TECHNICAL DESCRIPTION

OF

RECIRCULATION PUMP TRIP

AND

ANALOG TRIP SYSTEM

INTRODUCTION

The change consists of two parts, installation of an Analog Trip system and a Recirculation Pump Trip (RPT) system.

Selected pressure and differential-pressure switches used to monitor reactor pressure and level are to be replaced with analog transmitters and electronic trip units to increase the availability of Vermont Yankee and to reduce the manpower requirements for functional testing and calibration of instruments.

The second part of the change is the installation of a Monticello type RPT.

DESCRIPTION

Analog Trip System: An instrument channel in the existing design consists of a pressure or differential-pressure switch monitoring the process variable. Contacts of this switch are used to energize an auxiliary relay in a logic panel. An instrument channel in the modified design consists of a pressure or differential-pressure transmitter monitoring the process variable. The output of the transmitter is connected to an electronic trip unit and indicator. The indicator displays the output of the transmitter and the trip unit produces a trip output signal when a preset input value is reached. The trip unit output then actuates a relay whose contacts are used in the logic circuit in place of the existing pressure or differential-pressure switch contacts. A list of the effected instruments and their function is enclosed as Table I.

The only alteration being made by this portion of the change is the method of generating the trip signals. All trip functions will remain the same. There are no changes to the design basis, protective function, redundancy, trip point setting, or logic.

Recirculation Pump Trip: Output signals from trip units within the analog trip system will energize relays in the RPT relay logic - see Figure 1. The parameters that initiate RPT system will be reactor low-low water level, after a time delay of less than or equal to ten seconds, and high reactor pressure. The use of a ten second delay on low-low level trip is desirable to avoid making the consequences of a postulated LOCA more severe. The RPT relay logic is installed in analog trip system ECCS cabinets. Reset and manual actuation switches are mounted on the recirculation pump portion of the main control board. The normally closed generator field breakers of the recirculation pump motor generator will be opened by the RPT system.

Upon receipt of a manual actuation signal, reactor water level low-low trip signal, or a reactor high pressure trip signal, the logic will seal in and hold the trip until the reset switch is depressed. A trip signal will result in opening the generator field breakers of both recirculation pump motor generators. The trip logic to each breaker is two-out-of-two in which contacts K3A and K3C or contacts K3B and K3D (see Figure 1) must close to trip the breaker.

Hardware: The analog transmitters will be mounted on the existing instrument racks and will replace the existing swtiches. The instrument racks will be analyzed to ensure seismic qualification with the new transmitters installed.

New seismically qualified cabinets will be provided for mounting the trip units, indicators, relays, power supplies and RPT relay logic. The cabinets will be located in the reactor building near the instrument racks which house the existing pressure switches.

The cabinets are divided into two groups;

1. those housing the RPS instruments, and
2. those housing the ECCS instruments and RPT relay logic.

Power for the RPS instruments will be supplied by the two RPS buses. Power for the ECCS instruments will be supplied by two new 24 volt safety class batteries.

The 24 volt safety class batteries and battery chargers will be sized to accept the load from this change and those changes planned for the future analog trip system modifications.

Power for the final RPT trip relay and for the RPT trip coil will be from the two 125 volt safety class plant batteries.

The new trip coil added to each generator field breaker for RPT will be from the same manufacturer as the existing generator field breaker trip coil.

The cabinets' electronics and the 24 volt battery systems will produce various alarm contacts which will be wired to the plant's control room annunciator. The alarm functions are:

1. power supply/sensor/trip unit failure.
2. channel logic activated.
3. undervoltage/overvoltage/ground detection/breaker open.

Design Criteria:

All safety class equipment installed by this change will be environmentally and seismically qualified for its application.

The safety class equipment installed in the reactor building will be qualified for a normal range of 55^{o}F to 100^{o}F at 50% relative humidity and maximum short term 150^{o}F at 90% relative humidity.

The equipment will be qualified to operate before, during and after receiving a total dosage of 10^5 rads.

The equipment will be qualified to operate before, during and after a safe shutdown earthquake. The safe shutdown earthquake is defined as being twice the operating basis earthquake discussed in amendments to the FSAR.

The manual actuation switches installed in the main control board will be the same as the switches used in the original design of the control board.

The relays in the RPS trip logic will be de-energized to operate and will be powered from the RPS motor generator buses.

The relays in the ECCS and RPT trip logic will be energized to operate and will be powered from the plant battery systems and the newly installed 24 volt safety class batteries.

The rating of the relay contacts will be equal to or better than the rating of the pressure switch contacts which they replace.

In order to provide system diversity, the final relay in the RPT system will be of a different manufacturer than the final relay in the scram system.

Administrative Controls:

Periodic surveillance, preventative maintenance testing and calibration will be provided through the use of plant procedures to assure that analog trip loops, analog sensors, and actuated equipment will be capable of functioning as designed and that the system accuracy and performance have not deteriorated with time and usage.

