includes the following system actuations: spray additive.

APPLICABILITY

The ESAS manual initiation Functions shall be OPERABLE in MODES 1 and 2, and in MODES 3 and 4 when the associated ES equipment is required to be

OPERABLE. The manual initiation channels are required because ES Functions are designed to provide protection in these MODES. ESAS initiates systems that are either reconfigured for decay heat removal operation or disabled while in MODES 5 and 6. Accidents in these MODES are slow to develop and would be mitigated by manual operation of individual components. Time is available to evaluate unit conditions and to respond by manually operating the ES components, if required.

ACTIONS

A Note has been added to the ACTIONS indicating separate Condition entry is allowed for each ESAS manual initiation Function.

A.1

Condition A applies when one manual initiation channel of one or more ESAS Functions becomes inoperable. Required Action A.1 must be taken to restore the channel to OPERABLE status within the next 72 hours. The Completion Time of 72 hours is based on unit operating experience and administrative controls, which provide alternative means of ESAS Function initiation via individual component controls. The 72 hour Completion Time is generally consistent with the allowed outage time for the safety systems actuated by ESAS.

B.1 and B.2

If Required Action A.1 and the associated Completion Time are not met, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required MODES from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.3.6.1

This SR requires the performance of a CHANNEL FUNCTIONAL TEST of the ESAS manual initiation. This test verifies that the initiating circuitry is OPERABLE and will actuate the digital actuation logic channels. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. This Frequency is demonstrated to be sufficient, based on operating experience, which shows these components usually pass the Surveillance when performed on the 18 month Frequency.

REFERENCES

1. 10 CFR 50.36.

B 3.3 INSTRUMENTATION

B 3.3.7 Engineered Safeguards Actuation System (ESAS) Actuation Logic

BASES

BACKGROUND

The digital actuation logic channels of ESAS are defined as the instrumentation between, but not including, the buffers of the analog instrument channels and the unit controls that actuate ESAS equipment. Each of the components actuated by the ESAS Functions is associated with one or more digital actuation logic channels. If two-out-of-three ESAS analog instrument channels indicate a trip, or if channel level manual initiation occurs, the digital actuation logic channel is activated and the associated equipment is actuated.

The purpose of requiring OPERABILITY of the ESAS digital actuation logic channels is to ensure that the Functions of the ESAS can be automatically initiated in the event of an accident. Automatic actuation of some Functions is necessary to prevent the unit from exceeding the Emergency Core Cooling Systems (ECCS) limits in 10 CFR 50.46 (Ref. 1). It should be noted that OPERABLE digital actuation logic channels alone will not ensure that each Function can be activated; the analog instrument channels and actuated equipment associated with each Function must also be OPERABLE to ensure that the Functions can be automatically initiated during an accident.

LCO 3.3.7 covers only the digital actuation logic channels that initiate these Functions. LCO 3.3.5, "Engineered Safeguards Actuation System (ESAS) Instrumentation," and LCO 3.3.6, "Engineered Safeguards Actuation System (ESAS) Manual Initiation," provide requirements on the analog instrument and manual initiation channels that input to the digital actuation logic channels.

The ESAS, in conjunction with the actuated equipment, provides protective functions necessary to mitigate Design Basis Accidents (DBAs), specifically, the loss of coolant accident (LOCA) and steam line break (SLB) events. The ESAS relies on the OPERABILITY of the digital actuation logic for each component to perform the actuation of the selected systems.

The small and large break LOCA analyses assume a conservative delay time for the actuation of high pressure injection (HPI) and low pressure injection (LPI) in BAW-10103A, Rev. 3 (Ref. 2). This delay time includes allowances for diesel generator (DG) starts, DG loading, ECCS pump starts, and valve alignment. Similarly, the reactor building (RB) Cooling, RB Isolation, and RB Spray have been analyzed with delays appropriate for the entire system.

The ESAS automatic initiation of Engineered Safeguards (ES) Functions to mitigate accident conditions is assumed in the DBA analysis and is required to ensure that consequences of analyzed events do not exceed the accident analysis predictions.

Automatically actuated features include HPI, LPI, RB Cooling, RB Spray, RB Spray Additive, and RB Isolation.

APPLICABLE SAFETY ANALYSES

Accident analyses rely on automatic ESAS actuation for protection of the core and RB and for limiting off site dose levels following an accident. The digital actuation logic is an integral part of the ESAS.

The ESAS actuation logic satisfies Criterion 3 of 10 CFR 50.36 (Ref. 3) for operation in MODE 1. There are no specific safety analyses for operation in MODES 2, 3 and 4. However, industry operating experience has identified the ESAS actuation logic as significant to public health and safety during these operating conditions. Therefore, the ESAS actuation logic satisfies Criterion 4 of 10 CFR 50.36 for operation in MODES 2, 3 and 4.

LCO

The digital actuation logic channels are required to be OPERABLE whenever conditions exist that could require ES protection of the reactor or the RB. This ensures automatic initiation of the ES required to mitigate the consequences of accidents.

The ESAS is divided into five Functions actuated by ten digital actuation logic channels as indicated in the following table:

Function	Associated Channels
High Pressure Injection	1 & 2
Low Pressure Injection	3 & 4
RB Cooling	5 & 6
RB Spray	7 & 8
Spray Additive	9 & 10

The ESAS HPI Function is actuated by ESAS digital actuation logic channels 1 and 2 and includes the following system actuations: HPI, a subset of RB isolation valves, DGs, and ES electrical alignment. Digital actuation logic channels 1 and 2 are actuated by two-out-of-three RCS Pressure—Low analog instrument channels, or two-out-of-three RB Pressure—High analog instrument channels.

The ESAS LPI Function is actuated by ESAS digital actuation logic channels 3 and 4 and includes the following system actuations: LPI, a subset of RB isolation valves, and EFW through an ESAS signal provided to EFIC. Digital actuation logic channels 3 and 4 are actuated by two-out-of-three RCS Pressure—Low analog instrument channels, or two-out-of-three RB Pressure—High analog instrument channels.

The ESAS RB Isolation and Cooling Function is actuated by ESAS digital actuation logic channels 5 and 6 and includes the following system actuations: RB cooling, a subset of RB isolation valves, and RB penetration room ventilation system. Digital actuation logic channels 5 and 6 are actuated by two-out-of-three RB Pressure—High analog instrument channels.

The ESAS RB Spray Function is actuated by ESAS digital actuation logic channels 7 and 8 and includes the following system actuations: RB spray. Digital actuation logic channels 7 and 8 are actuated by two-out-of-three RB Pressure—High High analog instrument channels.

The ESAS Spray Additive Function is actuated by ESAS digital actuation logic channels 9 and 10 and includes the following system actuations: spray additive. Digital actuation logic channels 9 and 10 are actuated by two-out-of-three RB Pressure—High High analog instrument channels.

APPLICABILITY

The digital actuation logic channels shall be OPERABLE in MODES 1 and 2, and in MODES 3 and 4 when the associated ES equipment is required to be OPERABLE, because ES Functions are designed to provide protection in these MODES. Automatic actuation in MODE 5 or 6 is not required because the systems initiated by the ESAS are either reconfigured for decay heat removal operation or disabled. Accidents in these MODES are slow to develop and would be mitigated by manual operation of individual components. Time is available to evaluate unit conditions and respond by manually operating the ES components, if required.

ACTIONS

A Note has been added to the ACTIONS indicating separate Condition entry is allowed for each ESAS digital actuation logic channel.

<u>A.1 and A.2</u>

When one or more digital actuation logic channel(s) are inoperable, the associated component(s) can be placed in their ES configuration. Required Action A.1 is equivalent to the digital actuation logic channel performing its safety function ahead of time. In some cases, placing the component in its ES configuration would violate unit safety or operational considerations. In these cases, the component status should not be changed, but the supported system component must be declared inoperable. Conditions which would preclude the placing of a component in its ES configuration include, but are not limited to, violation of system separation, activation of fluid systems that could lead to thermal shock, isolation of fluid systems that are normally functioning, and actuation of components which would not return to their actuated condition upon restoration of electrical power. The

Completion Time of 1 hour is based on operating experience and reflects the urgency associated with the inoperability of a safety system component.

Required Action A.2 requires entry into the Required Actions of the affected supported systems, since the true effect of digital actuation logic channel failure is inoperability of the supported system. The Completion Time of 1 hour is based on operating experience and reflects the urgency associated with the inoperability of a safety system component. A combination of Required Actions A.1 and A.2 may be used for different components associated with an inoperable ESAS digital actuation logic channel.

