1. 007 EG2.4.11 001

Given the following plant conditions:

- The unit has just experienced an automatic reactor trip
- BOTH turbine stop valves are CLOSED
- TWO (2) turbine governor valves are CLOSED
- RCS pressure is 1860 psig
- T_{avg} is 542°F
- No SI equipment has actuated

S/G	Pressure	Steam Flows
A	895 psig	0.1 X 10^6 lbm/hr
B	915 psig	0.1 X 10^6 lbm/hr
C	835 psig	1.3 X 10^6 lbm/hr

Which ONE (1) of the following identifies the correct plant status and operator response?

The reactor is tripped, the turbine is:

A. NOT tripped

Trip the turbine AND verify TWO (2) charging pumps running

B.✓ Tripped

Verify TWO (2) charging pumps running

C. NOT tripped

Trip the turbine AND manually initiate SI

D. Tripped

Manually initiate SI

The correct answer is B.

A. Incorrect - The first part of the distractor is incorrect. In the PATH-1 basis document the turbine is considered tripped if both turbine stop valves are closed. During immediate actions the governor valves are checked but not required to be closed if both stop valves are closed. The second part of the distractor would be correct if the turbine was not considered tripped.

B. Correct.

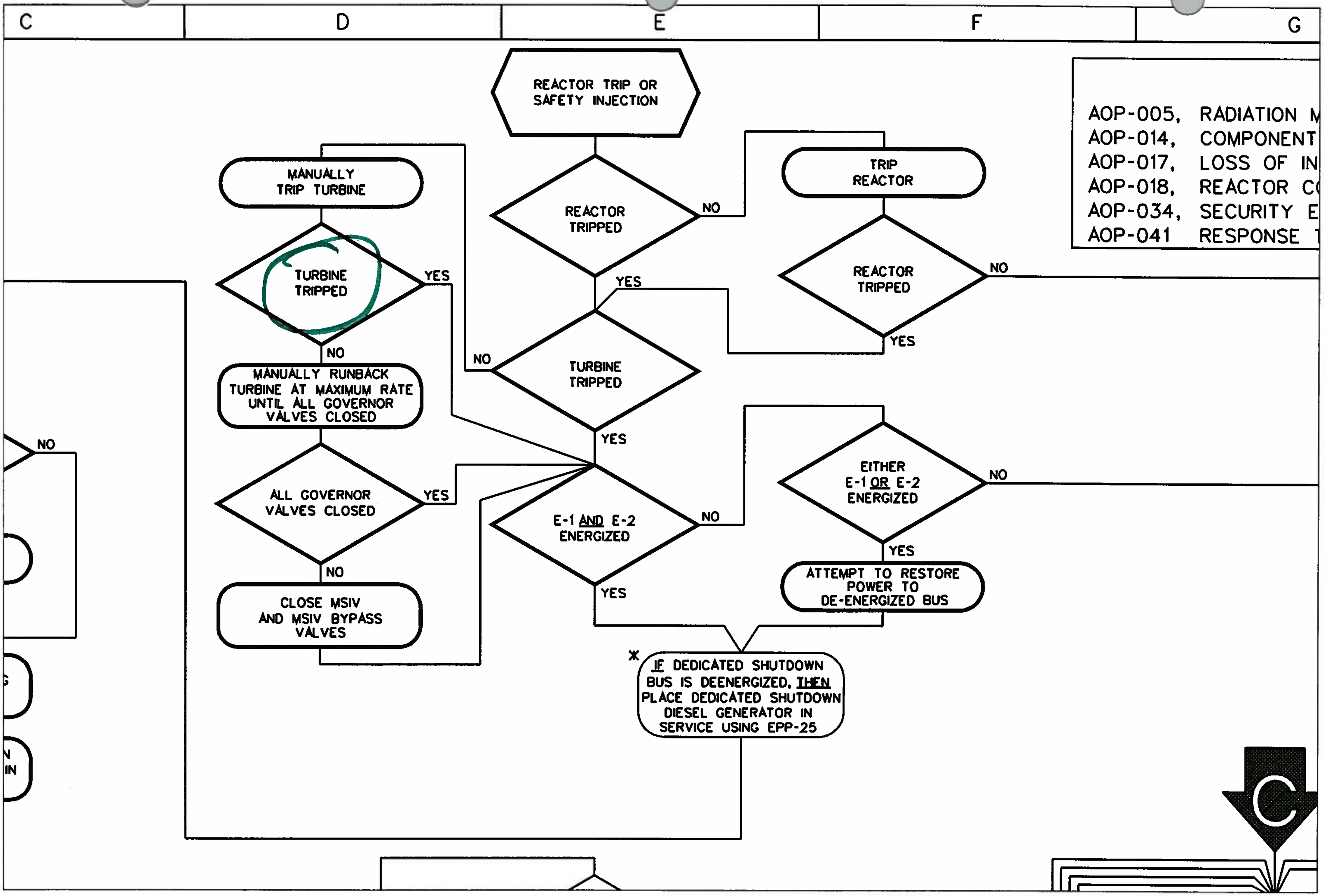
C. Incorrect - The first part of the distractor is incorrect. In the PATH-1 basis document the turbine is considered tripped if both turbine stop valves are closed. During immediate actions the governor valves are checked but not required to be closed if both stop valves are closed. The second part of the distractor is incorrect since no SI setpoint has been exceeded. The high steam flow with low Tave coincidence is not met since only one S/G has excessive steam flow.

D. Incorrect - The first part of distractor is correct. The second part of the distractor is incorrect since no SI setpoint has been exceeded. The high steam flow with low Tave coincidence is not met since only one S/G has excessive steam flow.

Question 1
Tier/Group 1/1
K/A Importance Rating - RO 4.0 SRO 4.2

Reactor Trip: Knowledge of abnormal condition procedures.

Reference(s) - Sim/Plant design, PATH-1, PATH-1 bases, ESFAS Logics
Proposed References to be provided to applicants during examination - None
Learning Objective - PATH-1-003
Question Source - BANK (Not used in an NRC Exam from 2004 to present.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.10 / 43.5 / 45.13
Comments -



C
D
E
F
G
REACTOR TRIP OR SAFETY INJECTION
REACTOR TRIPPED
NO
YES
TRIP REACTOR
REACTOR TRIPPED
NO
YES
TURBINE TRIPPED
NO
YES
MANUALLY TRIP TURBINE
TURBINE TRIPPED
YES
NO
MANUALLY RUNBACK TURBINE AT MAXIMUM RATE UNTIL ALL GOVERNOR VALVES CLOSED
ALL GOVERNOR VALVES CLOSED
YES
NO
CLOSE MSIV AND MSIV BYPASS VALVES
E-1 AND E-2 ENERGIZED
NO
YES
EITHER E-1 OR E-2 ENERGIZED
NO
YES
ATTEMPT TO RESTORE POWER TO DE-ENERGIZED BUS
* IF DEDICATED SHUTDOWN BUS IS DEENERGIZED, THEN PLACE DEDICATED SHUTDOWN DIESEL GENERATOR IN SERVICE USING EPP-25
AOP-005, RADIATION M
AOP-014, COMPONENT
AOP-017, LOSS OF IN
AOP-018, REACTOR C
AOP-034, SECURITY E
AOP-041 RESPONSE
NO
IN

GRID WOG STEP BASIS/DIFFERENCES

E-2 2 RNP STEP

TURBINE TRIPPED

WOG BASIS

PURPOSE: To ensure that the turbine is tripped

BASIS:

The turbine is tripped to prevent an uncontrolled cooldown of the RCS due to steam flow that the turbine would require.

RNP DIFFERENCES/REASONS

There are essentially no differences.

Interpretation

The ERG contains a substep to check ALL Stop Valves closed. At RNP there are two stop valves, if both are closed the turbine is considered tripped.

SSD DETERMINATION

This is not an SSD.