Administrative controls will be established through the use of plant procedures to control access to the set point adjustments, calibration and test points.

Control room annunciators will be provided to keep the operator informed about the status of the analog trip loops, the RPT trip logic, and the 24 volt battery system.

Plant procedures require that the operator be informed prior to the time that any test, maintenance, or calibration is performed and after they have been completed. All necessary information for the operators' involvement during these functions is made available in the control room.

Maintainability:

The design of the system includes plug in printed circuit boards and plug in relays to reduce mean-time-to-repair. Control room alarms, local trouble lights, and local meters will provide indications to facilitate recognition, location, replacement and/or adjustment of malfunctioning equipment.

Testability:

The trip units will be tested periodically by injecting a signal and monitoring the output. Operation of the analog loop is verified by periodic instrument checks. The RPT logic will be tested by tripping one process channel and observing the neon lights in parallel with the trip actuation contact. This will verify closure of the contact being tested and will also verify trip coil continuity. This testing will be performed periodically according to the technical specification requirements.

All setpoints will be made and testing will be done in accordance with the technical specifications which will be imposed after the modifications have been completed.

CODES AND STANDARDS

This modification affects safety class systems and has been designed to meet, but is not limited to the following:

ANSI N45.2.2 - 1972	- Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants
IEEE 279 - 1971	- Criteria for Protection Systems for Nuclear Power Generating Stations
IEEE 308 - 1971	- Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations
IEEE 323 - 1971	- Standard for Qualifying Class 1E Electric Equipment for Nuclear Power Generating Stations
IEEE 344 - 1971	- Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations
IEEE 383 - 1974	- Standard for Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations
UL 50-1976	- Cabinets and Boxes
UL 67-1976	- Electric Panelboards (ANSI C33.38-1974)

QUALITY ASSURANCE

Quality assurance and control will be applied to this change as detailed in Yankee Atomic Electric Company's Operational Quality Assurance Program.

TABLE I

Existing Instrumentation

Tag Number	Function
LIS 2-3-57A,B	Reactor water level - RPS, Scram, PCIS-Group 1, RPT (motor breaker)
LIS 2-3-58A,B	Reactor water level - RPS, Scram, PCIS-Group 1, RPT (motor breaker)
PS 2-3-55A,B,C,D	Reactor Pressure - RPS, Scram
LIS 2-3-72A,B,C,D	Reactor water level - ECCS Initiation, HPCI & RCIC Isolation
LIS 2-3-59A,B,C,D	Reactor water level - Main Turbine Trip

New Instrumentaion

Tag Number	Function
LT 2-3-57A,B	Reactor water level - RPS, Scram, PCIS-Group 1, RPT (motor breaker)
LT 2-3-58A,B,	Reactor water level - RPS, Scram, PCIS-Group 1, RPT (motor breaker)
PT 2-3-55A,B,C,D	Reactor Pressure - RPS, Scram
LT 2-3-72A,B,C,D	Reactor water level - ECCS Initiation, HPCI & RCIC Isolation, RPT (field breaker), Main Turbine Trip
PT 2-3-56A,B,C,D	Reactor Pressure - RPT (field breaker)