SURVEILLANCE REQUIREMENTS

SR 3.3.7.1

SR 3.3.7.1 is the performance of a CHANNEL FUNCTIONAL TEST on a 31 day Frequency. The test demonstrates that each digital actuation logic channel successfully performs the two-out-of-three logic combinations every 31 days. The test simulates the required one-out-of-three inputs to the logic circuit and verifies the successful operation of the digital actuation logic. The Frequency is based on operating experience that demonstrates the rarity of more than one channel failing within the same 31 day interval. The CHANNEL FUNCTIONAL TEST performed for the Reactor Building Spray System Logic Channels shall include testing of the associated spray pump, spray valves, and chemical additive valve logic channels.

REFERENCES

1. 10 CFR 50.46.
2. BAW-10103A, Rev. 3, July 1977.
3. 10 CFR 50.36.

CTS DISCUSSION OF CHANGES

ITS Section 3.3B: Instrumentation - ESAS

Note: ITS Section 3.3B package includes the following ITS:

ITS 3.3.5	Engineered Safeguards Actuation System (ESAS) Instrumentation
ITS 3.3.6	ESAS Manual Initiation
ITS 3.3.7	ESAS Actuation Logic

which address the corresponding NUREG-1430 LCOs.

ADMINISTRATIVE

A1 The designated change represents a non-technical, non-intent change to the Arkansas Nuclear One, Unit 1 Current Technical Specifications (CTS) made to make the ANO-1 Improved Technical Specifications (ITS) consistent with the B&W Standard Technical Specification (RSTS), NUREG-1430, Revision 1. This change does not alter the requirements of the CTS or NUREG. Examples of this type of change include: wording preference; convention adoption; editorial, numbering and formatting changes; and hierarchy structure.

A2 The ANO-1 CTS Bases will be administratively deleted in their entirety in favor of the NUREG-1430 Bases. The CTS Bases will be reviewed for technical content that will be identified for retention in the ITS Bases.

A3 CTS 3.5.1.1 and 3.5.1.2 represent information on the proper action when the number of channels is less than required by CTS Table 3.5.1-1. For example, CTS 3.5.1 does not clearly specify that the number of channels identified in Table 3.5.1-1, Column 1, are required to be OPERABLE, and CTS 3.5.1.2 provides limitations for inoperable channels. Similarly, CTS 4.1.a, and 4.1.b contain information on the proper application of CTS Table 4.1-1. These Specifications and the format of the referenced Tables are replaced with the appropriate ITS requirements. The CTS markup for these Specifications and Tables does not attempt to depict all of the changes required to adopt the ITS format. Rather, the appropriate specific Discussion of Change (DOC) is indicated along with the appropriate CTS versus ITS cross reference. Therefore, this change in format is considered administrative.

CTS DISCUSSION OF CHANGES

A4 Surveillance frequencies in CTS Table 4.1-1 have been replaced with those from NUREG-1430. The CTS and corresponding ITS Frequencies are as follows:

CTS	ITS
S - Each shift	12 hours
W - Weekly	7 days
M - Monthly	31 days
D - Daily	24 hours
T/W - Twice per week	96 hours
Q - Quarterly	92 days
P - Prior to each startup if not done previous week	Not Used
B/M - Every 2 months	Not Used
R - Once every 18 months	18 months
PC - Prior to going Critical if not done within previous 31 days	Not Used
NA - Not Applicable	Not Used
SA - SA Twice per Year	184 days

(Note: Not all Frequencies are applicable to this package.)

A5 The Notes which allow for separate entry into the ACTIONS of ITS 3.3.5, ITS 3.3.6, and ITS 3.3.7 have been adopted. These additions have been made to provide requirements in a format consistent with NUREG-1430. The addition of these Notes maintains allowances consistent with the use and application of the requirements of the corresponding portions of CTS Table 3.5.1-1. This change represents a change in presentation format only with no addition or deletion of requirements.

A6 Requirements for instrument channels presented in CTS Table 3.5.1-1 have been replaced by the requirements of ITS 3.3.5. This change maintains the requirement for three OPERABLE channels of instrumentation for each of the required parameters. It does represent a change in format for these requirements. However, no additional requirements have been added by this change and no current requirements have been deleted.

A7 The term Minimum Degree of Redundancy as presented in CTS, i.e., Table 3.5.1-1 Column 4, will not be retained in ITS. Omission of this term is not considered to result in any changes in requirements since the intent of this column is consistent with application of Table 3.5.1-1 Column 3, "Minimum Channels Operable," which is retained (although the format is changed per DOC A3). Removal of this term and its usage from the CTS does not represent any actual change in requirements, only a change in presentation.

A8 The CTS requirements for the ESAS manual trip pushbuttons found in CTS Table 3.5.1-1 have been replaced by the requirements of ITS 3.3.6. This change maintains the requirement for two OPERABLE channels of manual actuation instrumentation for each of the required Functions. It does however represent a change in format for these requirements, although no additional requirements have been added by this change and no current requirements have been deleted.

A9 CTS Table 3.5.1-1, Engineered Safeguards Actuation System (ESAS), Functional Units 1, 2, 3, 4, and 5 have been replaced by ITS LCO 3.3.7. Although the CTS does not clearly present these requirements as an LCO, the requirements of these portions of Table 3.5.1-1 are treated as such by ANO-1. The adoption of ITS LCO 3.3.7 represents a change in format. However, this change in format does not change the application of the requirements found in CTS as they relate to the ESAS Actuation Logic Channels.

A10 The requirement to test the ESAS Manual Trip Functions Logic on a monthly basis will no longer be individually specified as it is in CTS Table 4.1-1 Item 43 b. This CTS requirement is redundant to the testing requirements presented in CTS Table 4.1-1 Items 14, 16, 18, and 20. The design of the ESAS at ANO-1 is such that performance of the CHANNEL FUNCTIONAL TEST of the Actuation Logic Channels encompasses the manual actuation system logic test specified in CTS Table 4.1-1 Item 43 b. Testing of the ESAS Actuation Logic Channels, as required by ITS SR 3.3.7.1, will maintain the testing requirements consistent with CTS.

A11 The requirement to perform a CHANNEL CHECK on the reactor building (RB) pressure high-high instrument channels (Reactor Building Spray System Analog Channels, Reactor Building Pressure Channels) has been indicated as an addition to the CTS in Table 4.1-1 Item 21.a. Although this is a change in presentation it does not represent a change in requirements. The design of the ANO-1 ESAS instrument channels is such that the same three transmitters provide input to both the High and the High-High RB pressure functions. Because the indications available for the performance of the required CHANNEL CHECKS are shared by both the High and the High-High RB pressure functions, one performance of this check is sufficient for both functions. The additional CHANNEL CHECK requirement was indicated in the CTS to provide a more complete cross-reference to the ITS requirements. This change provides requirements consistent with NUREG-1430 both in presentation and in content.

A12 The allowance provided in CTS 3.5.3 to bypass the High Reactor Building Pressure and Low Reactor Coolant System Pressure Functional Units during reactor building leak rate tests is omitted. The revised Applicabilities for these Functions (see DOC L1) do not require them to be OPERABLE during the leak rate testing. Therefore, this change is considered administrative.

CTS DISCUSSION OF CHANGES

A13 This page is not yet approved as provided in this package. Therefore, the markup is dependent on the expected NRC approval of the August 18, 1999 (Ref. 1CAN089903) license amendment request (LAR) related to the ESAS RCS low pressure setpoint revision.

A14 CTS 4.1.c is omitted since it duplicates requirements provided in the regulations, i.e., 10 CFR 50, Appendix B, criteria XI, XVI, and XVII. Such duplication is unnecessary and results in additional administrative burden to revise the duplicate TS when these regulations are revised. Since removal of the duplication results in no actual change in the requirements, removal of the duplicative information is considered an administrative change. Further, changes to the requirements are controlled by the NRC. This change is consistent with NUREG-1430.

CTS DISCUSSION OF CHANGES

TECHNICAL CHANGE -- MORE RESTRICTIVE

M1 Not used.

M2 CTS Table 3.5.1-1 Note 8 provides action requirements in the event any portion of an ESAS digital subsystem is inoperable. This action requirement is referenced from CTS Table 3.5.1-1 although no specific LCO requirement is provided. CTS Table 3.5.1-1 Note 8 indicates that the safety features associated with an inoperable ESAS digital subsystem are to be considered inoperable and that CTS 3.3 applies. It does not however, specify a Completion Time for this action requirement. ITS 3.3.7 Required Action A.2 and its associated Completion Time are adopted to replace the requirements of CTS 3.5.1-1 Note 8. The adoption of the 1 hour Completion Time provides more restrictive, but appropriate, requirements in that no time period for the performance of this action was specified in CTS. This change is consistent with NUREG-1430.

