4.4 INSTRUMENTATION AND CONTROL SYSTEMS - LIMITING CONDITIONS FOR OPERATION

Applicability

Applies to the plant protective system and other critical instrumentation and controls.

Objective

To assure the operability of the plant protective system and other critical instrumentation by defining the minimum operable instrument channels and trip settings.

Specification LCO 4.4.1 - Plant Protective System and Other Critical Instrumentation and Controls, Limiting Conditions for Operation

The limiting conditions for the plant protective system and other critical instrumentation and controls are shown on Tables 4.4-1 through 4.4-5. These tables utilize the following definitions:

Degree of Redundancy - Difference between the number of operable channels and the minimum number of operable channels which when tripped will cause an automatic system trip.

Operable Channel - A channel is operable if it is capable of fulfilling its design functions.

Inoperable Channel - Opposite of operable channel.

Tables 4.4-1 through 4.4-5 are to be read in the following manner: If the minimum operable channels or the minimum degree of redundancy for each functional unit of a table cannot be met or cannot be bypassed under the stated permissible bypass conditions, the following action shall be taken:

For Table 4.4-1, the reactor shall be shut down within 12 hours, except that to facilitate maintenance on the Plant Protective System (PPS) moisture monitors, the moisture monitor input trip functions to the Plant Protective System which cause scram, loop shutdown, circulator trip, and steam water dump may be disabled for up to 72 hours. During the time that the Plant Protective System moisture monitor trips are disabled, an observer in direct communication with the reactor operator shall be positioned in the control room in the location of pertinent instrumentation. The observer shall continuously monitor the primary coolant moisture levels indicated by at least two moisture monitors and the primary coolant pressure indications, and shall alert the reactor operator to any indicated moisture or pressure change.

For Table 4.4-2, the affected loop shall be shut down within 12 hours.

For Table 4.4-3, the affected helium circulator shall be shut down within 12 hours.

For Table 4.4-4, the reactor shall be shut down within 24 hours.

For Table 4.4-5, the affected 480V AC essential bus shall be declared inoperable, and the appropriate action for that system shall be followed.

If, within the indicated time limit, the minimum number of operable channels and the minimum degree of redundancy can be reestablished, the system is considered normal and no further action needs to be taken.

Specification LCO 4.4-1

TABLE 4.4-4

INSTRUMENT OPERATING REQUIREMENTS
FOR REACTOR PROTECTIVE SYSTEM, ROD WITHDRAWAL PROHIBIT (RWP)

NO.	FUNCTIONAL UNIT	TRIP SETTING	MINIMUM OPERABLE CHANNELS	MINIMUM DEGREE OF REDUNDANCY	PERMISSIBLE BYPASS CONDITIONS
1.	Startup Channel-Low count rate	$\geq$ 2.5 cps	2	1	Above 10^{-3}% Rated Power
2a.	Linear Channel-Low power RWP (Channels 3, 4 and 5)	$\geq$ 5% (m)	2	1	(g)
2b.	Linear Channel-Low power RWP (Channels 6, 7 and 8)	$\geq$ 5% (m)	2	1	(g)
3a.	Linear Channel-High power RWP (Channels 3, 4 and 5)	$\leq$ 30% (n)	2 (f)	1	None
3b.	Linear Channel-High power RWP (Channels 6, 7 and 8)	$\leq$ 30% (n)	2 (f)	1	None

TABLE 4.4-5

INSTRUMENT OPERATING REQUIREMENTS FOR
480V A.C. ESSENTIAL BUS UNDERVOLTAGE PROTECTION

NO.	FUNCTIONAL UNIT	TRIP SETTING	MINIMUM OPERABLE CHANNELS	MINIMUM DEGREE OF REDUNDANCY	PERMISSIBLE BYPASS CONDITIONS
1.	Degraded Voltage (D.G. Start, Load Shed and Sequence)	396V-436V with a time delay of 114 sec.-126 sec.	2(e)(f)	1	None
2.	Loss of Voltage (D.G. Start, Load Shed and Sequence)	318V-338V with CV-2 Relay Setting of Time Dial 6	2(e)(f)	1	None
3.	Loss of Voltage (Automatic Throw Over - ATO)	361V-383V with CV-2 Relay Setting of Time Dial 6	2(u)(f)	1	None

Specification LCO 4.4.1

NOTES FOR TABLES 4.4-1 THROUGH 4.4-5

(a) See Specification LSSS3.3 for trip setting.