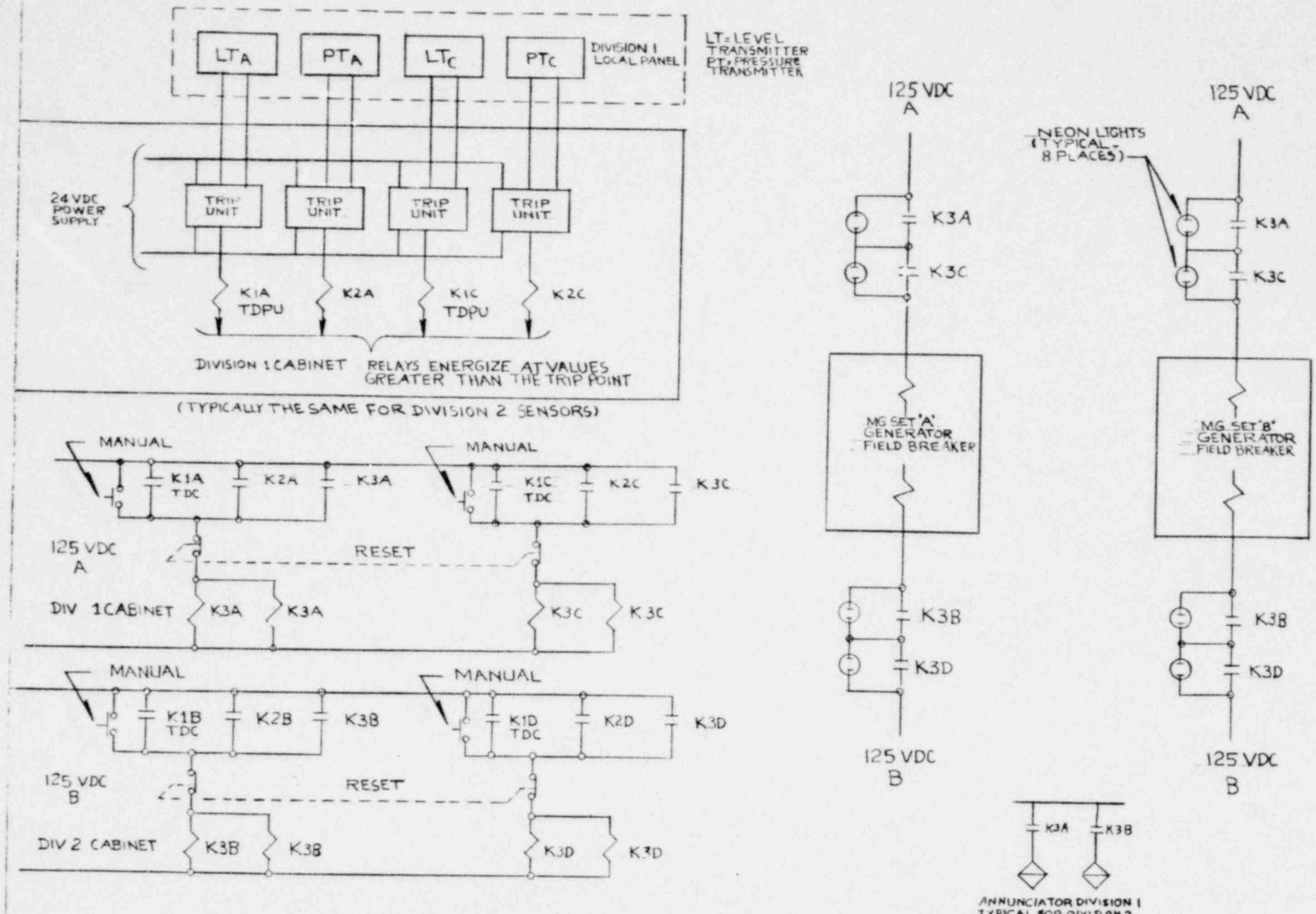
LT A
PT A
LT C
PT C
DIVISION 1 LOCAL PANEL
LT=LEVEL TRANSMITTER
PT=PRESSURE TRANSMITTER
24 VDC POWER SUPPLY
TRIP UNIT
TRIP UNIT
TRIP UNIT
TRIP UNIT
K1A TDPU
K2A
K1C TDPU
K2C
DIVISION 1 CABINET
RELAYS ENERGIZE AT VALUES GREATER THAN THE TRIP POINT
(TYPICALLY THE SAME FOR DIVISION 2 SENSORS)
MANUAL
K1A TDC
K2A
K3A
MANUAL
K1C TDC
K2C
K3C
125 VDC A
RESET
DIV 1 CABINET
K3A
K3A
K3C
K3C
MANUAL
K1B TDC
K2B
K3B
MANUAL
K1D TDC
K2D
K3D
125 VDC B
RESET
DIV 2 CABINET
K3B
K3B
K3D
K3D
125 VDC A
K3A
K3C
MG SET "A" GENERATOR FIELD BREAKER
K3B
K3D
125 VDC B
125 VDC A
NEON LIGHTS (TYPICAL - 8 PLACES)
K3A
K3C
MG SET "B" GENERATOR FIELD BREAKER
K3B
K3D
125 VDC B
K3A
K3B
ANNUNCIATOR DIVISION 1
TYPICAL FOR DIVISION 2

FIGURE 1

TABLE 4.1.1

SCRAM INSTRUMENTATION AND LOGIC SYSTEMS FUNCTIONAL TESTS

MINIMUM FUNCTIONAL TEST FREQUENCIES FOR SAFETY INSTRUMENTATION, LOGIC SYSTEMS AND CONTROL CIRCUITS

Instrument Channel	Group (3)	Functional Test (7)	Minimum Frequency (4)
Mode Switch in Shutdown	A	Place Mode Switch in Shutdown	Each Refueling Outage
Manual Scram	A	Trip Channel and Alarm	Every 3 Months
IRM			
High Flux	C	Trip Channel and Alarm (5)	Before Each Startup & Weekly during refueling (6)
Inoperative	C	Trip Channel and Alarm	Before Each Startup & Weekly during refueling (6)
APRM			
High Flux	B	Trip Output Relays (5)	Once Each Week
High Flux (Reduced)	B	Trip Output Relays (5)	Before Each Startup & Weekly during refueling (6)
Inoperative	B	Trip Output Relays	Once Each Week
Downscale	B	Trip Output Relays (5)	Once Each Week
Flow Bias	B	Trip Output Relays (5)	(1)
High Reactor Pressure	B	Trip Channel and Alarm (5)	(1)
High Drywell Pressure	A	Trip Channel and Alarm	(1)
Low Reactor Water Level (2) (8)	B	Trip Channel and Alarm (5)	(1)
High Water Level in Scram Discharge Volume	A	Trip Channel and Alarm	Every 3 Months
High Main Steamline Radiation (2)	B	Trip Channel and Alarm (5)	Once Each Week
Main Steamline Iso. Valve Closure	A	Trip Channel and Alarm	(1)
Turbine Con. Valve Fast Closure	A	Trip Channel and Alarm	(1)
Turbine Stop Valve Closure	A	Trip Channel and Alarm	(1)