M3 CTS Table 3.5.1-1 Note 6 provides an allowance for continued operation by tripping an inoperable channel and reducing the 2 out of 3 logic to 1 out of the remaining 2 channels. However, no time is specified to complete this action. Therefore, Note 1 is applicable until the inoperable channel is tripped. Note 1 requires the unit to be in hot shutdown within 12 hours. Therefore, the unit essentially has 12 hours to trip the inoperable channel (and restore compliance) or be in MODE 3. ITS 3.3.5 Required Actions A.1 and B.1 will provide only one hour to trip the channel or be in MODE 3 within an additional 6 hours (see also DOC M5). This change represents more restrictive requirements in that ITS 3.3.5 Required Actions A.1 and B.1 specify 7 hours before the unit must be in MODE 3 where CTS allows 12 hours (if the channel is not placed in the tripped condition). Further, the 1 hour Completion Time to place the channel in a tripped condition is not specified in CTS and also represents a more restrictive requirement. This change provides an appropriate Completion Time for this Required Action consistent with NUREG-1430.

M4 CTS Table 3.5.1-1 Note 5 has been replaced by ITS 3.3.5 Required Action B.2.2 and ITS 3.3.6 Required Action B.2. CTS Table 3.5.1-1 Note 5, in conjunction with CTS Table 3.5.1-1 Note 1, provides a total time of 84 hours, from failure to meet the LCO, to enter cold shutdown (MODE 5). ITS 3.3.5 Required Action B.2.2 and ITS 3.3.6 Required Action B.2 will require entry into MODE 5 within 36 hours of failure to meet the LCO. These more restrictive requirements minimize the time during which the safety function is degraded while providing sufficient time to accomplish an orderly shutdown. Additionally, this Completion Time is consistent with NUREG-1430.

CTS DISCUSSION OF CHANGES

M5 CTS Table 3.5.1-1 Note 1 has been replaced by ITS 3.3.5 Required Action B.1 and ITS 3.3.6 Required Action B.1. CTS Table 3.5.1-1 Note 1 provides a time of 12 hours, from failure to meet the LCO, to enter hot shutdown (MODE 3). ITS 3.3.5 Required Action B.1 and ITS 3.3.6 Required Action B.1 will require entry into MODE 3 within 6 hours of failure to meet the LCO. These more restrictive requirements minimize the time during which the safety function is degraded while providing sufficient time to accomplish an orderly shutdown. Additionally, this Completion Time is consistent with NUREG-1430.

TECHNICAL CHANGE -- LESS RESTRICTIVE

L1 Specific Applicability statements for each of the Parameters in ITS Table 3.3.5-1 have been adopted. An Applicability exists in CTS only as implied by the appropriate action requirements which are CTS Table 3.5.1-1 Notes 1 and 5. These requirements would result in the unit being placed in cold shutdown (MODE 5) if any of the ESAS instrumentation Parameters contained more than one inoperable channel. The adoption of the specific ITS Applicability statements is less restrictive in that the Reactor Coolant System Pressure-Low Setpoint Parameter instrument channels will only be required OPERABLE when RCS pressure is above 1750 psig. This specific Applicability is consistent with the design of the ESAS, which provides the capability of bypassing this function when RCS pressure is reduced below 1750 psig (with some margin for instrumentation capabilities) and automatically removing this bypass when pressure is raised back above setpoint (CTS 3.5.3, Note **). Failure of the automatic bypass removal feature or the inability to bypass the RCS pressure function when below 1750 psig does not constitute channel inoperability. However, a channel that remains bypassed when pressure is raised above 1750 psig will be considered inoperable and appropriate conditions will be entered. Because the automatic bypass feature provides no safety function, a discussion of its purpose and relationship to channel operability has been included in the Bases.

3.3.5-02

Additionally, ITS 3.3.5 Required Action B.2.1 along with its Note and the Note modifying Required Action B.2.2 have been adopted. This change provides action requirements to remove the unit from the Applicability of the LCO.

These changes have been made to provide requirements appropriate for the design and licensing basis for the unit. Additionally, this Completion Time is consistent with NUREG-1430.

L2 CTS Table 3.5.1-1 Note 8 indicated that if any one component of an ESAS digital subsystem is inoperable then the entire subsystem is inoperable. The design of the digital subsystems of the ESAS is such that there are five actuation logic channels contained in each of the two digital subsystems. A failure which renders one actuation logic channel inoperable may or may not affect any other of the actuation logic channels contained within that digital subsystem. As a result, the requirement to declare equipment inoperable while it is fully capable of performing its design function is inconsistent with both the CTS and ITS definitions of OPERABLE-OPERABILITY. The requirements of CTS Table 3.5.1-1 Note 8 are replaced by the ACTIONS of ITS 3.3.7.

L3 NUREG-1430 3.3.7 Required Action A.1 and its associated Completion Time have been adopted in the ITS. This Required Action allows equipment associated with an inoperable ESAS Actuation Logic Channel to be placed in its actuated state. This is an alternative to Required Action A.2, and CTS Table 3.5.1-1 Note 8, which would require declaring the equipment inoperable and entering the associated Required Actions for that equipment. This change allows additional flexibility in unit operation by not requiring the performance of the Required Actions for equipment made inoperable by the inoperability of an ESAS Actuation Logic Channel. This change provides requirements consistent with NUREG-1430 and which maintain the safety function of the equipment associated with the ESAS Actuation Logic Channels.

L4 NUREG-1430 3.3.6 Required Action A.1 and its associated Completion Time have been adopted in the ITS. This change establishes a 72 hour period of time in which the unit may continue operation, with one or more ESAS Functions having one channel of the manual initiation feature inoperable, prior to entering an ACTION which results in the unit entering MODE 3. This change has been made to provide ACTION requirements consistent with the safety function of the system, considering the allowed outage time for the actuated system. Additionally, this change is consistent with NUREG-1430.

L5 The Applicability statements of ITS 3.3.6 and 3.3.7 have been adopted. The Applicability for requirements related to these instrument channels was established, in CTS, only by the action requirements of CTS Table 3.5.1-1 Notes 1 and 5. These Notes could have resulted in the unit being placed in cold shutdown (MODE 5). Adoption of the ITS Applicabilities will require OPERABILITY of this instrumentation only during the MODES in which its actuated equipment is required to be OPERABLE. This change is consistent with the philosophy of the NUREG and with the requirements of NUREG-1430 as modified to accommodate the specific Applicabilities of the actuated equipment.

L6 Not used.

L7 CTS Table 4.1-1, items 15.a and 17.a require monthly testing of the HPI and LPI analog channels which are initiated by RCS pressure. CTS Note (1) on each of these two items indicates that the channel is tested "including test of shutdown bypass function (ECCS bypass function)." This Note and its requirements are omitted in ITS 3.3.5. The bypass provides for operational flexibility only by preventing the actuation of ECCS during a shutdown. This bypass provides no safety function in that if the channel does not provide the intended bypass, the system can still perform its required actuations. If the ESAS is somehow prevented from actuation of the required components by the bypass, the channel is inoperable and the unit cannot enter the Applicable conditions for ITS 3.3.5.

CTS DISCUSSION OF CHANGES

The Bases for NUREG 3.3.5, LCO section, state: "Failure of a bypass bistable or bypass circuitry, such that a trip channel cannot be bypassed, does not render the channel inoperable." This is acceptable only if the bypass performs no safety function. Further, for this to be true, the bypass is not required to be tested with the CHANNEL FUNCTIONAL TEST, since if it were included, and it failed, the SR would be failed. Pursuant to SR 3.0.1, with a failed SR, the LCO would not be met, i.e., the channel would be inoperable. Since the Bases clearly indicate the channel is not inoperable, the bypass must not be a required function, and therefore, is not included in the SR.

CTS DISCUSSION OF CHANGES

LESS RESTRICTIVE -- ADMINISTRATIVE DELETION OF REQUIREMENTS

LA1 This information has been moved to the Bases. This information provides details of design or process which are not directly pertinent to the actual requirement, i.e., Definition, Limiting Condition for Operation or Surveillance Requirement, but rather describe an acceptable method of compliance. Since these details are not necessary to adequately describe the actual regulatory requirement, they can be moved to a licensee controlled document without a significant impact on safety. Placing these details in controlled documents provides adequate assurance that they will be maintained. The Bases will be controlled by the Bases Control Process in Section 5 of the proposed Technical Specifications. This change is consistent with NUREG-1430.

CTS Location	New Location
Table 3.5.1-1 Column 1 "Number of Channels"	Bases 3.3.5, LCO
Table 3.5.1-1 Column 2 "No. of Channels for System Trip"	Bases 3.3.5, BACKGROUND
3.5.3	Bases 3.3.5, BACKGROUND

LA2 The information provided in Table 4.1-1, Item 20, Note (1) has been moved to the Bases of ITS 3.3.7, which describe the RB Spray system and its automatic actuation. This information provides details of design or process which are not directly pertinent to the actual requirement, i.e., Surveillance Requirement, but rather only further describe the required equipment. Since these details are not necessary to adequately describe the actual regulatory requirement, they can be moved to a licensee controlled document without a significant impact on safety. Placing these details in controlled documents provides adequate assurance that they will be maintained. The Bases will be controlled by the Bases Control Process in Section 5 of the proposed Technical Specifications. This change is consistent with NUREG-1430.