(b) Two thermocouples from each loop, total of four, constitute one channel. For each channel, two thermocouples must be operable in at least one operating loop for that channel to be considered operable.

(c) With one primary coolant high level moisture monitor tripped, trips of either loop primary coolant moisture monitors will cause full scram. Hence, number of operable channels (1) minus minimum number required to cause scram (0) equals one, the minimum degree of redundancy.

(d) Loss of voltage on 2 of 3 480V A.C. essential busses for no longer than 35 seconds.

(e) One channel monitors each of the three 480V A.C. essential busses. A channel trip will occur when two of the three bus undervoltage relays comprising that channel operate.

(f) The inoperable channel must be in the tripped condition, unless the trip of the channel will cause the protective action to occur.

(g) RWP bypass permitted if the bypass also causes associated single channel scram.

(h) Permissible Bypass Conditions:

I. Any circulator buffer seal malfunction.
II. Loop hot reheat header high activity.
III. As stated in LCO 4.9.2

(j) Items 1a. or 1c. or 1d. accompanied by 2a., 2b., 2c., or 2d. on Table 4.4-2 are required for loop 1 shutdown. Items 1b. or 1c. or 1f., accompanied by 2a., 2b., 2c., or 2d. on Table 4.4-2 are required for loop 2 shutdown.

(k) One operable helium circulator inlet thermocouple in an operable loop is required for the channel to be considered operable.

(m) Low Power RWP bistable resets at 4% after reactor power initially exceeds 5%.

(n) Power range RWP bistables automatically reset at 10% after reactor power is decreased from greater than 30%. The RWP may be manually reset between 10% and 30%.

(p) Item 7a. must be accompanied by item 7c. for Loop 1 shutdown.
Item 7b. must be accompanied by item 7c. for Loop 2 shutdown.

Notes for Tables 4.4-1 through 4.4-5 (continued)

(r) Separate instrumentation is provided on each circulator for this functional unit. Only the affected helium circulator shall be shut down within 12 hours if the indicated requirements are not met.

(s) Each channel has 2 microphones running in parallel with one ultrasonic amplifier. For the channel to be considered operable, both microphones and the amplifier must be operable.

(t) A primary coolant dew point moisture monitor shall not be considered operable unless the following conditions are met:

1)

Reactor Power Range	Minimum Sample Flow
Startup to 2%	1 scc/sec.
Greater than 2% - 5%	5 scc/sec.
Greater than 5% - 20%	15 scc/sec.
Greater than 20% - 35%	30 scc/sec.
Greater than 35% - 100%	50 scc/sec.

2) Minimum flow of item 1) is alarmed in the control room and the alarm is set in accordance with the power ranges specified.

3) The ambient temperatures indicated by both temporary thermocouples mounted on the flow sensors in penetrations B1 and B3 are less than 185°F.

4) Fixed alarms of 1 scc/sec and 75 scc/sec are operable.

(u) One channel consists of three undervoltage relays each monitoring a single phase of a 480V A.C. essential bus. A channel trip will occur when two of the three bus undervoltage relays comprising that channel operate.

Basis for Specification LCO 4.4.1

The plant protection system automatically initiates protective functions to prevent established limits from being exceeded. In addition, other protective instrumentation is provided to initiate action which mitigates the consequences of accidents. This specification provides the limiting conditions for operation necessary to preserve the effectiveness of these instrument systems.

If the minimum operable channels or the minimum degrees of redundancy for each functional unit of a table cannot be met or cannot be bypassed under the stated permissible bypass conditions, the following actions shall be taken:

For Table 4.4-1, the reactor shall be shut down within 12 hours.

For Table 4.4-2, the affected loop shall be shut down within 12 hours.

For Table 4.4-3, the affected helium circulator shall be shut down within 12 hours.

For Table 4.4-4, the reactor shall be shut down within 24 hours.

For Table 4.4-5, the affected 480V A.C. essential bus shall be declared inoperable, and the appropriate action for that system shall be followed.

If, within the indicated time limit, the minimum number of operable channels and the minimum degree of redundancy can be reestablished, the system is considered normal and no further action needs to be take.