D-2 2 (RNO) RNP STEP

TRIP OR RUN BACK TURBINE

WOG BASIS

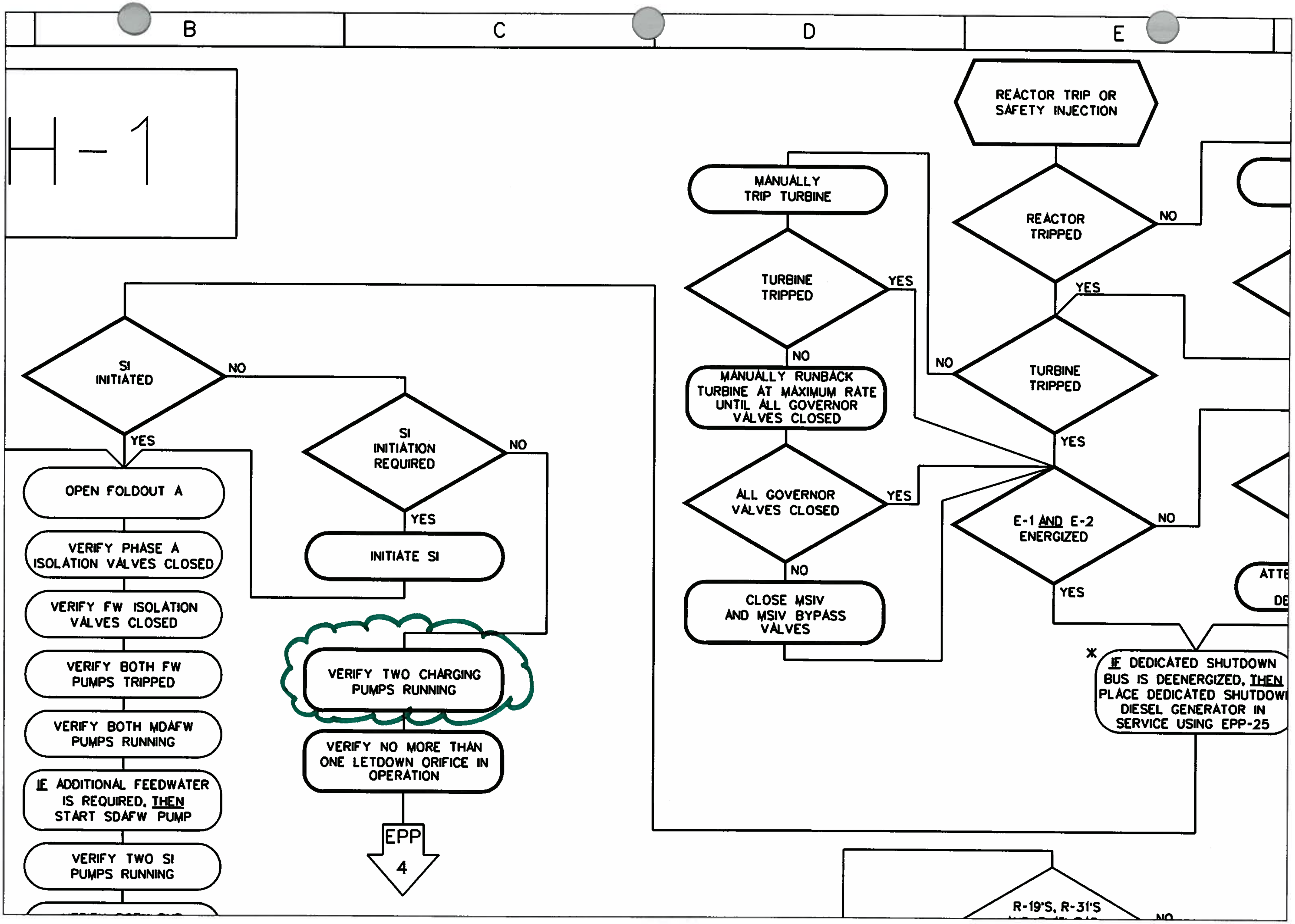
See ERG step 2 above.

RNP DIFFERENCES/REASONS

The RNP step has added additional actions to manually trip the turbine and if that is unsuccessful then to run the Turbine back until all governor valves are closed and should that fail, then to close the MSIVs and Bypasses.

SSD DETERMINATION

This is an SSD per criterion 10.


B
C
D
E
H-1
REACTOR TRIP OR SAFETY INJECTION
REACTOR TRIPPED
YES
NO
TURBINE TRIPPED
YES
NO
MANUALLY TRIP TURBINE
TURBINE TRIPPED
YES
NO
MANUALLY RUNBACK TURBINE AT MAXIMUM RATE UNTIL ALL GOVERNOR VALVES CLOSED
ALL GOVERNOR VALVES CLOSED
YES
NO
CLOSE MSIV AND MSIV BYPASS VALVES
E-1 AND E-2 ENERGIZED
YES
NO
* IF DEDICATED SHUTDOWN BUS IS DEENERGIZED, THEN PLACE DEDICATED SHUTDOWN DIESEL GENERATOR IN SERVICE USING EPP-25
SI INITIATED
YES
NO
SI INITIATION REQUIRED
YES
NO
INITIATE SI
VERIFY TWO CHARGING PUMPS RUNNING
VERIFY NO MORE THAN ONE LETDOWN ORIFICE IN OPERATION
EPP 4
OPEN FOLDOUT A
VERIFY PHASE A ISOLATION VALVES CLOSED
VERIFY FW ISOLATION VALVES CLOSED
VERIFY BOTH FW PUMPS TRIPPED
VERIFY BOTH MDAFW PUMPS RUNNING
IF ADDITIONAL FEEDWATER IS REQUIRED, THEN START SDAFW PUMP
VERIFY TWO SI PUMPS RUNNING
R-19'S, R-31'S
NO

control systems.

4.1.1 Pressurizer Pressure (ESF-Figure-2)

Pressurizer Pressure measurement is one of the inputs used to generate a Safety Injection signal. Three pressure comparators (bistables) provide an input to a 2/3 matrix to generate a Safety Injection signal at 1715 psig lowering pressure. This signal provides protection against the following accidents: an inadvertent opening of a SG safety valve, a steam line break, a spectrum of rod control cluster assembly ejection accidents(rod ejections), inadvertent opening of a pressurizer safety or PORV, and a SG tube rupture.

This measurement is also used to provide:

Low and High pressure reactor trips

An input to the on-line algorithm to calculate the Overtemperature ΔT setpoints; and

An input, via independent transmitters which transmit signals to the Presssurizer Pressure Control System, is provided to achieve channel independence. No components are shared by the protection and control functions; they are either protection grade RPS inputs, located and designed as such, or they are part of the Pressurizer Pressure Control System.

The pressurizer pressure uses two-out-of-three RSPS logic. Since separate pressurizer pressure sensors are used for the control and RSPS channels, no interaction will occur. For more information on the pressurizer pressure detectors and pressurizer pressure control system refer to SD-059, Pressurizer and Pressurizer Relief Tank.

4.1.2 Reactor Coolant Temperature (ESF-Figure-1)

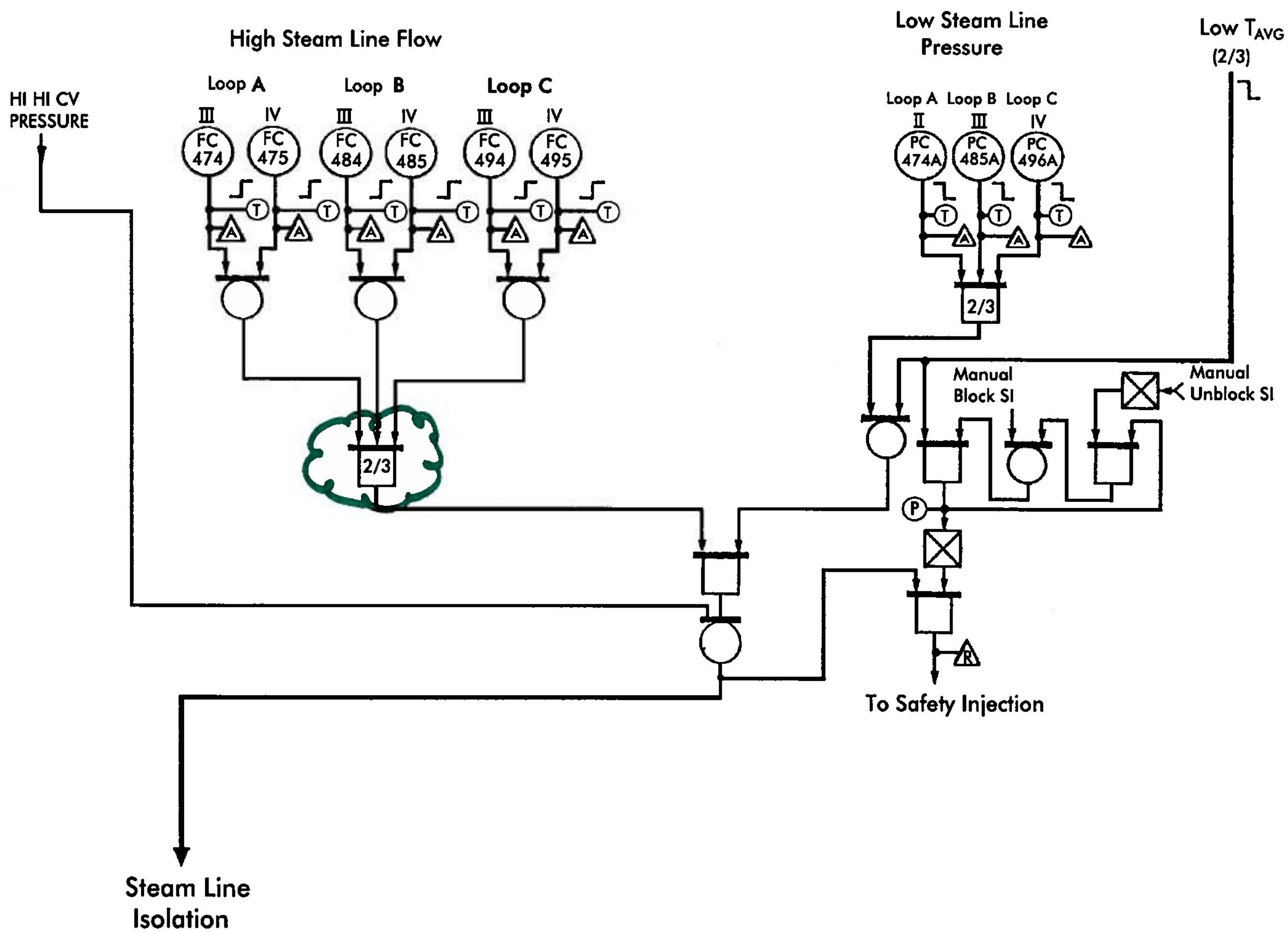
The RCS Low Tavg signal (2 of 3 channels below 543°F) is used to initiate the Safety Injection signal, when coincident with high steam flow; and close the Main Steam Isolation Valves, when coincident with high steam flow (i.e., generate the Steam Line Isolation Signal).

4.1.3 Steam Flow (ESF-Figure-1)

Hi Steam Flow (37.25% flow at no load to 20% load, increases linearly to 109% at full load) detected by at least one sensor on two of three steam lines, coincident with low Tavg (543°F) or low steam line pressure (614 psig), generates a Safety Injection signal and closes all MSIVs. Two flow controllers on each steam line are used to sense high steam line flow. This circuit is designed to detect steam line breaks downstream of the

HIGH STEAM LINE FLOW
ESF-FIGURE-1

HIGH STEAM LINE FLOW



INFORMATION USE ONLY

MSIVs.