3.3.5
3.3.6
3.3.7

3.5 INSTRUMENTATION SYSTEMS

3.5.1 Operational Safety Instrumentation

Applicability

Applies to unit instrumentation and control systems.

Objectives

To delineate the conditions of the unit instrumentation and safety circuits necessary to assure reactor safety.

Specifications

A1

A3

<LATER> (3.3A, 3.3C, 3.3D, 3.4B)

3.5.1.1 Startup and operation are not permitted unless the requirements Table 3.5.1-1, columns 3 and 4 are met.

3.5.1.2 In the event the number of protection channels operable falls be the limit given under Table 3.5.1-1, Columns 3 and 4, operation shall be limited as specified in Column 5.

<LATER>

<LATER> (3.3A)

3.5.1.3 For on-line testing or in the event of a protection instrument : channel failure, a key operated channel bypass switch associatec with each reactor protection channel may be used to lock the channel trip relay in the untripped state as indicated by a ligr Only one channel shall be locked in the untripped state or contain inoperable functions in the untripped state at any one time. In the event more than one protection channel contains inoperable functions in the untripped state, or a protection channel or function becomes inoperable concurrent with another protection channel locked in the untripped state, within 1 hour implement the actions required by Table 3.5.1-1 Note 6. Only cr channel bypass key shall be accessible for use in the control :: While operating with an inoperable function unbypassed in the untripped state, the remaining RPS key operated channel bypass switches shall be tagged to prevent their operation.

-LATER

3.5.1.4 The key operated shutdown bypass switch associated with each rea protection channel shall not be used during reactor power operat except during channel testing.

R TRM

<LATER> (3.3A)

3.5.1.5 During startup when the intermediate range instruments come on scale, the overlap between the intermediate range and the source range instrumentation shall not be less than one decade. If the overlap is less than one decade, the flux level shall be mainta: in the source range until the one decade overlap is achieved.

-LATER

3.5.1.6 In the event that one of the trip devices in either of the sour: supplying power to the control rod drive mechanisms fails in the untripped state, the power supplied to the rod drive mechanisms through the failed trip device shall be manually removed within minutes following detection. The condition will be corrected ar the remaining trip devices shall be tested within eight hours following detection. If the condition is not corrected and the remaining trip devices are not tested within the eight-hour per: the reactor shall be placed in the hot shutdown condition withi: additional four hours.

3.3.5
3.3.6
3.3.7

A2

Bases

Every reasonable effort will be made to maintain all safety instrumentation in operation. A startup is not permitted unless the requirements of Table 3.5.1-1, Columns 3 and 4, are met.

Operation at rated power is permitted as long as the systems have at least the redundancy requirements of Column 4 (Table 3.5.1-1). This is in agreement with redundancy and single failure criteria of IEEE 279 as described in FSAR, Section 7.

There are four reactor protection channels. Normal trip logic is two-out-of-four. Required trip logic for the power range instrumentation channels is two-out-of-three. Minimum trip logic on other instrumentation channels is one-out-of-two.

The four reactor protection channels were provided with key operated bypass switches to allow on-line testing or maintenance on only one channel at a time during power operation. Each channel is provided with alarm and lights to indicate when that channel is bypassed. There will be one reactor protection system channel bypass switch key permitted in the control room. Upon the discovery of inoperable functions in any one reactor protection channel, the effect of the failure on the reactor protection syst and other interconnected systems is evaluated. The affected reactor protect channel may be placed in channel bypass, remain in operation in a degraded condition, or placed in the tripped condition as determined by operating conditions and management judgment. This action allows placing the plant in the safest condition possible considering the extent of the failure, plant conditions, and guidance from plant management. Should the failure in the reactor protection channel prohibit the proper operation of another system, the appropriate actions for the affected system are implemented. Administra controls are established to preclude placing a reactor protection channel i channel bypass when any other reactor protection channel contains an inopera function in the untripped state.

Each reactor protection channel key operated shutdown bypass switch is provided with alarm and lights to indicate when the shutdown bypass switch is being used.

R
TRM

The source range and intermediate range nuclear flux instrumentation scales overlap by one decade. This decade overlap will be achieved at 10^{-10} amps o the intermediate range scale.

A2

The ESAS employs three independent and identical analog channels, which supply trip signals to two independent, identical digital subsystems. In order to actuate the safeguards systems, two out of three analog channels must trip. This will cause both digital subsystems to trip. Tripping of either digital subsystem will actuate all safeguards systems associated with that digital subsystem.

Because only one digital subsystem is necessary to actuate the safeguards systems and these systems are capable of tripping even when they are being tested, a single failure in a digital subsystem cannot prevent protective action.

3.3.5
3.3.6
3.3.7

A2

Removal of a module required for protection from a RPS channel will cause that channel to trip, unless that channel has been bypassed, so that only one channel of the other three must trip to cause a reactor trip. Thus, sufficient redundancy has been built into the system to cover this situation.

Removal of a module required for protective action from an analog ESAS channel will cause that channel to trip, so that only one of the other two must trip to actuate the safeguards systems. Removal of a module required for protective action from a digital ESAS subsystem will not cause that subsystem to trip. The fact that a module has been removed will be continuously annunciated to the operator. The redundant digital subsystem is still sufficient to indicate complete ESAS action.

The testing schemes of the RPS, the ESAS, and the EFIC enables complete system testing while the reactor is operating. Each channel is capable of being tested independently so that operation of individual channels may be evaluated.

The EFIC is designed to allow testing during power operation. One channel may be placed in key locked "maintenance bypass" prior to testing. This will bypass only one channel of EFW initiate logic. An interlock feature prevents bypassing more than one channel at a time. In addition, since the EFIC receives signals from the NI/RPS, the maintenance bypass from the NI/RPS is interlocked with the EFIC. If one channel of the NI/RPS is in maintenance bypass, only the corresponding channel of EFIC may be bypassed. Prior to placing a channel of EFIC in maintenance bypass, any NI/RPS channel containing inoperable functions in the untripped state is evaluated for its effect on EFIC. Only the EFIC channel corresponding to the NI/RPS channel containing the inoperable function may be placed in maintenance bypass unles it can be shown that the failure in the NI/RPS channel has no effect on EFIC actuation, actions are taken to ensure EFIC actuation when required, or the appropriate actions of Table 3.5.1-1 are implemented. The EFIC can be teste from its input terminals to the actuated device controllers. A test of the EFIC trip logic will actuate one of two relays in the controllers. Activati of both relays is required in order to actuate the controllers. The two relays are tested individually to prevent automatic actuation of the compone The EFIC trip logic is two (one-out-of-two).

Reactor trips on loss of all main feedwater and on turbine trips will sense the start of a loss of OTSG heat sink and actuate earlier than other trip signals. This early actuation will provide a lower peak RC pressure during the initial over pressurization following a loss of feedwater or turbine trip event. The LOFW trip may be bypassed up to 10% to allow sufficient margin for bringing the MFW pumps into use at approximately 7%. The Turbine Trip may be bypassed up to 45% based on BAW-1893, "Basis for Raising Arming Threshold for Anticipatory Reactor Trip on Turbine Trip," October 1985 and the NRC Safety Evaluation Report for BAW-1893 issued from Mr. D. M. Crutchfield to Mr. J. H. Taylor via letter dated April 25, 1986.

The Automatic Closure and Isolation System (ACI) is designed to close the Decay Heat Removal System (DHRS) return line isolation valves when the Reactor Coolant System (RCS) pressure exceeds a selected fraction of the DHRS design pressure or when core flooding system isolation valves are opened. The ACI is designed to permit manual operation of the DHRS return line isolation valves when permissive conditions exist. In addition, the ACI is designed to disallow manual operation of the valves when permissive conditions do not exist.