The trip level settings are included in this section of the specification. The bases for these settings are briefly discussed below. Additional discussions pertaining to the scram, loop shutdown and circulator trip inputs may be found in Section 7.1 of the FSAR. High moisture instrumentation is discussed in Section 7.3 of the FSAR.

5.4 INSTRUMENTATION AND CONTROL SYSTEMS - SURVEILLANCE AND CALIBRATION REQUIREMENTS

Applicability

Applies to the surveillance and calibration of the reactor protective system and other critical instrumentation and controls.

Objective

To assure the operability of the reactor protection system and other critical instrumentation and controls by specifying their surveillance and calibration frequencies.

Specification SR 5.4.1 - Reactor Protective System and Other Critical Instrumentation and Control Checks, Calibrations, and Tests

The surveillance and calibration tests of the protective instrumentation shall be as given in Tables 5.4-1 through 5.4-5:

a) Table 5.4-1 - Minimum Frequencies for checks, calibrations, and testing of Scram System.

b) Table 5.4-2 - Minimum Frequencies for checks, calibrations, and testing of Loop Shutdown System.

c) Table 5.4-3 - Minimum Frequencies for checks, calibrations, and testing of Circulator Trip System.

d) Table 5.4-4 - Minimum Frequencies for checks, calibrations, and testing of Rod Withdrawal Prohibit System.

e) Table 5.4-5 - Minimum Frequencies for checks, calibrations, and testing of 480V A.C. Essential Bus Undervoltage Protection.

Basis for Specification SR 5.4.1

The specified surveillance check and test minimum frequencies are based on established industry practice and operating experience at conventional and nuclear power plants. The testing is in accordance with the IEEE Criteria for Nuclear Power Plant Protection Systems, and in accordance with accepted industry standards.

Calibration frequency of the instrument channels listed in Tables 5.4-1, 5.4-2, 5.4-3, 5.4-4, and 5.4-5 are divided into three categories: passive type indicating devices that can be compared with like units on a continuous basis; semiconductor devices and detectors that may drift or lose sensitivity; and on-off sensors which must be tripped by an external source to determine their setpoint. Drift tests by GGA on transducers similar to the reactor pressure transducers (FSAR Section 7.3.3.2) indicate insignificant long term drift. Therefore a once per refueling cycle calibration was selected for passive devices (thermo-couples, pressure transducers, etc.). Devices incorporating semiconductors, particularly amplifiers, will be also calibrated on a once per refueling cycle basis, and any drift in response or bistable setpoint will be discovered from the test program. Drift of electronic apparatus is not the only consideration in determining a calibration frequency; for example, the change in power distribution and loss of detector chamber sensitivity require that the nuclear power range system be calibrated every month. On-off sensors are calibrated and tested on a once per refueling cycle basis.

Table 5.4-3

MINIMUM FREQUENCIES FOR CHECKS, CALIBRATIONS, AND TESTING OF CIRCULATOR TRIP SYSTEM

4.	Circulator Penetration Pressure	a.	Test	M	a. Pressure switches actuated by pressure applied.
		b.	Test	M	b. Pulse test one channel with another channel tripped, and verify proper indications.
		c.	Calibrate	R	b. Known pressure applied at sensor to adjust trip setting.
5.	Circulator Drain Pressure	a.	Check	D	a. Comparison of three separate indicators/circulator.
		b.	Test	M	b. Pulse test one channel with another channel tripped and verify proper indications.
		c.	Calibrate	R	c. Known pressure applied at sensor to adjust trip setting.
6.	Circulator Seal Malfunction	a.	Check	D	a. Comparison of 3 separate indicators/circulator.
		b.	Test	M	b. Pulse test one channel with another channel tripped and verify proper indications.
		c.	Calibrate	R	c. Known pressure applied at sensor to adjust trip setting.
7.	Circulator Trip	a.	Test	R	a. Trip steam turbine drives. Verify water turbine automatic start.