4.1.4 Steam Line Pressure (ESF-Figure-1 & 3)

Steam Line Pressure measurement is utilized for steam line break protection. Low steam line pressure (614 psig) in two of three main steam lines or Low Tavg (543°F) in two of three loops, coincident with high steam line flow in two-of-three main steam lines, will initiate the Steam Line Isolation and Safety Injection signals. This is to protect against: a steam line break downstream of the main steam check valves, a feed line break, and/or an inadvertent opening of a SG safety.

In addition, each steam line pressure measurement is compared with a main steam header pressure measurement to determine if a high steam line differential pressure exists. A coincidence of two-of-three steam line differential pressures (100 psid) in any one steam line, that is, steam line pressure lower than main steam header pressure, will initiate a Safety Injection signal.

The steam header pressure is electronically limited to a minimum value of 585 psig. Therefore, this SI signal must be blocked before a plant cooldown is started to prevent SI actuation when S/G pressures drop below 485 psig(approximately 467°F). The steam line differential pressure circuit detects faults upstream of the MSIVs. Since the steam line check valves prevent reverse flow to the faulted S/G, excessive steam line differential pressure does not close the MSIVs.

4.1.5 Containment Pressure (ESF-Figure-4 & 5)

Containment Pressure measurement is utilized to initiate Emergency Core Cooling in response to a Loss of Coolant Accident (LOCA), and to provide containment pressure protection for either a LOCA, a feed line break inside containment, or a Main Steam Line Break inside containment. Nine pressure comparators, with inputs from six pressure transmitters, are used as inputs to ESFAS. Three pressure comparators provide an input for Hi Containment Pressure at 4 psig increasing pressure. Six pressure comparators provide an input for Hi-Hi Containment Pressure at 10 psig.

A coincidence of two of three Hi Containment Pressure (4 psig) will initiate a Safety Injection signal.

A coincidence of two separate two-of-three Hi-Hi Containment Pressure signals (10 psig), i.e., two-of-three twice, will initiate the following signals:

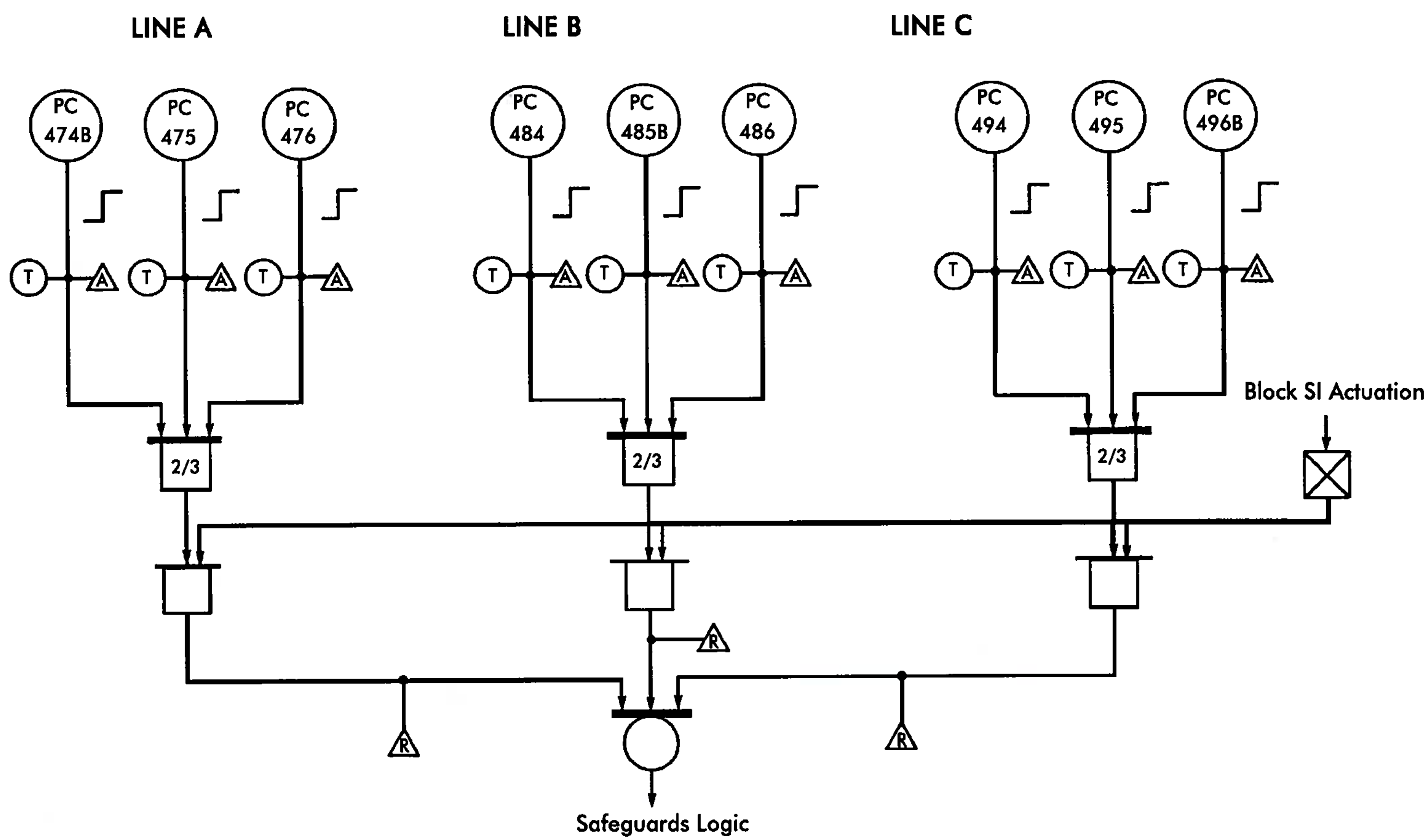
Steam Line Isolation,
Containment Spray Actuation
Containment Isolation Phase "B"
Safety Injection Signal(This SI is not credited and is blocked by the Tavg Block)

HIGH STEAM LINE DIFFERENTIAL PRESSURE

ESF-FIGURE-3

High Steam Line Differential Pressure

100 psid



INFORMATION USE ONLY

2. 008 AK2.03 001

Given the following plant conditions:

- The plant is at 100% RTP.
- PC-444J, PZR PRESS, has failed **HIGH**.

Assuming **NO** operator actions are taken, which ONE (1) of the following completes the following statement?

The FIRST reactor trip signal will be generated when the reactor protection __(1)__ setpoint is exceeded.

PCV-455C, PZR PORV, will receive a closed signal once pressurizer pressure lowers below __(2)__ psig.

A.✓ (1) OTdeltaT

(2) 2000

B. (1) Low Pressurizer Pressure

(2) 2000

C. (1) OTdeltaT

(2) 1715

D. (1) Low Pressurizer Pressure

(2) 1715

The correct answer is A.

A. Correct.

B. Incorrect - At 100% RTP the failed open PORV will have a large impact on the OTdeltaT setpoint. It has been proven on numerous scenarios on the simulator that the reactor will trip on OTdeltaT vice Low Pressurizer Pressure at high power levels. At low power levels the Low Pressurizer Pressure setpoint will typically be the cause of the reactor trip. The second part of the distractor is correct.

C. Incorrect - The first part of distractor is correct. The second part is incorrect. The pressurizer pressure protection channels will provide an input to close PCV-455C once pressure has lowered below 2000 psig. 1715 psig is the low pressure safety injection setpoint.

D. Incorrect - At 100% RTP the failed open PORV will have a large impact on the OTdeltaT setpoint. It has been proven on numerous scenarios on the simulator that the reactor will trip on OTdeltaT vice Low Pressurizer Pressure at high power levels. At low power levels the Low Pressurizer Pressure setpoint will typically be the cause of the reactor trip. The second part is incorrect. The pressurizer pressure protection channels will provide an input to close PCV-455C once pressure has lowered below 2000 psig. 1715 psig is the low pressure safety injection setpoint.