Add 3.3.5 ACTIONS NOTE
Add 3.3.6 ACTIONS NOTE
Add 3.3.7 ACTIONS NOTE

A5 LA1 Bases A3 A7

Table 3.5.1-1 (Cont'd)

ENGINEERED SAFEGUARDS ACTUATION SYSTEM

	Functional Unit	1 No. of channels	2 No. of channels for system trip	3 Min. operable channels	4 Min. degree of redundancy	5 Operator action if conditions of column 3 or 4 cannot be met	
3.3.7 LCO	1. Highpressure injection system (Note 8) Actuation Logic channels						A9
3.3.5 LCO Table 3.3.5-1 parameter 1. & LATER (3.3D)	a. Reactor coolant pressure instrument channels	3	2	3 (Note 6)	1	Notes 1, 5	A6 & LATER
Parameter 2.	b. Reactor building 4 psig instrument channels	3	2	3 (Note 6)	1	Notes 1, 5	A6
3.3.6 LCO #a.	c. Manual trip pushbutton	2	1	2	1	Notes 1, 5	A8
3.3.7 LCO	2. Low pressure injection system (Note 8) Actuation Logic Channels						A9
3.3.5 LCO Table 3.3.5-1 Parameter 1. & LATER (3.3D)	a. Reactor coolant pressure instrument channels	3	2	3 (Note 6)	1	Notes 1, 5	A6 & LATER
Parameter 2.	b. Reactor building 4 psig instrument channels	3	2	3 (Note 6)	1	Notes 1, 5	A6
3.3.6 LCO #b.	c. Manual trip pushbutton	2	1	2	1	Notes 1, 5	A8
3.3.7 LCO	3. Reactor building isolation and reactor building cooling system (Note 8) Actuation Logic Channels						A9
3.3.5 LCO Table 3.3.5-1 Parameter 2.	a. Reactor building 4 psig instrument channel	3	2	3 (Note 6)	1	Notes 1, 5	A6
3.3.6 LCO #c.	b. Manual trip pushbutton	2	1	2	1	Notes 1, 5	A8

Add 3.3.5 RA B.2.2 Note
Add 3.3.5 Appl. & Table 3.3.5-1 Applicable MODES or Other Specified Condition
Add 3.3.5 RA B.2.1 with NOTE

L1

3.3.5
3.3.6
3.3.7

Amendment No. 91

45a

Table 3.5.1-1 (Cont'd

LA1 Bases

A3

A7

ENGINEERED SAFEGUARDS ACTUATION SYSTEM
(Cont'd)

	Functional Unit	1 No. of channels	2 No. of channels for system trip	3 Min. operable channels	4 Min. degree of redundancy	5 Operator action if conditions of column 3 or 4 cannot be met	
3.3.7 LCO	4. Reactor building spray pumps (Note 8) Actuation Logic Channels						A9
3.3.5 LCO Table 3.3.5-1 Parameter 3.	a. Reactor building 30 psig instrument channel	3	2	3 (Note 6)	1	Notes 1, 5	A6
3.3.6 LCO #d.	b. Manual trip pushbutton	2	1	2	1	Notes 1, 5	A8
3.3.7 LCO	5. Reactor building spray valves (Note 8) Actuation Logic Channels						A9
3.3.5 LCO Table 3.3.5-1 Parameter 3.	a. Reactor building 30 psig instrument channel	3	2	3 (Note 6)	1	Notes 1, 5	A6
3.3.6 LCO #e.	b. Manual trip pushbutton	2	1	2	1	Notes 1, 5	A8
<LATER> (3.3C)	EMERGENCY FEEDWATER INITIATION AND CONTROL SYSTEM						
	1. EFW Initiation						
	a. Manual	2	1	2	1	Note 1	LATER

<ADD 3.3.6 Appl.>
<ADD 3.3.7 Appl.>
L5

3.3.5
3.3.6
3.3.7

<Add 3.3.6 RA A.1> L4

<Add 3.3.7 RA A.1> L3

A3

TABLE 3.5.1-1 (Cont'd)

Notes:

3.3.5 RA B.1, 3.3.6 RA B.1 & <LATER> (3.3A/C/D & 3.4B) — 1. ~~Initiate a shutdown using normal operating instructions and~~ place the reactor in the hot shutdown condition MODE 3 within ~~12~~ 6 hours if the requirements of Columns 3 and 4 are not met. — M5 & LATER

<LATER> (3.3A) — LATER

2. When 2 of 4 power range instrument channels are greater than 10% rated power, hot shutdown is not required.

3. When 1 of 2 intermediate range instrument channels is greater than 10-10 amps, hot shutdown is not required.

4. For channel testing, calibration, or maintenance, the minimum number of operable channels may be two and a degree of redundancy of one for a maximum of four hours, after which Note 1 applies.

3.3.5 RA B.2.2, 3.3.6 RA B.2 & LATER (3.4B) — 5. If the requirements of Columns 3 or 4 cannot be met ~~within an additional 48 hours,~~ place the reactor in the cold shutdown condition MODE 5 within ~~24~~ 36 hours. — M4 & LATER

3.3.5 RA A.1 & <LATER> (3.3A, 3.3C) — 6. The minimum number of operable channels may be reduced to 2, provided that the system is reduced to 1 out of 2 coincidence by tripping the remaining channel within one hour. Otherwise, the actions required by Column 5 shall apply. — M3 & LATER

<LATER> (3.3A) — 7. These channels initiate control rod withdrawal inhibits not reactor trips at 10% rated power. Above 10% rated power, those inhibits are bypassed. — LATER

3.3.7 RA A.2 — 8. If any one component of a digital subsystem is inoperable, the entire digital subsystem is considered inoperable. ~~Hence~~ Declare the associated safety features ~~are~~ inoperable within 1 hour and Specification 3.3 applies. — L2, M2, A1

<LATER> (3.3D) — LATER

9. The minimum number of operable channels may be reduced to one and the minimum degree of redundancy to zero for a maximum of 24 hours, after which Note 1 applies.

10. With the number of operable channels less than required, either restore the inoperable channel to operable status within 30 days, or be in hot shutdown within 12 hours.

11. With the number of operable channels less than required, isolate the electromatic relief valve within 4 hours, otherwise Note 9 applies.

3.3.5
3.3.6
3.3.7

45e

3.5.3 ~~Safety Features Actuation System Setpoints~~

~~Applicability~~

~~This specification applies to the safety features actuation system actuation setpoints.~~

~~Objective~~

~~To provide for automatic initiation of the safety features actuation system in the event of a breach of reactor coolant system integrity.~~

~~Specification~~

~~The safety features actuation setpoints and permissible bypasses shall be as follows:~~

A1

	Functional Unit	Action	Setpoint (Allowable Values)
Table 3.3.5-1 Parameter 1	~~High~~ Reactor Building Pressure* High High	~~Reactor Building Spray~~	~~≤30 psig~~ (44.7 psia)
Parameter 2	Reactor Building Pressure High	~~High Pressure Injection~~	≤ 4 psig (18.7 psia)
		~~Start of Reactor Building Cooling and Reactor Building Isolation~~	≤ 4 psig (18.7 psia)
		~~Reactor Bldg. Ventilation~~	≤ 4 psig (18.7 psia)
		~~Low Pressure Injection~~	≤ 4 psig (18.7 psia)
		~~Penetration Room Ventilation~~	≤ 4 psig (18.7) psia)
Parameter 3	Low Reactor Coolant System Pressure**	~~High Pressure Injection~~	≥ 1585 psig
		~~Low Pressure Injection~~	≥ 1585 psig
		~~Start of Reactor Building Cooling and Reactor Building Isolation~~	≥ 1585 psig

A1 A1 LA1 BASES

~~*May be bypassed during reactor building leak rate test.~~ A12

**May be bypassed below 1750 psig and is automatically reinstated above 1750 psig. L1

~~With the safety features actuation setpoints less conservative than the above values, declare the channel inoperable and apply the applicable Action requirements of Table 3.5.1-1 until the channel is restored to OPERABLE status with the trip setpoint adjusted consistent with the trip setpoint value.~~ A1

A13

Bases

High Reactor Building Pressure

The basis for the 30 psig and 4 psig setpoints for the high pressure signal is to establish a setting which would be reached in adequate time in the event of a DBA, cover a spectrum of break sizes and yet be far enough above normal operation maximum internal pressure to prevent spurious initiation.

Low Reactor Coolant System Pressure

The basis for the 1585 psig low reactor coolant pressure setpoint for high and low pressure injection initiation is to establish a value which is high enough such that protection is provided for the entire spectrum of break sizes and is far enough below normal operating pressure to prevent spurious initiation. (1)

A2

REFERENCES

(1) FSAR, Section 14.2.2.5

(2) B&W Calculation 32-1158581

LAR

A13

3.3.5
3.3.6
3.3.7

SURVEILLANCE REQUIREMENTS (Continued)

4.0.5 (Continued)

<LATER> (5.0)

b. Surveillance intervals specified in Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda for the inservice inspection and testing activities required by the ASME Boiler and Pressure Vessel Code and applicable Addenda shall be applicable as follows in these Technical Specifications: LATER

ASME Boiler and Pressure Vessel Code and applicable Addenda terminology for inservice inspection and testing activities	Required frequencies for performing inservice inspection and testing activities
Weekly	At least once per 7 days
Monthly	At least once per 31 days
Quarterly or every 3 months	At least once per 92 days
Semiannually or every 6 months	At least once per 184 days
Yearly or annually	At least once per 366 days

c. The provisions of Specification 4.0.2 are applicable to the above required frequencies for performing inservice inspection and test activities.

d. Performance of the above inservice inspection and testing activit[ies] shall be in addition to other specified Surveillance Requirements.

e. Nothing in the ASME Boiler and Pressure Vessel Code shall be construed to supersede the requiremetns of any Technical Specification.