TABLE 4.1.1 NOTES

1. Initially once per month; thereafter, with an interval not less than one month nor more than three months. The compilation of instrument failure rate data may include data obtained from other Boiling Water Reactors for which the same design instrument operates in an environment similar to that of Vermont Yankee.

2. An instrument check shall be performed on reactor water level and reactor pressure instrumentation once per day and on steamline radiation monitors once per shift.

3. A description of the three groups is included in the basis of this Specification.

4. Functional tests are not required when the systems are not required to be operable or are tripped. If tests are missed, they shall be performed prior to returning the systems to an operable status.

5. This instrumentation is exempted from the Instrument Functional Test Definition (1.G.). This Instrument Functional Test will consist of injecting a simulated electrical signal into the measurement channels.

6. Frequency need not exceed weekly.

7. A functional test of the logic of each channel is performed as indicated. This coupled with placing the mode switch in shutdown each refueling outage constitutes a logic system functional test of the scram system.

8. The water level in the reactor vessel will be perturbed and the corresponding level indicator changes will be monitored. This test will be performed every month after the completion of the monthly tests program.

TABLE 4.1.2

SCRAM INSTRUMENT CALIBRATION

MINIMUM CALIBRATION FREQUENCIES FOR REACTOR PROTECTION INSTRUMENT CHANNELS

Instrument Channel	Group(1)	Calibration Standard(4)	Minimum Frequency(2)
High Flux APRM			
Output Signal	B	Heat Balance	Once Every 7 Days
Output Signal (Reduced)	B	Heat Balance	Once Every 7 Days
Flow Bias	B	Standard Pressure and Voltage Source	Refueling Outage
APRM	B(5)	Using TIP System	Every 1000 equiv full pwr hr.
High Reactor Pressure	B	Standard Pressure Source	Once/Operating Cycle
Turbine Control Valve Fast Closure	A	Standard Pressure Source	Every 3 months
High Drywell Pressure	A	Standard Pressure Source	Every 3 months
High Water Level in Scram Discharge Volume	A	Water Level	Refueling Outage
Low Reactor Water Level	B	Standard Pressure Source	Once/Operating Cycle
Turbine Stop Valve Closure	A	(6)	Refueling Outage
High Main Steamline Radiation	B	Appropriate Radiation Source (3)	Refueling Outage
First Stage Turbine Pressure Permissive	A	Pressure Source	Every 6 months and after refueling
Maine Steamline Isolation Valve Closure	A	(6)	Refueling Outage

Bases:

4.1 REACTOR PROTECTION SYSTEM

A. The scram sensor channels listed in Tables 4.1.1 and 4.1.2 are divided into three groups: A, B and C. Sensors that make up Group A are of the on-off type and will be tested and calibrated at the indicated intervals. Initially the tests are more frequent than Yankee experience indicates necessary. However, by testing more frequently, the confidence level with this instrumentation will increase and testing will provide data to justify extending the test intervals as experience is accrued.

Group B devices utilize an analog sensor followed by an amplifier and bi-stable trip circuit. This type of equipment incorporates local and/or control room mounted indicators and annunciator alarms. A failure in the sensor or amplifier may be detected by an alarm or by an operator who observes that one indicator does not track the others in similar channels. The bi-stable trip circuit failures are detected by the periodic testing.

Group C devices are active only during a given portion of the operating cycle. For example, The IRM is active during start-up and inactive during full-power operation. Testing of these instruments is only meaningful within a reasonable period prior to their use.

B. The peak heat flux and total peaking factor shall be checked once per day to determine if the APRM gains require adjustment. This will normally be done by checking LPRM readings. Because few control rod movements or power changes occur, checking these parameters daily is adequate.

I. RECIRC PUMP TRIP INSTRUMENTATION

During reactor power operation, the Recirc Pump Trip Instrumentation shall be operative in accordance with Table 3.2.1.

I. RECIRC PUMP TRIP INSTRUMENTATION

The Recirc Pump Trip Instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.1.