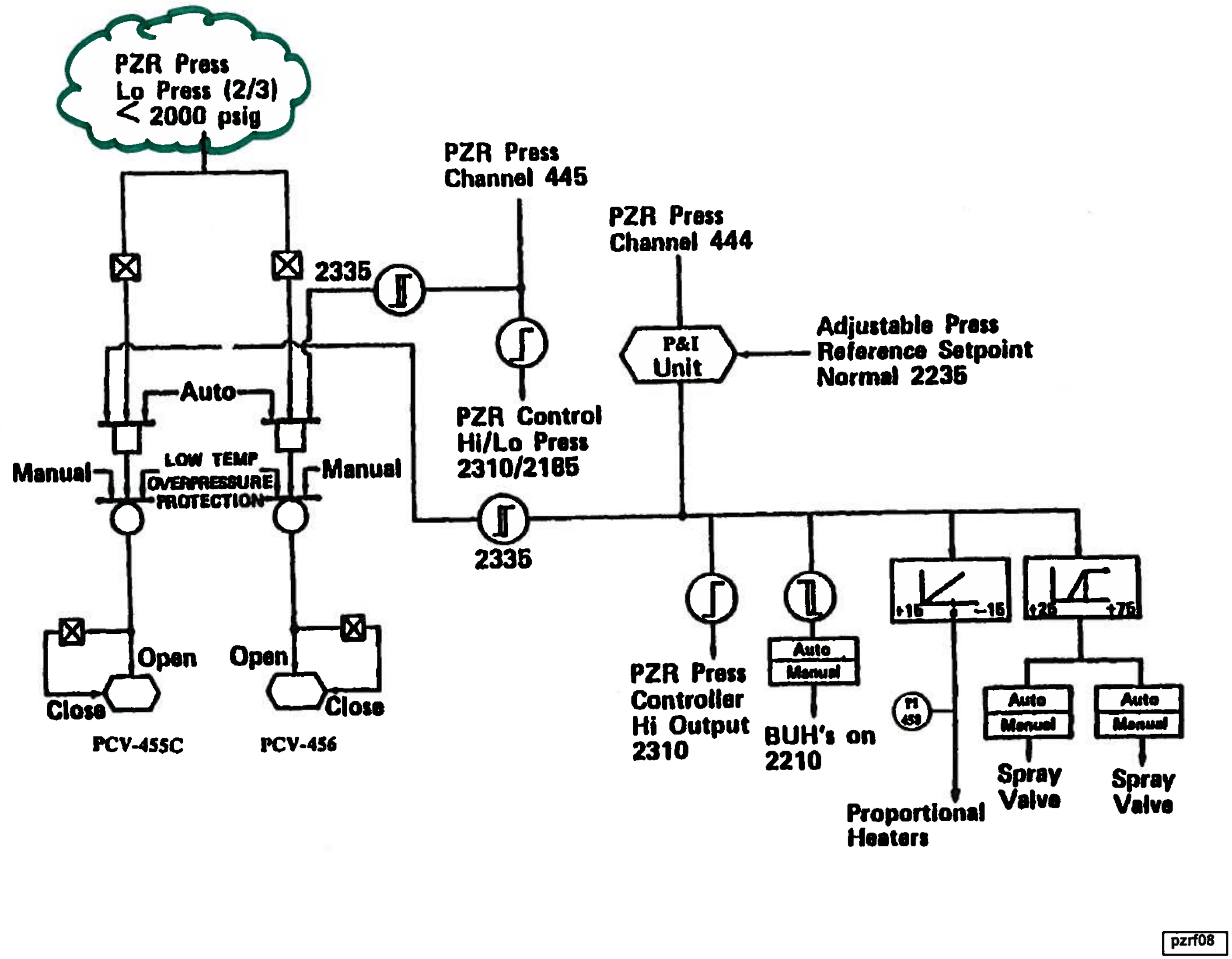
Question 2
Tier/Group 1/1
K/A Importance Rating - RO 2.5 SRO 2.4

Knowledge of the interrelations between the Pressurizer Vapor Space Accident and the following: Controllers and positioners

Reference(s) - Sim/Plant design, System Description, RPS / ESFAS Logics
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-019-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.6 / 45.4
Comments -

PRESSURE CONTROLLER

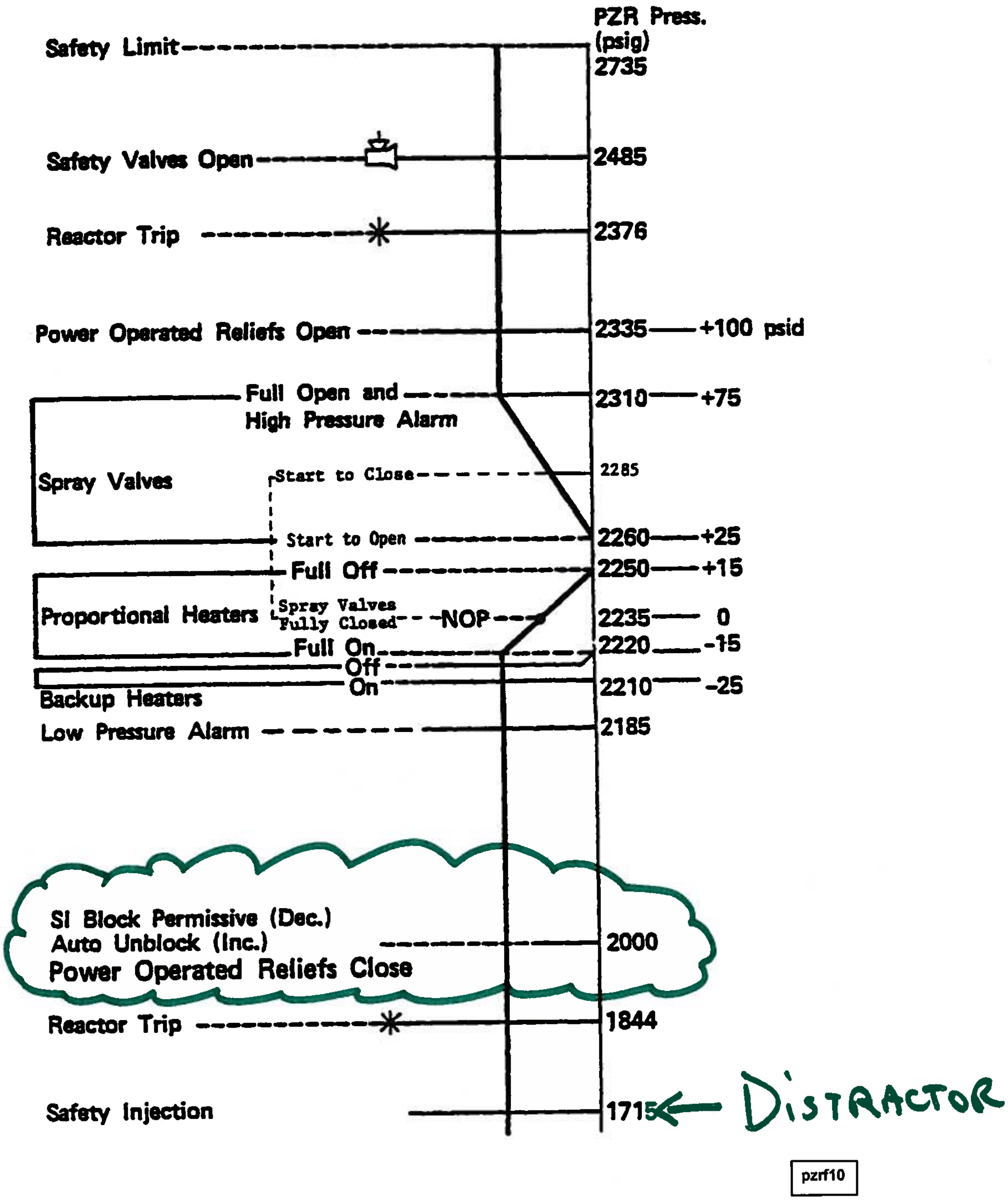
PZR-FIGURE-6



INFORMATION USE ONLY

PRESSURE SETPOINTS

PZR-FIGURE-8



INFORMATION USE ONLY

of load without reactor trip or any other control, except that the secondary plant safety valves are assumed to operate when steam pressure reaches their set point. A water seal is maintained below each valve seat to inhibit leakage. A resistance temperature detector (RTD) is installed in the discharge piping for each valve.

The RTD provides indication and a high temperature alarm in the control room to warn the operator of an actuated safety valve or safety valve seat leakage. Acoustic monitors are also installed on each of the three safety valves. These monitors are located in the Cable Spreading Room where they provide local indication. Control Room indication and alarm is provided to warn the operators of an actuated safety valve or safety valve seat leakage.

3.5.2 PORVs (PCV-455C & 456) (PZR-Figure 4)

Number	2
Service	Open-Close air diaphragm
Relief capacity	210,000 lb/hr per valve
Set Pressure	2335 psig
Fluid	Saturated Steam
Relief Line Design Temperature	470°F
Relief Line Design Pressure	500 psig
Relief Line Diameter	3 inches

The two PORVs PCV-455C, powered from 125 VDC Circuit 7 on Distribution Panel "B", and PCV-456, powered from 125VDC Circuit 19 on Distribution Panel "A", have dual activating pressures. Whenever RCS temperature is above 360 F, the OVERPRESSURE PROTECTION switch is set for normal operation, and the valves will open at 2335 psig (except that PCV-455C is actuated by the variable output of a controller. That output is proportional to the error signal and reset, so that it may open at less than 2335 psig). During normal operation, the PORVs limit any pressure excursion and, thus, limit the operation of the spring-loaded PZR safety valves. An interlock with PT-455, 456, and 457 exists. This interlock will prevent the PORV's from opening unless two of three transmitters see RCS pressure greater than 2000 psig. Motor-operated Block Valves, RC-535 and RC-536, powered from 480V MCC-6, located ahead of the PORVs, are provided in order to isolate the PORVs from service should they fail to close, or leak excessively. The Block Valves may remain closed during normal operation to isolate a PORV experiencing excessive seat leakage.

Whenever the RCS temperature is between 360°F and 350°F, RCS pressure is between 375 psig and 350 psig, the OVERPRESSURE PROTECTION switch must be set for low pressure operation. The setpoint for opening is 400 psig at 360°F or less and increases as RCS temperature increases to a maximum setpoint of 2500 psig at 472°F. This

control systems.

4.1.1 Pressurizer Pressure (ESF-Figure-2)

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4.1.3 Steam Flow (ESF-Figure-1)

Hi Steam Flow (37.25% flow at no load to 20% load, increases linearly to 109% at full load) detected by at least one sensor on two of three steam lines, coincident with low Tavg (543°F) or low steam line pressure (614 psig), generates a Safety Injection signal and closes all MSIVs. Two flow controllers on each steam line are used to sense high steam line flow. This circuit is designed to detect steam line breaks downstream of the

When an Intermediate Range Channel is blocked or bypassed, the Rod Stop associated with that Intermediate Range is blocked.

b. Setpoint - NC-35F, NC-36F/Reactor Trip Current equivalent to 25% Full Power

Setpoint - NC-35E, NC-36E/Rod Stop Current equivalent to 20% Full Power

4.1.5.3 Power Range High Flux Trip - Low Setpoint (Figure 20)

a. The Power Range High Flux Trip - Low Setpoint provides protection for power excursions beginning from low power during a startup and trips the Reactor when 2 out of 4 Power Range Channels exceeds the Trip Setpoint. The trip may be manually blocked when 2 out of 4 Power Range Channels exceed 10% (P-10). The manual block is automatically removed when 3 out of 4 Power Range Channels are below 10% (P-10).

b. Setpoint - NC-41P, NC-42P, NC-43P, NC-44P/24% Reactor Power

4.1.5.4 Power Range High Flux Trip - High Setpoint (Figure 21)

a. The Power Range High Flux Trip – High trip function ensures that protection is provided, from all power levels, against a positive reactivity excursion leading to DNB during power operations. These can be caused by rod withdrawal or reduction in RCS temperature. The Power Range High Flux - High Setpoint trips the Reactor when 2 out of 4 Power Range Channels exceeds the Trip Setpoint. The trip cannot be blocked.

b. Setpoint - NC-41R, NC-42R, NC-43R, NC-44R/108% Reactor Power *

* May be set at lower values based on plant conditions.