4.1 OPERATIONAL SAFETY ITEMS A1

Applicability

Applies to items directly related to safety limits and limiting conditions fo[r] operation.

Objective

To specify the minimum frequency and type of surveillance to be applied to unit equipment and conditions.

Specification

a. The minimum frequency and type of surveillance required for react[or] protective system and engineered safeguards system instrumentatio[n] when the reactor is critical shall be as stated in Table 4.1-1. A3 R TDM

3.3.5
3.3.6
3.3.7

<LATER> (3.3A,3.3C,3.3D)

OPERATIONAL SAFETY ITEMS (continued)

4.1 (Continued) — A3

b. Equipment and sampling test shall be performed as detailed in Table 4.1-2 and 4.1-3. — R TRM

c. Discrepancies noted during surveillance testing will be corrected and recorded. — A14

<LATER> (3.2)

d. A power distribution map shall be made to verify the expected power distribution at periodic intervals at least every 10 effective full power days using the incore instrumentation detector system. — LATER

BASES — A2

4.0.1 through 4.0.5 Establish the general requirements applicable to Surveillance Requirements. These requirements are based on the Surveillance Requirements stated in the Code of Federal Regulations, 10CFR 50.36(c)(3):

"Surveillance Requirements are requirements relating to test, calibration, or inspection to ensure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions of operation will be met."

4.0.1 Establishes the requirement that surveillances must be performed during the operational modes or other conditions for which the requirements of the Limiting Conditions for Operation apply unless otherwise stated in an individual Surveillance Requirement. The purpose of this specification is to ensure that surveillances are performed to verify the operational status of systems and components and that parameters are within specified limits to ensure safe operation of the facility when the plant is in a mode or other specified condition for which the associated Limiting Conditions for Operation are applicable. Surveillance Requirements do not have to be performed when the facility is in an operational mode for which the requirements of the associated Limiting Condition for Operation do not apply unless otherwise specified.

3.3.5
3.3.6
3.3.7

BASES (continued)

Under the terms of this specification, the more restrictive requirements of the Technical Specifications take precedence over the ASME Boiler and Pressure Vessel Code and applicable Addenda. The requirements of Specification 4.0.4 to perform surveillance activities before entry into an operational mode or other specified condition takes precedence over the ASME Boiler and Pressure Vessel Code provision which allows pumps and valves to be tested up to one week after return to normal operation. The Technical Specification definition of OPERABLE does not allow a grace period before a component, that is not capable of performing its specified function, is declared inoperable and takes precedence over the ASME Boiler and Pressure Vessel Code provision which allows a valve to be incapable of performing its specified function for up to 24 hours before being declared inoperable. A2

4.1 Bases

Check

Failures such as blown instrument fuses, defective indicators, faulted amplifiers which result in "upscale" or "downscale" indication can be easily recognized by simple observation of the functioning of an instrument or system. Furthermore, such failures are, in many cases, revealed by alarm or annunciator Action. Comparison of output and/or state of independent channels measuring the same variable supplements this type of built-in surveillance. Based on experience in operation of both conventional and nuclear plant systems, when the plant is in operation, the minimum checking frequency stated is deemed adequate for reactor system instrumentation. A2 & R TRM

Calibration

Calibration shall be performed to assure the presentation and acquisition of accurate information. The nuclear flux (power range) channels shall be calibrated at least twice weekly (during steady state operating conditions) against a heat balance standard to compensate for instrumentation drift. During nonsteady state operation, the nuclear flux channels shall be calibrated daily to compensate for instrumentation drift and changing rod patterns and core physics parameters. A2

3.3.5
3.3.6
3.3.7

Other channels are subject only to "drift" errors induced within the instrumentation itself and, consequently, can tolerate longer intervals between calibrations. Process system instrumentation errors induced by drift can be expected to remain within acceptable tolerances if recalibration is performed once every 18 months.

Substantial calibration shifts within a channel (essentially a channel failure) will be revealed during routine checking and testing procedures.

Thus, minimum calibration frequencies for the nuclear flux (power range) channels, and once every 18 months for the process system channels is considered acceptable.

Testing

On-line testing of reactor protective channel and EFIC channels is required once every 4 weeks on a rotational or staggered basis. The rotation scheme is designed to reduce the probability of an undetected failure existing within the system and to minimize the likelihood of the same systematic test errors being introduced into each redundant channel. A2

All reactor protective channels will be tested before startup if the individual channel rotational frequency has been discontinued or if outage activities could potentially have affected the operability of one or more channels. A rotation will then be established to test the first Channel one week after startup, the second Channel two weeks after startup, the third Channel three weeks after startup, and the fourth Channel four weeks after startup.

The established reactor protective system instrumentation and EFIC test cycle is continued with one channel's instrumentation tested each week. Upon detection of a failure that prevents trip action, all instrumentation associated with the protective channels will be tested after which the rotational test cycle is started again. If actuation of a safety channel occurs, assurance will be required that actuation was within the limiting safety system setting.

The protective channels coincidence logic and control rod drive trip breakers are trip tested every quarter. The trip test checks all logic combinations and is to be performed on a rotational basis. The logic and breakers of the four protective channels shall be trip tested prior to startup and their individual channels trip tested on a cyclic basis. Discovery of a failure requires the testing of all channel logic and breakers, after which the trip test cycle is started again.

3.3.5
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3.3.7

A2

& R
TRM

~~The equipment testing and system sampling frequencies specified in Table 4.1-2 and Table 4.1-3 are considered adequate to maintain the status of the equipment and systems to assure safe operation.~~

~~REFERENCE~~

~~FSAR Section 7.1.2.3.4~~

A3

Table 4.1-1 (cont.)

	Channel Description	Check	Test	Calibrate	Remarks
<LATER> (3.3A)	~~13. High Reactor Building Pressure Channel~~	~~S~~	~~M~~	~~R~~	LATER
3.3.7	14. High Pressure Injection Logic Channel	NA	M SR 3.3.7.1	NA	
3.3.5	15. High Pressure Injection Analog Channels				
& <LATER> (3.3D)	a. Reactor Coolant Pressure Channel	S SR 3.3.5.1	M(1) SR 3.3.5.2	R SR 3.3.5.3	~~(1) Including test of shutdown bypass function (ECCS bypass function).~~ L7
	b. Reactor Building 4 psig Channel	S SR 3.3.5.1	M SR 3.3.5.2	R SR 3.3.5.3	
3.3.7	16. Low Pressure Injection Logic Channel	NA	M SR 3.3.7.1	NA	
3.3.5	17. Low Pressure Injection Analog Channels				
& <LATER> (3.3D)	a. Reactor Coolant Pressure Channel	S SR 3.3.5.1	M(1) SR 3.3.5.2	R SR 3.3.5.3	~~(1) Including test of shutdown bypass function (ECCS bypass function).~~ L7
	b. Reactor Building 4 psig Channel	S SR 3.3.5.1	M SR 3.3.5.2	R SR 3.3.5.3	
3.3.7	18. Reactor Building Emergency Cooling and Isolation System Logic Channel	NA	M SR 3.3.7.1	NA	
3.3.5	19. Reactor Building Emergency Cooling and Isolation System Analog Channels				
	a. Reactor Building 4 psig Channels	S SR 3.3.5.1	M SR 3.3.5.2	R SR 3.3.5.3	

3.3.5
3.3.7

(A3)

Table 4.1-1 (Cont'd)

	Channel Description	Check	Test	Calibrate	Remarks
3.3.7	20. Reactor Building Spray System System Logic Channels	NA	M(1) SR 3.3.7.1	NA	(1) Including RB spray pump, spray valves, and chem. add. valve logic channels. (LA2) Bases
3.3.5	21. Reactor Building Spray System Analog Channels	<Add SR 3.3.5.1>			(A11)
	a. Reactor Building Pressure Channels	NA	SR 3.3.5.2 M	SR 3.3.5.3 R	LATER
<LATER> (3.3D)	22. Pressurizer Temperature Channels	S	NA	R	
<LATER> (3.1)	23. Control Rod Absolute Position	S(1)	NA	R	(1) Compare with Relative Position Indicator. LATER
	24. Control Rod Relative Position	S(1)	NA	R	(1) Check with Absolute Position Indicator
<LATER> (3.5)	25. Core Flooding Tanks				LATER
	a. Pressure Channels	S	NA	R	
	b. Level Channels	S	NA	R	LATER
<LATER> (3.3D)	26. Pressurizer Level Channels	S	NA	R	
	27. Makeup Tank Level Channels	D	NA	R	
<LATER> (3.4B) (3.3D)	28. Radiation Monitoring Systems other than containment high range monitors (item 57)				(1) Check functioning of self-checking feature on each detector. LATER
	a. Process Monitoring System	S	Q	R	
	b. Area Monitoring System	S	M(1)	R	
<LATER> (3.3D)	c. Main Steam Line Radiation Monitors	S	M	R	LATER

A 3

Table 4.1-1 (Cont.)