TABLE 3.2.1

RECIRCULATION PUMP TRIP ACTUATION INSTRUMENTATION

Recirculation Pump Trip - A & B (Note 1)			
Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip Level Setting	Required Action When Minimum Conditions for Operation are not Satisfied
2	Low-Low Reactor Vessel Water Level	$\geq$ 6' 10.5" above top of active fuel	Note 2
2	High Reactor Pressure	$\geq$ 1150 psig	Note 2
2	Time Delays	$\leq$10 sec.	Note 2
1	Trip System Logic	---	Note 2

TABLE 3.2.1 NOTES

1. Each of the two Core Spray, LPCI and RPT, subsystems are initiated and controlled by a trip system. The subsystem "B" is identical to the subsystem "A".

2. If the minimum number of operable instrument channels are not available, the inoperable channel shall be tripped using test jacks or other permanently installed circuits. If the channel cannot be tripped by the means stated above, that channel shall be made operable within 24 hours or an orderly shutdown shall be initiated and the reactor shall be in the cold shutdown condition within 24 hours.

3. One trip system with initiating instrumentation arranged in a one-out-of-two taken twice logic.

4. One trip system with initiating instrumentation arranged in a one-out-of two logic.

5. If the minimum number of operable channels are not available, the system is considered inoperable and the requirements of Specification 3.5 apply.

6. Any one of the two trip systems will initiate ADS. If the minimum number of operable channels in one trip system is not available, the requirements of Specification 3.5.F.2 and 3.5.F.3 shall apply. If the minimum number of operable channels is not available in both trip systems, Specifications 3.5.F.3 shall apply.

7. One trip system arranged in a two-out-of-two logic.

TABLE 4.2.1

MINIMUM TEST & CALIBRATION FREQUENCIES

EMERGENCY CORE COOLING ACTUATION INSTRUMENTATION

Core Spray System			
Trip Function	Functional Test (8)	Calibration (8)	Instrument Check
High Drywell Pressure	(Note 1)	every 3 months	---
Low-Low Reactor Vessel Water Level	(Note 1)	once/operating cycle	once each day
Low Reactor Pressure	(Note 1)	every 3 months	---
Pump 14-1A, Discharge Press	(Note 1)	every 3 months	---
Auxiliary Power Monitor	(Note 1)	every refueling	once each day
Pump Bus Power Monitor	(Note 1)	none	once each day
High Sparger Pressure	(Note 1)	every 3 months	---
Trip System Logic except relays 14A-K11A 14A-K11B 14A-K19A 14A-K19B	every 6 months (Note 2)	every 6 months (Note 3)	---

TABLE 4.2.1 (Continued)

Low Pressure Coolant Injection System

Trip Function	Function Test (S)	Calibration (S)	Instrument Check
Low Reactor Pressure #1	(Note 1)	every 3 months	----
High Drywell Pressure #1	(Note 1)	every 3 months	----
Low-Low Reactor Vessel Water Level	(Note 1)	once/operating cycle	once each day
Reactor Vessel Shroud Level	(Note 1)	every 3 months	----
Low Reactor Pressure #2	(Note 1)	every 3 months	----
RHR Pump Discharge Pressure	(Note 1)	every 3 months	----
High Drywell Pressure #2	(Note 1)	every 3 months	----
Low Reactor Pressure #3	(Note 1)	every 3 months	----
Auxiliary Power Monitor	(Note 1)	every refueling outage	once each day
Pump Bus Power Monitor	(Note 1)	None	once each day
LPCI Crosstie Monitor	None	None	once each day
Trip System Logic	Every 6 Months (Note 2)	every 6 months (Note 3)	----

TABLE 4.2.1 (CONT)

High Pressure Coolant Injection System

Trip Function	Functional Test (8)	Calibration (8)	Instrument Check
Low-Low Reactor Vessel Water Level	(Note 1)	once/operating cycle	once each day
Low Condensate Storage Tank Water Level	(Note 1)	every 3 months	—
High Drywell Pressure	(Note 1)	every 3 months	—
High Suppression Chamber Water Level	(Note 1)	every 3 months	—
Bus Power Monitor	(Note 1)	None	once each day
Trip System logic	every 6 months (Note 2)	every 6 months (Note 3)	—

TABLE 4.2.1 (CONT)

Automatic Depressurization System			
Trip Function	**Functional Test (8)**	**Calibration (8)**	**Instrument Check**
Low-Low Reactor Vessel Water Level	(Note 1)	once/operating cycle	once each day
High Drywell Pressure	(Note 1)	every 3 months	---
Bus Power Monitors	(Note 1)	none	once each day
Trip System Logic (except solenoids of valves)	every 6 months (Note 2)	every 6 months (Note 3)	---

TABLE 4.2.1 (CONT)

Recirculation Pump Trip Actuation System

Trip Function	Functional Test[8]	Calibration[8]	Instrument Check
Low-Low Reactor Vessel Water Level[4]	(Note 1)	Once/Operating Cycle	Once Each Day
High Reactor Pressure [4]	(Note 1)	Once/Operating Cycle	Once Each Day
Trip System Logic	(Note 1)	Once/Operating Cycle	---