4.1.5.5 Overtemperature ΔT Trip (OTΔT) (Figure 22)

a. The OTΔT Trip provides protection for the Reactor against Departures from Nucleate Boiling (DNB) and trips the Reactor when 2 out of 3 Reactor Coolant Loop ΔT's (T_h-T_c) exceeds the calculated ΔT Setpoint. The OTΔT Setpoint is not a fixed number. It is calculated continuously with inputs from Tavg, PZR Pressure, and Power Range Upper & Lower detector Current Signals f(ΔI). To help prevent this trip from occurring, when the OTΔT nears the Reactor Trip Setpoint:

1. Control Rod withdrawal capability is blocked (Auto/Manual Rod withdrawal is disabled) when 2 out of 3 Reactor Coolant Loop ΔT's exceeds the calculated ΔT setpoint.

2. A Turbine Runback is initiated when 2 out of 3 Reactor Coolant Loop ΔT's exceeds the calculated ΔT setpoint.

b. Setpoint

$$\leq \Delta T_0 \left[K_1 - K_2 \frac{(1 + \tau_1 S)}{(1 + \tau_2 S)} (T - T') + K_3 (P - 2235) - f(\Delta I)\right]$$

ΔT_0 = indicated ΔT at RTP, in °F, for the channel being calibrated
S is the Laplace transform operator, sec^{-1}
T = measured average temperature, °F
T' = 575.9°F, Tavg at RTP
P = PZR pressure, psig
$K_1 \leq 1.1265$
$K_2 = 0.01228$ per °F
$K_3 = 0.00089$ per psig
(TM-412E, TM-422E, TM-432E) $\tau_1 = 20$ seconds
$\tau_2 = 3$ seconds
(NM-412C, NM-422C, NM-432C) f(ΔI) No effect until ΔI is >+12% RTP or < - 17% RTP

The setpoint formula allows the trip setpoint to be > or < K_1 (112.65%)

4.1.5.6 Overpower ΔT Trip (OPΔT) (Figure 23)

a. The OPΔT Trip provides protection for the Reactor against exceeding the Linear Power Rating (KW/ft) of the fuel rods and trips the Reactor when 2 out of 3 Reactor Coolant Loop ΔT's (T_h-T_c) exceeds the calculated ΔT Setpoint. The OPΔT Setpoint is not a fixed number. It is calculated continuously with inputs from Tavg and Power Range Upper & Lower detector Current Signals f(ΔI). To help prevent this trip from occurring, when the OPΔT nears the Reactor Trip Setpoint:

1. Control Rod withdrawal is blocked when 2 out of 3 Reactor Coolant Loop ΔT's exceeds the calculated ΔT setpoints. (Auto/Manual Rod withdrawal is disabled)

2. A Turbine Runback is initiated when 2 out of 3 Reactor Coolant Loop ΔT's exceeds the calculated ΔT setpoint.

1. Above 10% (P-7) 2 out of 3 RCP Breakers Open

2. Above 40% (P-8) 1 out of 3 RCP Breakers Open

3. No trip occurs below 10% (P-7) for any Loss of Flow

4.1.5.9 RCP Bus UV Trip (Figure 28)

a. The RCP Bus UV Trip provides protection for the Reactor against DNB as a result of a loss of voltage to more than one RCP. This trip occurs when an UV condition exists on 2 out of 3 RCP Buses when above 10% (P-7). This trip is automatically blocked below 10% (P-7).

   This trip assures a Reactor Trip Signal is generated before the Low Flow Trip Setpoint is reached.

b. Setpoint - 75% of nominal Bus Voltage

4.1.5.10 RCP Bus Underfrequency Trip (Not a direct reactor trip) (Figure 28)

a. The RCP Bus Underfrequency Trip trips the RCP breakers. RCP breaker open signal trips the reactor which provides protection for the Reactor against DNB as a result of an underfrequency on more than one RCP Bus. This trip occurs when an underfrequency condition exists on 2 out of 3 RCP Buses when above 10% (P-7). This trip is automatically blocked below 10% (P-7).

   This trip assures a Reactor Trip Signal is generated before the Low Flow Trip Setpoint is reached.

b. Setpoint - 58.2 Hertz

4.1.5.11 High PZR Pressure Trip (Figure 29)

a. The High PZR Pressure Trip provides protection for the Reactor Coolant System (RCS) against over pressurization and limits the range of required protection from the OTΔT Trip. This trip occurs when 2 out of 3 PZR Pressure Signals exceed the trip setpoint.

b. Setpoint - PC-455A, PC-456A, PC-457A/2376 psig

4.1.5.12 Low PZR Pressure Trip (Figure 30)

a. The Low PZR Pressure Trip provides protection against excessive void formation in the Reactor which could lead to a DNB ratio (DNBR) of < 1.17 and limits the necessary range of protection afforded by the OTΔT. This trip occurs when 2 out of 3 PZR Pressure Signals decreases below the trip setpoint. This trip is automatically blocked below 10% (P-7).

This trip is dynamically compensated based on the rate of change in pressure.

b. Setpoint - PC-455C, PC-456C, PC-457C
PM-455A, PM-456A, PM-457A

Trip Setpoint	1844 psig
Lead Time Constant	10 sec.
Lag Time Constant	1 sec.

4.1.5.13 High Pressurizer (PZR) Water Level Trip (Figure 31)

a. The High PZR Water Level Trip provides a back-up to the High PZR Pressure Trip and prevents the PZR Safety and Relief Valves from relieving water for credible accident conditions. This trip occurs when 2 out of 3 PZR Water Level Signals exceeds the trip setpoint. This trip is automatically blocked below 10% (P-7).

b. Setpoint - LC-459A, LC-460A, LC-461A/91% of span

4.1.5.14 Steam/Feedwater Flow Mismatch Trip (Figure 32)

a. The Steam/Feedwater Flow Mismatch Trip provides protection for the Reactor against an anticipated Loss of Heat Sink. This trip occurs when 1 out of 2 flow elements sense that Feedwater Flow is < Steam Flow and 1 out of 2 Steam Generator(S/G) Level Elements decrease below the setpoint in any S/G.

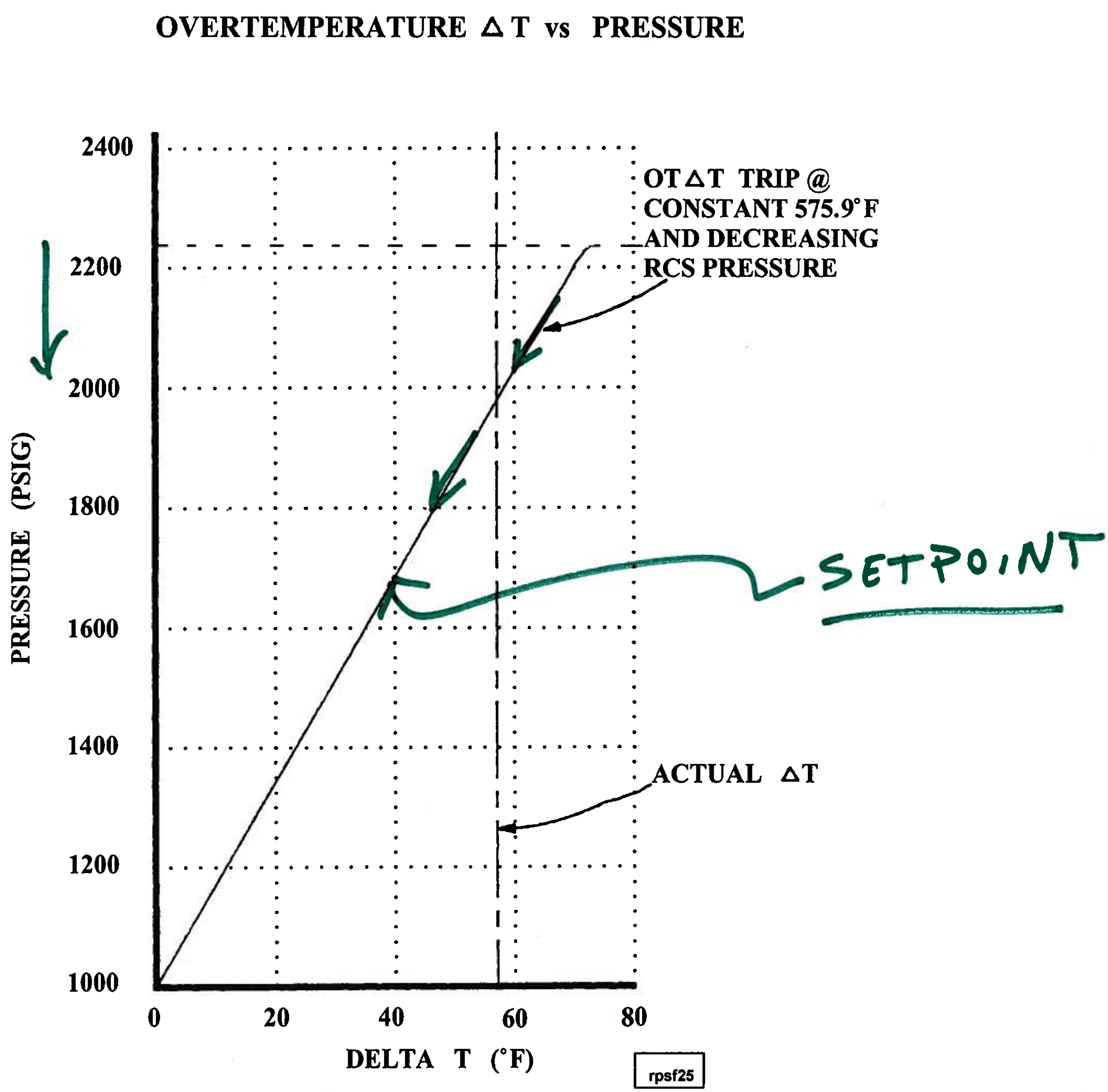
b. Setpoint - FC-478A, FC-478B/0.64 x 10^6 lbs/Hr
FC-488A, FC-488B/0.64 x 10^6 lbs/Hr
FC-498A, FC-498B/0.64 x 10^6 lbs/Hr
AND
LC-474B, LC-475B/30% of Span
LC-484B, LC-485B/30% of Span
LC-494B, LC-495B/30% of Span