NOTE 1: D - Daily when in use
M - Monthly
R - Once per refueling cycle
P - Prior to each start-up if not done previous week

Table 5.4-5

MINIMUM FREQUENCIES FOR CHECKS, CALIBRATIONS, AND TESTING OF 480V A.C. ESSENTIAL BUS UNDERVOLTAGE PROTECTION

	Channel Description	Function	Frequency (1)	Method
1.	Degraded Voltage (D.G. Start, Load Shed and Sequence)	a. Test	M	a. Functionally test each undervoltage relay and channel by applying simulated loss of voltage signal(s); verify alarms and indications.
		b. Calibrate	R	b. Known voltage applied to relay. Adjust trip point and indications.
2.	Loss of Voltage (D.G. Start, Load Shed and Sequence)	a. Test	M	a. Functionally test each undervoltage relay and channel by applying simulated loss of voltage signal(s); verify alarms and indications.
		b. Calibrate	R	b. Known voltage applied to relay. Adjust trip point and indications.
3.	Loss of Voltage (Automatic Throw Over - ATO)	a. Test	M	a. Functionally test each undervoltage relay and channel by applying simulated loss of voltage signal(s); verify alarms and indications.
		b. Calibrate	R	b. Known voltage applied to relay. Adjust trip point and indications.

NOTE 1: M - Monthly
R - Once per refueling cycle

Specification SR 5.4.2 - Control Room Smoke Detector

The control room smoke detectors and alarms will be functionally tested once per year.

Basis for Specification SR 5.4.2

The control room smoke detectors provide for sensing of the smoke in the outlet air ducts from both the control room and the auxiliary electrical room. In the event of any fire or smoke in the control panels, alarms will be initiated.

Specification SR 5.4.3 - Core Region Outlet temperature Instrumentation

The output of two thermocouples measuring each region outlet temperature will be checked daily during power operation. If the indicated temperatures for a region differ by $\geq \pm 75°F$, a calibration shall be made and the faulty thermocouple replaced by an operable thermocouple. The core region outlet thermocouple shall be calibrated once per year during power operation by traversing a calibrated thermocouple along each of the seven coolant thermocouple assemblies.

Basis for Specification 5.4.3

The long-term thermocouple drift is estimated to be $\leq 15°F$ per year and this drift was included in the measurement uncertainty of $\pm 50°F$ used to establish LCO 4.1.7. With this measurement uncertainty, a root mean square difference of $\geq \pm 75°F$ would be an indication of a faulty reading. Daily

checks and yearly calibrations are considered adequate since the expected drift in calibration is small and has been included in establishing LCO 4.1.7 (See FSAR Section 7.3.3).

Specification SR 5.4.4 - PCRV Cooling Water System Temperature Scanner - Surveillance Requirement

PCRV Cooling System temperature scanner readings shall be checked by comparison of representative liner cooling tube thermocouple outputs to their respective subheader temperatures and associated alarms tested once per month during power operation.

All thirty-six (36) outlet subheader temperature indicators shall be calibrated annually. In addition, ninety-seven (97) liner cooling tube outlet thermocouples shall be calibrated annually.

Basis for Specification SR 5.4.4

The temperature scanner for the PCRV cooling system provides for continuous temperature monitoring of the outlet water temperature of each individual liner cooling tube and alarming of high outlet temperatures.

The surveillance interval specified is sufficient to detect any drift in the output of the individual thermocouples or scanner electronics to assure the temperature limitations of the PCRV cooling system are not exceeded.

The ninety-seven (97) thermocouples shall be distributed among the thirty-six (36) subheaders so that between 16.7% and 21.5% of the total in each subheader are calibrated each year. Thus, the maximum time between calibration of any one thermocouple, or any complete subheader, shall not exceed six (6) years. The overall percentage of thermocouples calibrated per year exceeds 18%.

The surveillance interval for calibration, combined with that for checking, assures sufficient accuracy of temperature measurement to adequately protect the PCRV concrete.

Specification SR 5.4.5 - PCRV Cooling Water System Flow Scanner - Surveillance Requirement

A PCRV Cooling System flow scanner readout shall be taken and alarms functionally checked monthly. The scanner and alarms, and six (6) subheader flow meters shall be calibrated annually.

Basis for Specification SR 5.4.5

The flow scanner acts as a backup to the temperature scanner and initiates no automatic protective action, only an alarm. Because a restriction or a leak in the system would develop over a period of time, the monthly interval for comparing scanner readouts is sufficient to detect any long term change in the system.

Specification SR 5.4.6 - Core ΔP Indicator - Surveillance Requirement

The core ΔP instrumentation shall be calibrated on a once per refueling cycle interval.