TABLE 4.2.2

MINIMUM TEST & CALIBRATION FREQUENCIES

PRIMARY CONTAINMENT ISOLATION INSTRUMENTATION

Trip Function	Functional Test (8)	Calibration (8)	Instrument Check
Low-Low Reactor Vessel Water Level	(Note 1)	once/operating cycle	once each day
High Steam Line Area Temperature	(Note 1)	each refueling outage	---
High Steam Line Flow	(Note 1)	every 3 months	once each day
Low Main Steam Line Pressure	(Note 1)	every 3 months	---
Low Reactor Vessel Water Level	(Note 1)	once/operating cycle	---
High Main Steam Line Radiation	(Notes 1 & 7)	each refueling outage	once each day
High Drywell Pressure	(Note 1)	every 3 months	---
Condenser Low Vacuum	(Note 1)	every 3 months	---
Trip System Logic except relays 16A-K13 16A-K14 16A-K15 16A-K16 16A-K26 16A-K27	every 6 months (Note 2)	every 6 months (Note 3)	---

TABLE 4.2.2 (CONT'D)

MINIMUM TEST & CALIBRATION FREQUENCIES

HIGH PRESSURE COOLANT INJECTION SYSTEM ISOLATION INSTRUMENTATION

Trip Function	Functional Test(8)	Calibration(8)	Instrument Check
High Reactor Water Level	(Note 1)	once/operating cycle	---
High Steam Line Space Temperature	(Note 1)	each refueling outage	---
High Steam Line d/p (Steam Line Break)	(Note 1)	every 3 months	---
Low HPCI Steam Supply Pressure	(Note 1)	every 3 months	---
Main Steam Line Tunnel Temperature	(Note 1)	each refueling outage	---
Bus Power Monitor	(Note 1)	None	once each day
Trip System Logic	every 6 months (Note 2)	every 6 months (Note 3)	---

TABLE 4.2.2 (CONT'D)

MINIMUM TEST & CALIBRATION FREQUENCIES

REACTOR CORE ISOLATION COOLING SYSTEM ISOLATION INSTRUMENTATION

Trip Function	Functional Test (8)	Calibration (8)	Instrument Check
Main Steam Line Tunnel Temperature	(Note 1)	each refueling outage	---
High Steam Line Space Temperature	(Note 1)	each refueling outage	---
High Steam Line d/p (Steam Line Break)	(Note 1)	every 3 months	---
High Reactor Water Level	(Note 1)	once/operating cycle	---
Low RCIC Steam Supply Pressure	(Note 1)	every 3 months	---
Bus Power Monitor	(Note 1)	none	once each day
Trip System Logic	every 6 months (Note 2)	every 6 months (Note 3)	---

TABLE 4.2.3

MINIMUM TEST & CALIBRATION FREQUENCIES

REACTOR BUILDING VENTILATION & STANDBY GAS TREATMENT SYSTEM ISOLATION

Trip Function	Functional Test(8)	Calibration (8)	Instrument Check
Low Reactor Vessel Water Level	(Note 1)	once/operating cycle	---
High Drywell Pressure	(Note 1)	every 3 months	---
Reactor Building Vent Exhaust Radiation	Monthly	every 3 months	once each day
Refueling Floor Zone Radiation	Monthly	every 3 months	once each day during refueling
Reactor Building Vent Trip System Logic	every 6 months (Note 2)	every 6 months Note 3)	---
Standby Gas Treatment Trip System Logic	every 6 months (Note 2)	every 6 months (Note 3)	---
Logic Bus Power Monitor	(Note 1)	none	once each day

The low-low reactor water level instrumentation is set to trip when reactor water level is 6'10.5" or -44.5" H_2O indicated on the reactor water level instrumentation above the top of the active fuel. This trip initiates closure of the Group 1 primary containment isolation valves and also activates the ECCS, RPT and starts the standby diesel generator system. This trip setting level was chosen to be low enough to prevent spurious operation but high enough to initiate ECCS operation, RPT and primary system isolation so that no melting of the fuel cladding will occur and so that post-accident cooling can be accomplished and the limits of 10 CFR 100 will not be violated. For the complete circumferential break of a 28-inch recirculation line and with the trip setting given above, ECCS initiation, RPT and primary system isolation are initiated in time to meet the above criteria. The instrumentation also covers the full range of spectrum of breaks and meets the above criteria.

The low low low reactor water level instrumentation is set to trip when the reactor water level has reached a level greater than two thirds of the core height. This value was selected as the minimum water level in the reactor vessel, following a design basis accident, that emergency core cooling system water can be diverted from its normal injection path, into the reactor vessel. At two thirds core height level and with high drywell pressure, the appropriate valves may be manually operated to allow primary containment spray operation.