4.1.5.15 S/G Low-Low Water Level Trip (Figure 33)

a. The S/G Low-Low Water Level Trip provides protection for the Reactor by preventing operation without adequate heat removal capability in the event of a sustained Steam/Feedwater Flow mismatch which is sufficiently small not to be sensed by the Steam/Feedwater Flow Mismatch Trip. This trip occurs when 2 out

OVERTEMPERATURE ΔT VS PRESSURE

RPS-FIGURE-25



3. 009 EK2.03 001

Given the following plant conditions:

- A LOCA has occurred.
- RCS pressure is 1100 psig and lowering.
- Containment pressure had peaked at 12 psig.
- The crew is performing actions of EPP-8, Post LOCA Cooldown and Depressurization.

Which ONE (1) of the following identifies the method that will be used to initiate cooldown of the RCS?

Initiate cooldown using the...

A. steam dumps at the maximum achievable rate.

B. steam dumps at no greater than 100°F per hour.

C. S/G PORVs at the maximum achievable rate.

D✓ S/G PORVs at no greater than 100°F per hour.

The correct answer is D.

A. Incorrect - Steam dumps are not available due to the MSIVs receiving a main steam line isolation signal at 10 psig CV pressure. Several EOPs procedures direct the operator to cooldown at maximum achievable rate.

B. Incorrect - Steam dumps are not available due to the MSIVs receiving a main steam line isolation signal at 10 psig CV pressure. Steam dumps are the preferred means of cooling down, if available. The cooldown rate is correct.

C. Incorrect. The first part of distractor is correct. Several EOPs procedures direct the operator to cooldown at maximum achievable rate. A 100° F/hr limit is utilized to preclude violation of the Integrity Status Tree thermal shock limits.

D. Correct.

Question 3
Tier/Group 1/1
K/A Importance Rating - RO 3.0 SRO 3.3

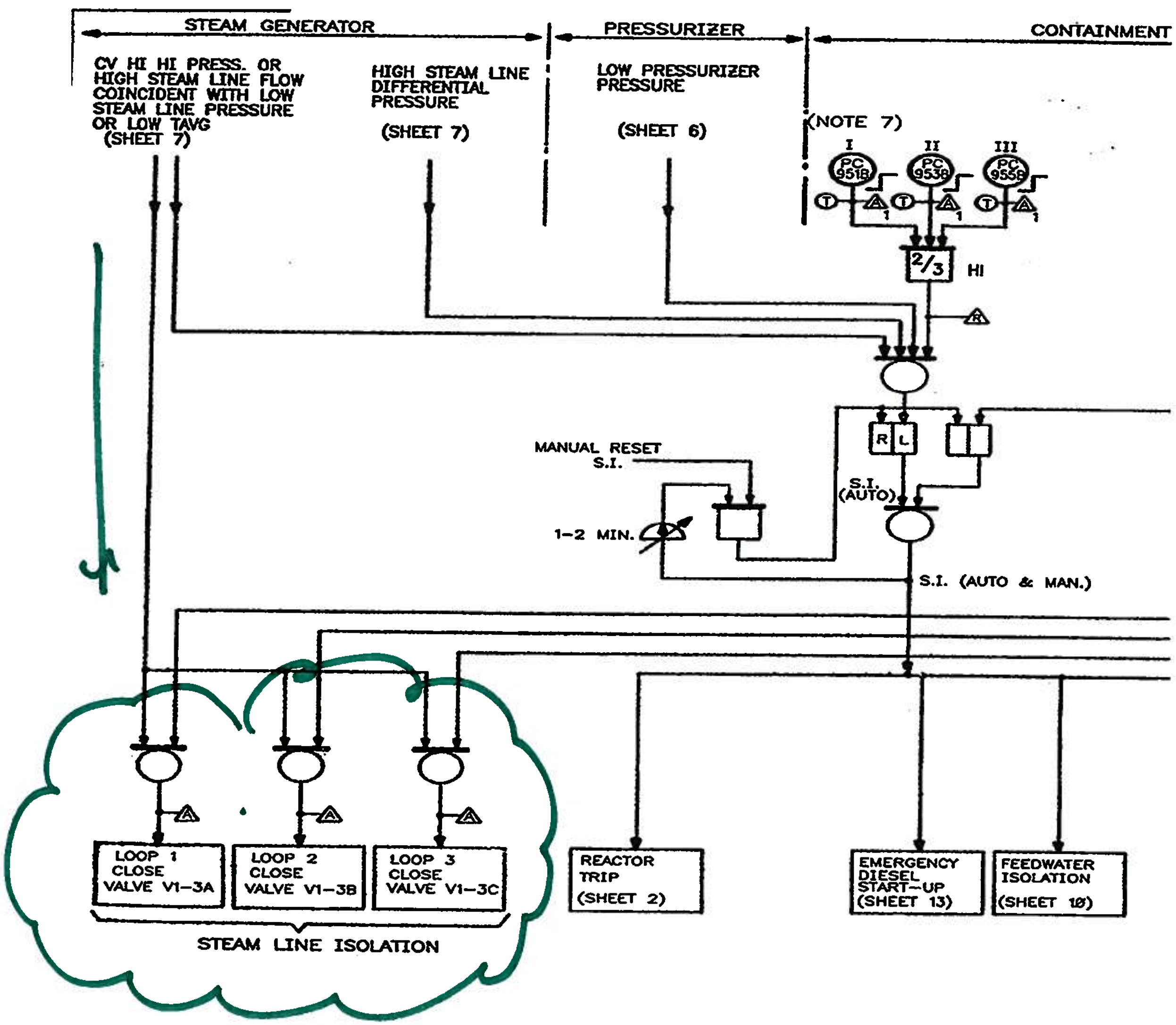
Knowledge of the interrelations between the small break LOCA and the following: S/Gs

Reference(s) - Sim/Plant design, EPP-8, ESFAS Logics, EOP Network
Proposed References to be provided to applicants during examination - None
Learning Objective - EPP-8-004
Question Source - BANK (Used on 2007 NRC Exam.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7
Comments -

SAFEGUARD ACTUATION SIGNALS

ESF-FIGURE-5

10#



INFORMATION USE ONLY

ATTACHMENT 10.2
Page 1 of 1

ESF PHASE B ISOLATION SIGNAL VALVE OPERATION

The following Valves CLOSE:

CC-716A & B RCP Cooling Water Inlet Isolation
FCV-626 RCP Thermal Barrier Flow Control
CC-735 RCP Thermal Barrier Outlet Isolation
CVC -381 RCP Seal Water Return Isolation
CC-730 RCP Oil Coolers Outlet Isolation
Steamline Isolation (for Auto Containment Phase B Isolation only)

Containment Ventilation Isolation (for manual initiation of Containment Phase B Isolation only) pushbuttons on the RTGB. IVSW is reset by two manual pushbuttons, one for each train, located in a cabinet in the Unit 2 Cable Spreading Room. Feedwater isolation is reset by key switches on the RTGB.

6.2 Spray Actuation 10#

When a Containment Spray signal is generated, it will perform the following:

1. A. Automatic Signal:
   - Steamline Isolation - Shuts all three Main Steam isolation valves.

   B. Manual Signal:
   - C.V. Ventilation Isolation - Shuts C.V. Purge Valves, Pressure Relief Valves, and Vacuum Relief Valves.

2. Spray Actuation - It starts both Containment Spray Pumps, and opens valves 880A, 880B, 880C, 880D, 845A, and 845B. This will deliver borated water with sodium hydroxide to the CV atmosphere to depressurize and remove free iodine.

   A Containment Spray signal can be reset/overridden after actuation if it becomes necessary to stop or realign equipment actuated by the Containment Spray signal. Resetting/Overriding the signal will not terminate Containment spray or cause any component actuated by the Containment Spray signal to change state. Once the signal is overridden, no further automatic Containment Spray actuations will occur until all automatic actuation signals have cleared. A key operated CV SPRAY RESET switch on the RTGB is used to reset a CV Spray signal. Operation of the switch from the NORMAL position will actuate an annunciator on APP-002-C1; FEEDWATER ISO/CV SPRAY OVRD/RESET. Until the Containment Spray signal is reset/overridden, any Containment Spray actuated equipment stopped from the RTGB cannot be restarted without removing and reinstalling that equipment's control power fuses. This is due to the anti-pump feature of the equipment breakers. The Phase "B" Containment Isolation must be reset individually after the Containment Spray signal is cleared or overridden. Phase "B" Containment Isolation is reset from a pushbutton on the RTGB. This is normally required in the EOP network when < 4 psig in the Containment. This allows stopping components and restoring Phase "B" isolation valves.