Basis for Specification SR 5.4.6

Core differential pressure is an indication of gross blockage of flow in the core.

Specification SR 5.4.7 - Control Room Temperature - Surveillance Requirement

The control room temperature control thermostat shall be functionally tested monthly and calibrated annually.

Basis for Specification SR 5.4.7

The surveillance interval specified for functional testing and calibration of the control room thermostat will assure its ability to not only control the room temperature as desired, but to also indicate the correct room temperature within the accuracy of the instrument.

Specification SR 5.4.8 - Power to Flow Instrumentation - Surveillance Requirement

The power to flow indication shall be verified daily and shall be calibrated once per refueling cycle.

Basis for Specification SR 5.4.8

The power to flow ratio indication is an indication of the balance between the heat generation and removal within the primary coolant system. A verification of the power to flow indication on a daily basis is adequate to assure the instrument is indicating properly. In addition, any change in reactor power level no matter how small, should produce a change in the power to flow ratio indication. A lack of response by this instrumentation would be noticed by the operator. Calibration of the instrumentation on a once per refueling cycle basis is acceptable by industry standards for this type of instrumentation.

Specification SR 5.4.9 - Area and Miscellaneous Process Radiation Monitors - Surveillance Requirement

The area radiation monitors shall be functionally checked weekly and calibrated annually.

Basis for Specification SR 5.4.9

The surveillance interval specified for functional testing and calibration are adequate to assure the proper operation of these detectors.

Specification SR 5.4.10 - Seismic Instrumentation - Surveillance Requirement

The Seismic Instrumentation shall be functionally tested every six months and calibrated every two years.

Basis for Specification SR 5.4.10

The intervals specified for testing and calibration of the Seismic Instrumentation are recommended by the manufacturer to assure the instruments operate as intended.

Specification SR 5.4.11 - PCRV Surface Temperature Indication - Surveillance Requirement

The PCRV surface temperature indicators shall be functionally tested monthly and calibrated annually.

Basis for Specification SR 5.4.11

The PCRV surface temperature indicators provide for continuous monitoring of surface concrete temperatures to assure the proper temperature gradient is maintained through the PCRV wall and heads.

The surveillance interval specified is adequate to detect any drift or malfunction of this instrumentation.

Specification SR 5.4.12 - Analytical System Primary Coolant Moisture Instrumentation - Surveillance Requirements

The analytical system primary coolant moisture instrumentation shall be calibrated on a once per refueling cycle basis.

Basis for Specification SR 5.4.12

The surveillance interval specified for calibration of this instrumentation will assure the proper operation of these detectors.

Specification SR 5.4.13 - 480 V Switchgear Room Temperature Indication - Surveillance Requirement

The 480 V switchgear room temperature indicator and alarm shall be functionally tested monthly and calibrated annually.

Basis for Specification SR 5.4.13

The surveillance interval specified for this instrumentation assures its proper operation on a continuous basis.

ATTACHMENT 3

SIGNIFICANT HAZARDS CONSIDERATIONS

SIGNIFICANT HAZARDS CONSIDERATIONS

I. EVALUATION

Table 4.4-5

The undervoltage protection equipment and trip settings proposed as Table 4.4-5 were part of the original modification previously reviewed and evaluated by Public Service Company and the Nuclear Regulatory Commission (P-83415 and G-82338). Therefore, the addition of this equipment to the Technical Specifications is not considered to affect the safety evaluations previously performed nor the conclusions which were reached. These requirements more closely conform to the Standard Technical Specifications and will provide assurance that this equipment and the associated setpoints and functions are maintained operable as a limiting condition for plant operation. The action requirement for Table 4.4-5 is consistent with system operation requirements and will provide assurance that appropriate actions are taken to maintain safe shutdown functions and capabilities.

Table 5.4-5

The proposed surveillance requirements and schedule are consistent with the requirements for other protective instrumentation and considered adequate to ensure equipment operability and protective actions.

II. CONCLUSION

Based on the above evaluation, it is concluded that operation of Fort St. Vrain in accordance with the proposed changes will not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the possibility of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in any margin of safety.

Therefore, these changes will not increase the risk to the health and safety of the public nor do they involve any significant hazards considerations.