The high drywell pressure instrumentation is a backup to the water level instrumentation and in addition to initiating ECCS it causes isolation of Group 2, 3, and 4 isolation valves. For the complete circumferential break discussed above, this instrumentation will initiate ECCS operation at about the same time as the low-low water level instrumentation; thus the results given above are applicable here also. Group 2 isolation valves include the drywell vent, purge, and sump isolation valves. High drywell pressure activates only these valves because high drywell pressure could occur as the result of non-safety related causes such as not purging the drywell air during startup. Total system isolation is not desirable for these conditions and only the valves in Group 2 are required to close. The water level instrumentation initiates protection for the full spectrum of loss-of-coolant accidents and causes a trip of all primary system isolation valves.

Venturis are provided in the main steam lines as a means of measuring steam flow and also limiting the loss of mass inventory from the vessel during a steam line break accident. In addition to monitoring steam flow, instrumentation is provided which causes a trip of Group 1 isolation valves. The primary function of the instrumentation is to detect a break in the main steam line, thus only Group 1 valves are closed. For the worst case accident, main steam line break outside the drywell, this trip setting of 120 percent of rated steam flow in conjunction with the flow limiters and main steam line valve closure limit the mass inventory loss such that fuel is not uncovered, fuel temperatures remain less than 1295°F and release of radioactivity to the environs is well below 10 CFR 100.

Temperature monitoring instrumentation is provided in the main steam line tunnel to detect leaks in this area. Trips are provided on this instrumentation and when exceeded cause closure of Group 1 isolation valves. Its setting of ambient plus 95°F is low enough to detect leaks of the order of 5 to 10 gpm; thus, it is capable of covering the entire spectrum of breaks. For large breaks, it is a backup to high steam flow instrumentation discussed above, and for small breaks with the resultant small release of radioactivity, gives isolation before the limits of 10 CFR 100 are exceeded.

3.10 LIMITING CONDITIONS FOR OPERATION

4.10 SURVEILLANCE REQUIREMENTS

b. The undervoltage automatic starting circuit of each disel generator shall be tested once a month.

c. Once per operating cycle, the actual conditions under which the diesel generators are required to start automatically will be simulated and a test conducted to demonstrate that they will start within 13 seconds and accept the emergency load and start each load within the specified starting time. The results shall be logged.

2. Batteries

The following battery chargers shall be operable:

a. Four battery chargers for the ± 24 volt neutron monitor and process radiation batteries.

b. Two of the three battery chargers for the 125 volt station batteries.

c. One of the two battery chargers for the 125 volt switchyard batteries.

2. Batteries

a. Every week the specific gravity and voltage of the pilot cell and temperature of adjacent cells and overall battery voltage shall be measured and logged.

b. Every three months the voltage of each cell to nearest 0.01 volt and specific gravity of each cell to the nearest 0.005 ap.gr. shall be measured and logged.

c. Once each operating cycle each station 125 volt battery shall be subjected to a rated loud discharge test. The specific gravity and voltage of each cell shall be measured after the discharge test and logged.

d. Two of the three battery chargers for the 24 volt ECCS Instrumentation.

3.10 LIMITING CONDITIONS FOR OPERATION

B. Operation with Inoperable Components

Whenever the reactor is in Run Mode or Startup Mode with the reactor not in the Cold Condition, the requirements of 3.9.A shall be met except:

1. Diesel Generators

From and after the date that one of the diesel generators or its associated buses are made or found to be inoperable for any reason and the remaining diesel generator is operable, the requirements of Specification 3.5.H.1 shall be satisfied.

2. Batteries

a. From and after the date that ventilation is lost in the battery room, portable ventilation equipment shall be provided.

b. From and after the date that one of the two 125 volt station battery systems is made or found to be inoperable for any reasons, continued reactor operation is permissible only during the succeeding three days provided Specification 3.5.H is met unless such battery system is sooner made operable.

c. From and after the date that one of the two 24 volt ECCS Instrumentation battery systems is made or found to be inoperable for any reason, continued reactor operation is permissible only during the succeeding three days unless such battery system is sooner made operable.

4.10 SURVEILLANCE REQUIREMENTS

B. Operation with Inoperable Components

1. Diesel Generators

When it is determined that one of the diesel generators in inoperable the requirements of Specification 4.5.H.1 shall be satisfied.

2. Batteries

Samples of the battery room atmosphere shall be taken daily for hydrogen concentration determination.

AUXILIARY ELECTRIC POWER SYSTEMS

A. The objective of this specification is to assure that adequate power will be available to operate the emergency safeguards equipment. Adequate power can be provided by any one of the following sources: either of the startup transformers, backfeed through the main transformer, the 4160 volt line from the Vernon Hydroelectric Station or either of the two diesel generators. The backfeed through the main transformer and 4160 volt Vernon line are both delayed-access offsite power sources. Backfeeding through the main transformer can be accomplished by disconnecting the main generator from the main transformer and energizing the auxiliary transformer from the 345 kv switchyard through the main transformer. The time required to perform this disconnection is approximately six hours. The 4160 volt line from the Vernon Hydroelectric Station can be connected to either of the two emergency buses within seconds by simple manual switching operation in the main control room.