3. Phase "B" Containment Isolation - This signal will further isolate the containment by shutting containment isolation valves as follows:
   - CC-716A CC to R.C.P. "A", "B", "C" and C.R.D. Cool Isol
   - CC-716B CC to R.C.P. "A", "B", "C" and C.R.D. Cool Isol
   - CVC-381 RCP Seal Water Return
   - CC-735 CC from R.C.P. "A", "B", "C" Thermal Barrier Isol.
   - CC-730 CC from R.C.P. "A", "B", "C" Oil Cool Isol.

corresponding to 37.25% flow at no load to 20% load and increases linearly to 109% at full load. Load is a function of turbine first stage pressure.
Low steam line pressure (2/3 lines) 614 psig

Low T_{avg} - (2/3 loops) 543 °F

2. High steam line differential pressure. (2/3 per line, 1/3 Lines)

   (P_{Header} - P_{Line}) 100 psid

   P_{Header} has a low limit pressure setpoint which prevents this signal from decreasing below 585 psig.

3. Low pressurizer pressure (2/3 pressures)
   Pressurizer pressure 1715 psig

4. Containment high pressure (2/3) 4 psig

5. Manual (1/2) either pushbutton

6. Containment Hi-Hi Pressure (2/3 on both trains) 10 psig

4.4.2 Containment Spray Signal

1. Containment Hi-Hi Pressure (2/3 on both trains) 10 psig

2. Manual (2/2) depressing both pushbuttons is required.

4.5 Alarms

APP-002-A1 LOSS OF DC PWR TO 480V BUS E1 UV CHANNEL
APP-002-A2 SAFEGUARDS LOGIC TEST
APP-002-B1 LOSS OF DC PWR TO 480V BUS E2 UV CHANNEL
APP-002-B2 SAFEGUARD PWR SUPPLY FAILURE
APP-002-C1 FW ISOLATION/CV SPRAY OVRD/RESET
APP-002-C2 CV ISOL PHASE A
APP-002-D1 SPRAY ACTUATION
APP-002-D2 CV ISOL PHASE B
APP-002-F6 AUTO S.I. SIGNAL OVERRIDDEN
APP-004-A1 S/G A STM LINE HI ΔP SFGRD/TRIP
APP-004-B1 S/G B STM LINE HI ΔP SFGRD/TRIP
APP-004-C1 S/G C STM LINE ΔP SFGRD/TRIP
APP-004-D1 PZR LO PRESS SFGRD/TRIP
APP-004-E1 HI STM FLO LO TAVG/LO SLP SFGRD/TRIP
APP-004-E4 CV HI PRESS SFGRD/TRIP
APP-004-E5 MANUAL SI TRIP

MSIVs.

4.1.4 Steam Line Pressure (ESF-Figure-1 & 3)

Steam Line Pressure measurement is utilized for steam line break protection. Low steam line pressure (614 psig) in two of three main steam lines or Low Tavg (543°F) in two of three loops, coincident with high steam line flow in two-of-three main steam lines, will initiate the Steam Line Isolation and Safety Injection signals. This is to protect against: a steam line break downstream of the main steam check valves, a feed line break, and/or an inadvertent opening of a SG safety.

In addition, each steam line pressure measurement is compared with a main steam header pressure measurement to determine if a high steam line differential pressure exists. A coincidence of two-of-three steam line differential pressures (100 psid) in any one steam line, that is, steam line pressure lower than main steam header pressure, will initiate a Safety Injection signal.

The steam header pressure is electronically limited to a minimum value of 585 psig. Therefore, this SI signal must be blocked before a plant cooldown is started to prevent SI actuation when S/G pressures drop below 485 psig(approximately 467°F). The steam line differential pressure circuit detects faults upstream of the MSIVs. Since the steam line check valves prevent reverse flow to the faulted S/G, excessive steam line differential pressure does not close the MSIVs.

4.1.5 Containment Pressure (ESF-Figure-4 & 5)

Containment Pressure measurement is utilized to initiate Emergency Core Cooling in response to a Loss of Coolant Accident (LOCA), and to provide containment pressure protection for either a LOCA, a feed line break inside containment, or a Main Steam Line Break inside containment. Nine pressure comparators, with inputs from six pressure transmitters, are used as inputs to ESFAS. Three pressure comparators provide an input for Hi Containment Pressure at 4 psig increasing pressure. Six pressure comparators provide an input for Hi-Hi Containment Pressure at 10 psig.

A coincidence of two of three Hi Containment Pressure (4 psig) will initiate a Safety Injection signal.

A coincidence of two separate two-of-three Hi-Hi Containment Pressure signals (10 psig), i.e., two-of-three twice, will initiate the following signals:

Steam Line Isolation,
Containment Spray Actuation
Containment Isolation Phase "B"
Safety Injection Signal(This SI is not credited and is blocked by the Tavg Block)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

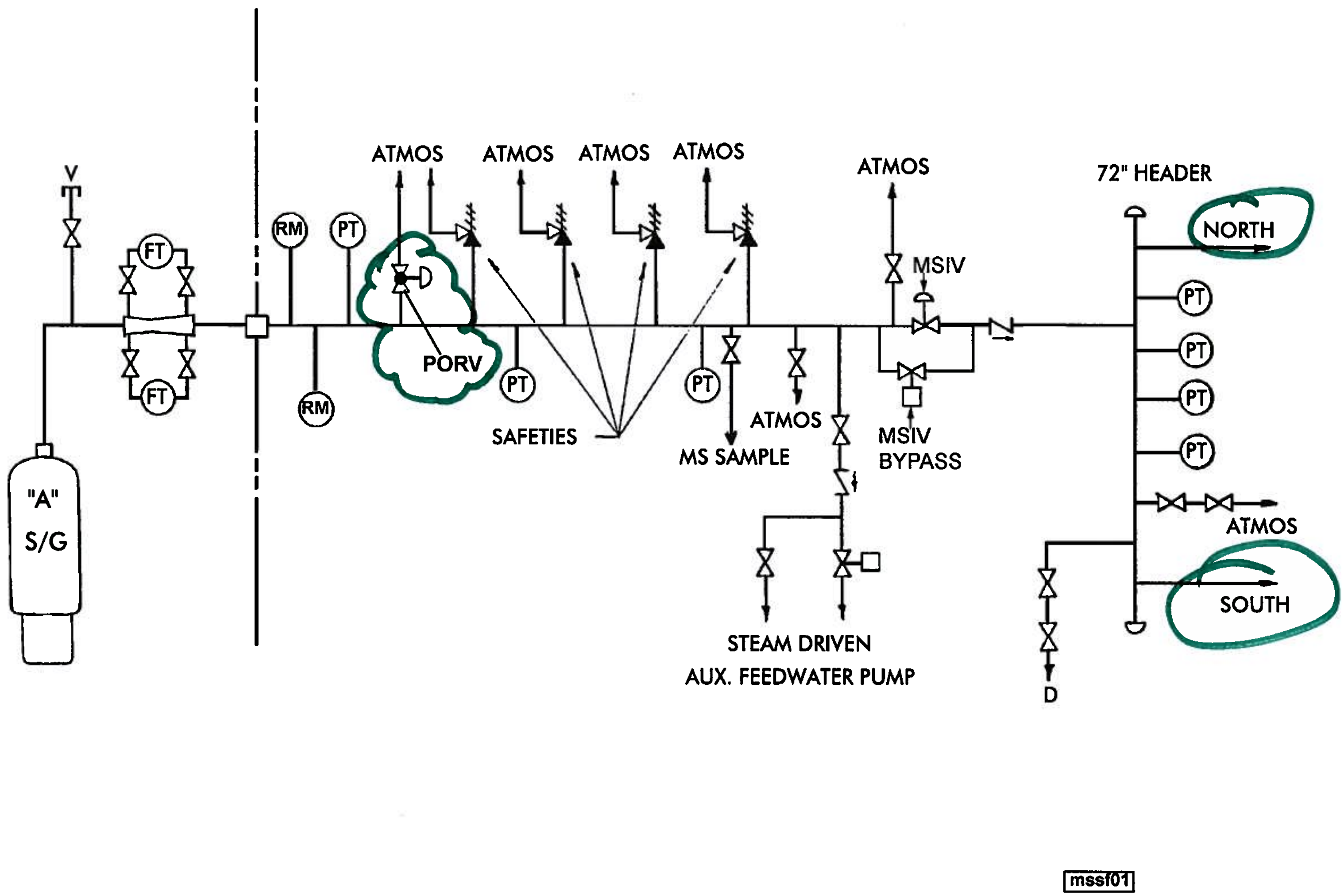
NOTE

- A differential pressure of 210 psid across the RCP number 1 seals is necessary for continued RCP operation.
- RCS cooldown should be completed as quickly as possible since the RCS may continue to depressurize to a value that may not support differential pressure across the RCP number 1 seals.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
11.	Initiate RCS Cooldown To Cold Shutdown As Follows:	
	a. Maintain cooldown rate in RCS cold legs less than 100°F/hr in the last 60 minute	
	b. Maintain RCS temperature and pressure within limits of curve 3.4, reactor coolant system pressure - temperature limitations for cooldown	
	c. Check steam dump to Condenser - AVAILABLE	c. Dump steam from intact S/Gs using STEAM LINE PORVs. Go To Step 12.
	d. Dump steam to Condenser from intact S/Gs	
12.	Check RCS Hot Leg Temperatures - LESS THAN 543°F	WHEN RCS hot leg temperatures less than 543°F, THEN Go To Step 13.