Channel Description	Check	Test	Calibrate	Remarks
43. ESAS Manual Trip Functions				A1
3.3.6 a. Switches & Logic	NA	~~R~~ SR 3.3.6.1	NA	A10
3.3.7 b. Logic	NA	~~M~~ SR 3.3.7.1	NA	
<LATER> (3.3.A) ~~44. Reactor Manual Trip~~	~~NA~~	~~P~~	~~NA~~	LATER
<LATER> (3.4.B) ~~45. Reactor Building Sump Level~~	~~NA~~	~~NA~~	~~R~~	LATER
<LATER> (3.3.D) ~~46. EFW Flow Indication~~	~~M~~	~~NA~~	~~R~~	LATER

3.3.6
3.3.7

Amendment No. ~~25~~, ~~39~~, ~~60~~, ~~61~~, ~~91~~, ~~110~~, ~~135~~, ~~160~~, 192

(A3)

Table 4.1-1 (Cont.)

	Channel Description	Check	Test	Calibrate	Remarks
<LATER> (3.3C)	d. SG A High Range Level High-high	S	M	R	LATER
	e. SG B High Range Level High-high	S	M	R	
<LATER> (3.3D)	57. Containment High Range Radiation Monitors	D	M	R	LATER
	58. Containment Pressure-High	M	NA	R	
	59. Containment Water Level-Wide Range	M	NA	R	
<LATER> (3.4B)	60. Low Temperature Overpressure Protection Alarm Logic	NA	R	R	
<LATER> (3.3D)	61. Core-exit Thermocouples	M	NA	R	
<LATER> (3.3A)	62 Electronic (SCR) Trip Relays	NA	Q	NA	
<LATER> (3.3D)	63 RVLMS	M	NA	R	
	64 HLLMS	M	NA	R	

+ <LATER> (3.3A, 3.3C, 3.3D, 3.4B)

NOTE:

S - Each Shift
W - Weekly
M - Monthly
D - Daily
T/W - Twice per Week
Q - Quarterly
P - Prior to each startup if not done previous week
B/M - Every 2 months
R - Once every 18 months
PC - Prior to going Critical if not done within previous 31 days
NA - Not Applicable
SA - SA Twice per Year

(A4) + LATER + (R) TRM

3.3.5
3.3.6
3.3.7

NO SIGNIFICANT HAZARDS CONSIDERATIONS
GENERIC EVALUATIONS

<u>"R" - Relocation of requirements:</u>

Relocating requirements which do not meet the Technical Specification selection criteria to documents with an established control program allows the Technical Specifications to be reserved only for those conditions or limitations upon reactor operation which are necessary to adequately limit the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety, thereby focusing the scope of Technical Specifications.

Therefore, requirements which do not meet the Technical Specification selection criteria in 10 CFR 50.36 have been relocated to other controlled license basis documents. This regulation addresses the scope and purpose of Technical Specifications. In doing so, it establishes a specific set of objective criteria for determining which regulatory requirements and operating restrictions should be included in Technical Specifications. These criteria are as follows:

Criterion 1: Installed instrumentation that is used to detect and indicate in the control room a significant abnormal degradation of the reactor coolant pressure boundary.

Criterion 2: A process variable that is an initial condition of a design basis accident (DBA) or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Criterion 3: A structure, system or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission barrier.

Criterion 4: A structure, system or component which operating experience or probabilistic safety assessment has shown to be significant to public health and safety.

The application of these criteria is provided in the "Application of Selection Criteria to the ANO-1 Technical Specifications." Requirements which met the criteria have been included in the proposed improved Technical Specifications. Entergy Operations proposes to remove the requirements which do not meet the criteria from the Technical Specifications and relocate the requirements to a suitable owner controlled document. The requirements in the relocated Specifications will not be affected by this Technical Specification change. Entergy Operations will initially continue to perform the required operation and maintenance to assure that the requirements are satisfied. Relocating specific requirements for systems or variables will have no impact on the system's operability or the variable's maintenance, as applicable.

License basis document control mechanisms, such as 10 CFR 50.59, 10 CFR 50.54(a)(3), and ITS Section 5, "Administrative Controls," will be utilized for the relocated Specifications as they will be placed in other controlled license basis documents. This would allow Entergy Operations to make changes to these requirements, without NRC approval, as allowed by the applicable regulatory requirements. These controls are considered adequate for assuring structures, systems and components in the relocated Specifications are maintained operable and variables in the relocated Specifications are maintained within limits.

Entergy Operations has evaluated this proposed Technical Specification change and has determined that it involves no significant hazards consideration. This determination has been performed in accordance with the criteria set forth in 10 CFR 50.92(c) as indicated below:

1. **Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   The proposed change relocates requirements and surveillances for structures, systems, components or variables which did not meet the criteria for inclusion in Technical Specifications as identified in the Application of Selection Criteria to the ANO-1 Technical Specifications. The affected structures, systems, components or variables are not assumed to be initiators of analyzed events and are not assumed to mitigate accident or transient events. The requirements and surveillances for these affected structures, systems, components or variables will be relocated from the Technical Specifications to an appropriate administratively controlled license basis document and maintained pursuant to the applicable regulatory requirements. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or change in parameters governing normal plant operation. The proposed change will not impose any different requirements and adequate control of information will be maintained. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. **Does this change involve a significant reduction in a margin of safety?**

   The proposed change will not reduce a margin of safety because it has no impact on any safety analysis assumptions. In addition, the affected requirement will be relocated to an owner controlled license basis document for which future changes will be evaluated pursuant to the requirements of the applicable regulatory requirements. Therefore, this change does not involve a significant reduction in a margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS
GENERIC EVALUATIONS

"A" - Administrative changes to requirements:

Reformatting and rewording the remaining requirements in accordance with the style of the improved Babcock & Wilcox Standard Technical Specifications in NUREG-1430 will make the Technical Specifications more readily understandable to plant operators and other users. Application of the format and style will also assure consistency is achieved between specifications. As a result, the reformatting and rewording of the Technical Specifications has been performed to make them more readily understandable by plant operators and other users. During this reformatting and rewording process, no technical changes (either actual or interpretational) to the Technical Specifications were made unless they were identified and justified.

Entergy Operations has evaluated this proposed Technical Specification change and has determined that it involves no significant hazards consideration. This determination has been performed in accordance with the criteria set forth in 10 CFR 50.92(c) as indicated below:

1. **Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   The proposed change involves reformatting and rewording of the existing Technical Specifications. The reformatting and rewording process involves no technical changes to existing requirements. As such, this change is administrative in nature and does not impact initiators of analyzed events or assumed mitigation of accident or transient events. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will not impose any different requirements. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. **Does this change involve a significant reduction in a margin of safety?**

   The proposed change will not significantly reduce the margin of safety because it has no impact on any safety analysis assumptions. This change is administrative in nature. As such, there is no technical change to the requirements and therefore, there is no significant reduction in the margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS
GENERIC EVALUATIONS

"LA" - Less restrictive, Administrative deletion of requirements:

Portions of some Specifications provide information that is descriptive in nature regarding the equipment, system(s), actions or surveillances. This information is proposed to be deleted from the specification and relocated to other license basis documents which are under licensee control. These documents include the TS Bases, Safety Analysis Report (SAR), Technical Requirements Manual, and Programs and Manuals identified in ITS Section 5, "Administrative Controls." The removal of descriptive information is permissible, because the documents containing the relocated information will be controlled through the applicable process provided by the regulatory requirements, e.g., 10 CFR 50.59, 10 CFR 50.54(a)(3), and ITS Section 5, "Administrative Controls." This will not impact the actual requirements but may provide some flexibility in how the requirement is conducted. Therefore, the descriptive information that has been moved continues to be maintained in an appropriately controlled manner.

Entergy Operations has evaluated this proposed Technical Specification change and has determined that it involves no significant hazards consideration. This determination has been performed in accordance with the criteria set forth in 10 CFR 50.92(c) as indicated below:

1. **Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   The proposed change relocates requirements from the Technical Specifications to other license basis documents which are under licensee control. The documents containing the relocated requirements will be maintained using the provisions of applicable regulatory requirements. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will not impose any different requirements and adequate control of the information will be maintained. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does this change involve a significant reduction in a margin of safety?

The proposed change will not reduce a margin of safety because it has no impact on any safety analysis assumptions. In addition, the requirements to be transposed from the Technical Specifications to other license basis documents, which are under licensee control, are the same as the existing Technical Specifications. The documents containing the relocated requirements will be maintained using the provisions of applicable regulatory requirements. Therefore, this change does not involve a significant reduction in a margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS
GENERIC EVALUATIONS

"M" - More restrictive changes to requirements:

The ANO-1 Technical Specifications are proposed to be modified in some areas to impose more stringent requirements than previously identified. These more restrictive modifications are being imposed to be consistent with the improved Babcock & Wilcox Standard Technical Specifications. Such changes have been made after ensuring the previously evaluated safety analysis was not affected. Also, other more restrictive technical changes have been made to achieve consistency, correct discrepancies, and remove ambiguities from the specification.