Two 480 V Uninterruptible Power Systems; each consisting of a battery bank, battery charger, and a sold state inverter, supply power to the LPCIS valves via designated motor control centers. The 480 V Uninterruptible Power Systems are redundant and independent of any onsite power sources.

This Specification assures that at least two offsite, two onsite power sources, and both 480 V Uninterruptible Power Systems will be available before the reactor is taken beyond "just critical" testing. In addition to assuring power source availability, all of the associated switchgear must be operable as specified to assure that the emergency cooling equipment can be operated, if required, from the power sources.

Station service power is supplied to the station through either the unit auxiliary transformer or the startup transformers. In order to startup the station, at least one startup transformer is required to supply the station auxiliary load. After the unit is synchronized to the system, the unit auxiliary transformer carries the station auxiliary load, except for the station cooling tower loads which are always supplied by one of the startup transformers. The station cooling tower loads are not required to perform an engineered safety feature function in the event of an accident, therefore, an alternate source of power is not essential. Normally one startup transformer supplies 4160 volt buses 1 and 3 and the other supplies buses 2 and 4, however, the two startup transformers are designed with adequate capacity such that, should one become or be made inoperable temporary connections can be made to supply the total station load (less the cooling towers) from the other startup transformer.

A battery charger is supplied for each battery. In addition the two 125 volt station batteries and the two 24 volt ECCS instrumentation batteries each have a spare charger available. Since one spare 24 volt and one 125 volt charger are available, one battery charger can be allowed out of service for maintenance and repairs.

B. Adequate power is available to operate the emergency safeguards equipment from either startup transformer or for minimum engineered safety features from either of the emergency diesel generators. Therfore, reactor operation is permitted for up to seven days with both delayed-access offsite power sources lost.

Each of the diesel generator units is capable of supplying 100 percent of the minimum emergency loads required under postulated design basis accident conditions. Each unit is physically and electrically independent of the other and of any offsite power source. Therefore, one diesel generator can be allowed out of service for a period of seven days without jeopardizing the safety of the station.

In the event that both startup transformers are lost, adequate power is available to operate the emergency safeguards equipment from either of the emergency diesel generators or from either of the delayed-access offsite power sources. Also, in the event that both emergency diesel generators are lost, adequate power is available immediately to operate the emergency safeguards equipment from at least one of the startup transformers or from either of the delayed-access offiste power sources within six hours. The plant is designed to accept one hundred percent load rejection without adverse effects to the plant or the transmission system. Network stability analysis studies indicate that the loss of Vermont Yankee unit will not cause inability and consequent ripping of the connecting 345 kv and 115 kv lines. The Vernon feed is an independent source. Thus, the availability of the delayed-access offsite power sources is assured in the event of a turbine trip. Therefore, reactor operation is permitted with the startup transformers out of service and with one diesel generator out of service provided the NRC is notifed immediatley of the event and restoration plans.

Either of the two station batteries has enough capacity to energize the vital buses and supply d-c power to the other emergency equipment for 8 hours without being recharged. In addition, two 24 volt ECCS Instrumentation batteries supply power to instruments that provide automatic initiation of the ECCS and some reactor pressure and indication in the control room.

Due to the high reliability of probability of unwarranted shutdown by providing adequate time for reasonable repairs. This minimuzes the probability of unwarranted shutdown by providing adequate time for reasonable repairs. A station battery, ECCS Instrumentation battery, or an Uninterruptible Power System battery is considered inoperable if more than one cell is out of service. A cell will be considered out of service if its float voltage is below 2.13 volts and the specific gravity is below 1.190 at 77°F.

The battery room is ventilated to prevent accumulation of hydrogen gas. With a complete loss of the ventilation system, the accumulation of hydrogen would not exceed 4 percent concentration in 16 days. Therefore, on loss of battery room ventilation, the use of portable ventilation equipment and daily sampling provide assurance that potentially hazardous quantities of hydrogen gas will not accumulate.

C. The minimum diesel fuel supply of 25,000 gallons will supply one diesel generator for a minimum of seven days of operation satisfying the load requirements for the operation of the safeguards equipment. Additional fuel can be obtained and delivered to the site from nearby sources within the seven day period.

4.10 AUXILIARY ELECTRICAL POWER SYSTEMS

Bases:

A. The monthly tests of the diesel generators are conducted to check for equipment failures and deterioration. The test of the undervoltage automatic starting circuits will prove that each diesel will receive a start signal if a loss of voltage should occur on its emergency bus. The loading of each diesel generator is conducted to demonstrate proper operation at less than the continuous rating and at equalibrium operating conditions. Generator experience at other generator stations indicates that the testing frequency is adequate to assure a high reliability of operation should the system be required.