The modification of the ANO-1 Technical Specifications and the changes made to achieve consistency within the specifications have been performed in a manner such that the most stringent requirements are imposed, except in cases which are individually evaluated.

Entergy Operations has evaluated this proposed Technical Specification change and has determined that it involves no significant hazards consideration. This determination has been performed in accordance with the criteria set forth in 10 CFR 50.92(c) as quoted below:

1. **Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   The proposed change provides more stringent requirements for the ANO-1 Technical Specifications. These more stringent requirements are not assumed to be initiators of analyzed events and will not alter assumptions relative to mitigation of accident or transient events. The change has been confirmed to ensure no previously evaluated accident has been adversely affected. The more stringent requirements are imposed to ensure process variables, structures, systems and components are maintained consistent with the safety analyses and licensing basis. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change does impose different requirements. However, these changes do not impact the safety analysis and licensing basis. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated for ANO-1.

3. Does this change involve a significant reduction in a margin of safety?

The imposition of more stringent requirements prevents a reduction in the margin of plant safety by:

a) Increasing the analytical or safety limit,
b) Increasing the scope of the specification to include additional plant equipment,
c) Increasing the applicability of the specification,
d) Providing additional actions,
e) Decreasing restoration times,
f) Imposing new surveillances, or
g) Decreasing surveillance intervals.

The change is consistent with the safety analysis and licensing basis. Therefore, this change does not involve a reduction in a margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS STATEMENTS

ITS Section 3.3B: Instrumentation - ESAS

Entergy Operations has evaluated these proposed Technical Specification changes and has determined that they involve no significant hazards consideration. This determination has been performed in accordance with the criteria set forth in 10CFR 50.92(c) as indicated below:

3.3B L1

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

The Applicability for the ESAS Reactor Coolant System Pressure-Low Setpoint Parameter has been changed from an implied above MODE 5 to a specified ≥ 1750 psig Reactor Coolant System (RCS) pressure. Similarly, the Required Actions have been revised to require only that the MODE of Applicability be exited. This change in Applicability and Required Actions for this instrumentation parameter does not result in any hardware changes. This change also does not significantly increase the probability of occurrence of any analyzed event since the function of the equipment does not change (and therefore any initiation scenarios are not changed). Also, the changes do not change the assumed response of the equipment in performing its specified mitigation functions from that considered during the original Applicability since the trip functions associated with this parameter were allowed by CTS to be bypassed during the Conditions which will be omitted from the revised Applicability. Therefore, the changes do not significantly increase the consequences of an accident.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will still ensure proper availability for the required instrumentation. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does this change involve a significant reduction in a margin of safety?

The ESAS Reactor Coolant System Pressure-Low Setpoint Parameter instrumentation provides ESAS actuation functions under certain operating conditions. In the conditions to be excluded from the Applicability, the actuation functions are bypassed and provide no input to the safety analysis. Therefore, the changes do not involve a significant reduction in the margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS STATEMENTS

3.3B L2

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

The requirement to declare an entire ESAS digital subsystem inoperable in the event any portion of that subsystem is inoperable has been replaced with a requirement to declare only the affected portions inoperable. This change in ACTION requirements for this instrumentation parameter does not result in any hardware changes, neither does it result in any change in the function of the equipment. Therefore, this change does not significantly increase the probability of occurrence of any analyzed event. Also, the changes do not change the assumed response of the equipment in performing its specified mitigation functions. Therefore, the changes do not significantly increase the consequences of an accident.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will still ensure proper availability for the required instrumentation. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does this change involve a significant reduction in a margin of safety?

The ESAS actuation instrumentation provides initiation of ESAS functions under certain operating conditions. This change does not affect any operational or safety parameters, but rather provides for maintaining the operability of equipment which is capable of performing its safety function (and which would be declared inoperable under CTS). Therefore, the changes do not involve a significant reduction in the margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS STATEMENTS

3.3B L3

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

This change provides the addition of an allowance to place equipment affected by an inoperable ESAS Actuation Logic Channel in the actuated position rather than declaring the affected equipment inoperable. This change in ACTION requirements for this instrumentation parameter does not result in any hardware changes. This change also does not significantly increase the probability of occurrence for initiation of any analyzed event since the function of the equipment does not change (and therefore any initiation scenarios are not changed). Also, the changes do not change the assumed response of the equipment in performing its specified mitigation functions. Therefore, the changes do not significantly increase the consequences of an accident.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will still ensure proper availability for the required equipment. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does this change involve a significant reduction in a margin of safety?

The margin of safety for an ESAS digital subsystem is based on availability and capability of the actuated equipment to perform its safety function. This change maintains the capability of the required equipment to perform its safety function even in the absence of its actuating instrumentation. Therefore, this change does not represent a significant reduction in the margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS STATEMENTS

3.3B L4

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

An extension of the Completion Time for a Required Action does not result in any hardware changes. The Completion Time for performance of Required Actions does not significantly increase the probability of occurrence for initiation of any analyzed event since the function of the equipment, or limit for the parameter, does not change (and therefore any initiation scenarios are not changed) and the proposed Completion Time extension is short (and therefore limits the impact on probability). Also, an extension of the Completion Time provides additional opportunity to restore compliance with the requirements and avoid the increased potential for a transient during the shutdown process. Further, the Completion Time for performance of Required Actions does not significantly increase the consequences of an accident because the change does not change the assumed response of the equipment in performing its specified mitigation functions from that considered during the previous evaluation of accidents.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will still ensure prompt restoration of compliance with the limiting condition for operation, or prompt and appropriate compensatory actions are taken. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does this change involve a significant reduction in a margin of safety?

Prompt and appropriate Required Actions have been determined based on the safety analysis functions to be maintained. The proposed Completion Time has been determined appropriate based on a combination of the time required to perform the action, the relative importance of the function or parameter to be restored, and engineering judgment. Therefore, the short extension of the Completion Time interval involves no significant reduction in the margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS STATEMENTS

3.3B L5

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

The Applicability for the ESAS Manual Initiation and ESAS Actuation Logic have been changed from an implied "above MODE 5" to a specified "MODES 1 and 2" and "MODES 3 and 4 when associated engineered safeguard equipment is required to be OPERABLE." This change in Applicability for this instrumentation parameter does not result in any hardware changes. This change also does not significantly increase the probability of occurrence for initiation of any analyzed event since the function of the equipment does not change (and therefore any initiation scenarios are not changed). Also, the changes do not change the assumed response of the equipment in performing its specified mitigation functions from that considered during the original Applicability since the trip functions associated with this parameter continue to be required when the associated equipment is required. Therefore, the changes do not significantly increase the consequences of an accident.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will still ensure proper availability for the required instrumentation whenever the actuated equipment is required. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does this change involve a significant reduction in a margin of safety?

The ESAS Manual Initiation and ESAS Actuation Logic instrumentation provides ESAS actuation functions under certain operating conditions. In the conditions to be excluded from the Applicability, the actuation functions are not required since the associated equipment is not required and provides no input to the safety analysis. Therefore, the changes do not involve a significant reduction in the margin of safety.

3.3B L6 Not Used

NO SIGNIFICANT HAZARDS CONSIDERATIONS STATEMENTS

3.3B L7

1. **Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?**

The Applicability for the ESAS Reactor Coolant System (RCS) Pressure-Low Setpoint Parameter is specified as ≥ 1750 psig RCS pressure. As such, the operational bypass that prevents ECCS actuation during a shutdown when the RCS pressure drops below this value does not function during the conditions for which the ESAS RCS Pressure-Low Setpoint Parameter is required to be OPERABLE. Therefore, this bypass is removed from the CTS as a required function. This change does not result in any hardware changes, and does not significantly increase the probability of occurrence of any analyzed event since the function of the equipment does not change (and therefore any initiation scenarios are not changed). Also, the revision does not change the assumed response of the equipment in performing its specified mitigation functions since the actuation function associated with this parameter will continue to be available and OPERABLE. Therefore, the changes do not significantly increase the consequences of an accident.

2. **Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?**

The proposed change does not necessitate a physical alteration of the plant (no new or different type of equipment will be installed) or changes in parameters governing normal plant operation. The proposed change will continue to ensure proper availability for the required instrumentation. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. **Does this change involve a significant reduction in a margin of safety?**

The ESAS RCS Pressure-Low Setpoint Parameter instrumentation is assumed to provide ESAS actuation functions with the RCS pressure at ≥ 1750 psig. Below these conditions, the instrumentation is allowed to be bypassed for operational considerations; however, the bypass performs no safety function. Therefore, the margin of safety is not dependent on the bypass and the change does not involve a significant reduction in the margin of safety.