SYSTEM DIAGRAM (S/G TO 72" HEADER)

MSS-FIGURE-1 (Rev 0)



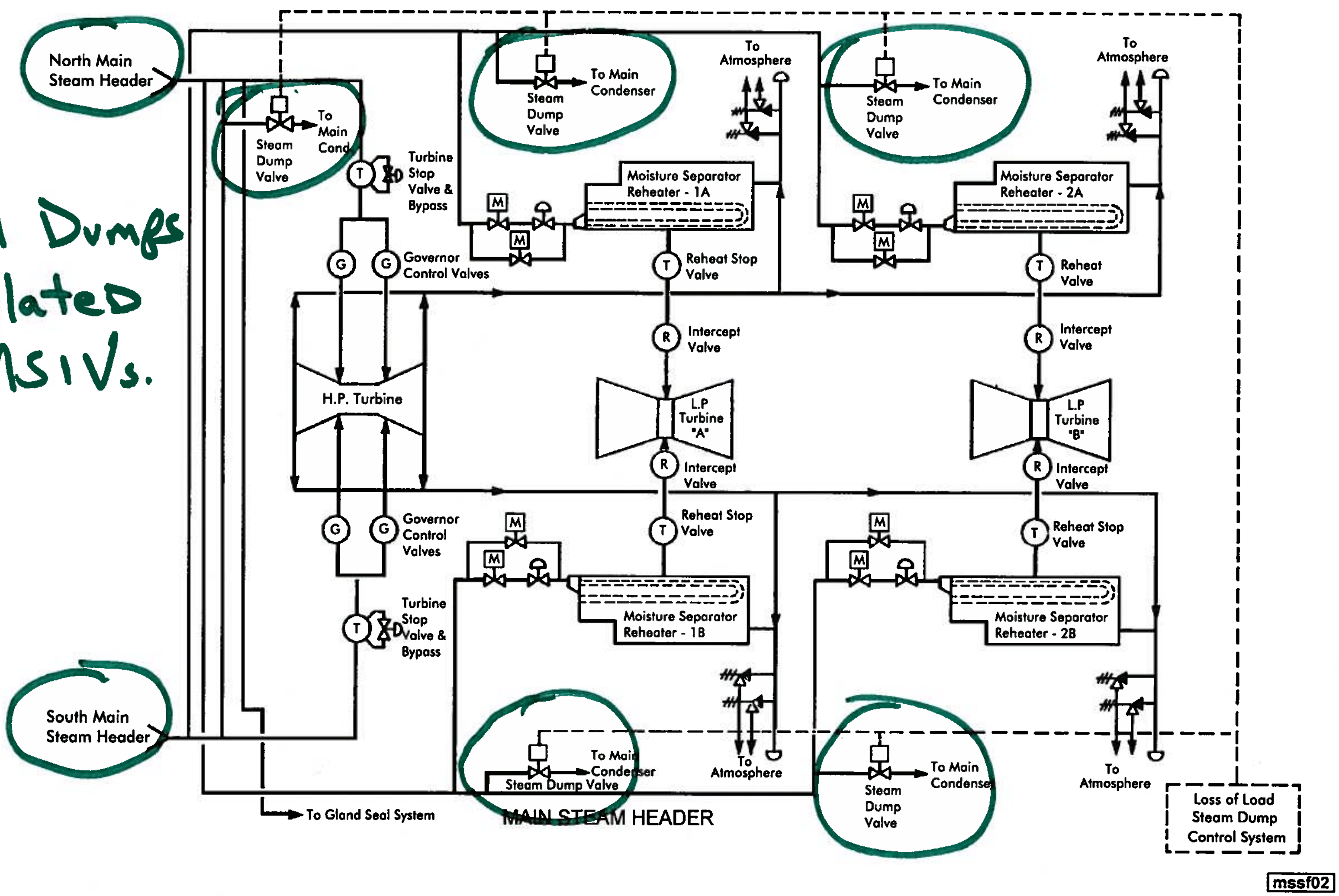
INFORMATION USE ONLY

SYSTEM DIAGRAM 72" HEADER TO LP TURBINE

MSS-FIGURE-2 (Rev 2)

Distractor

STEAM Dumps Isolated by MSIVs.



INFORMATION USE ONLY

CONTINUOUS USE

ATTACHMENT 4

LOCAL STEAM DUMP

(Page 1 of 6)

****

CAUTION

Any S/G that has been isolated using Supplement G should remain isolated.

****

NOTE

- Flashlights and any handtools needed are located with AOP/EOP/DSP Tool Kits.
- A locked valve Key is required to perform this attachment.

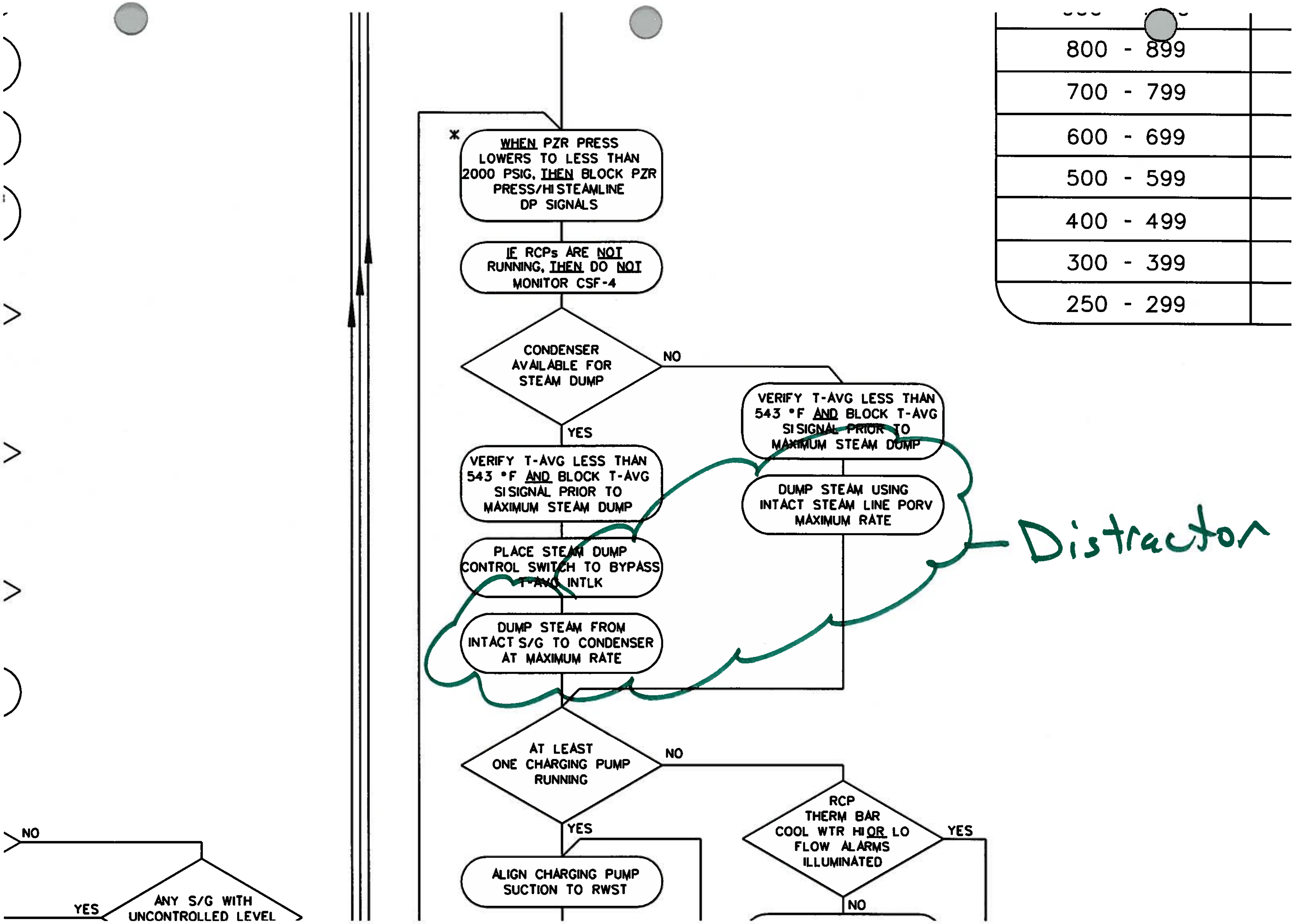
1. Locally Align The Following Steam Valves To Dump Steam At Maximum Rate:

   Distractor

   a. Unlock and Open the MSIV BYPASS Valves

      - MS-353A, MSIV V1-3A BYPASS
      - MS-353B, MSIV V1-3B BYPASS
      - MS-353C, MSIV V1-3C BYPASS

(CONTINUED NEXT PAGE)


800 - 899
700 - 799
600 - 699
500 - 599
400 - 499
300 - 399
250 - 299
*
WHEN PZR PRESS LOWERS TO LESS THAN 2000 PSIG, THEN BLOCK PZR PRESS/HI STEAMLINE DP SIGNALS
IF RCPs ARE NOT RUNNING, THEN DO NOT MONITOR CSF-4
CONDENSER AVAILABLE FOR STEAM DUMP
NO
YES
VERIFY T-AVG LESS THAN 543 °F AND BLOCK T-AVG SI SIGNAL PRIOR TO MAXIMUM STEAM DUMP
PLACE STEAM DUMP CONTROL SWITCH TO BYPASS T-AVG INTLK
DUMP STEAM FROM INTACT S/G TO CONDENSER AT MAXIMUM RATE
VERIFY T-AVG LESS THAN 543 °F AND BLOCK T-AVG SI SIGNAL PRIOR TO MAXIMUM STEAM DUMP
DUMP STEAM USING INTACT STEAM LINE PORV MAXIMUM RATE
Distractor
AT LEAST ONE CHARGING PUMP RUNNING
NO
YES
ALIGN CHARGING PUMP SUCTION TO RWST
RCP THERM BAR COOL WTR HI OR LO FLOW ALARMS ILLUMINATED
YES
NO
ANY S/G WITH UNCONTROLLED LEVEL
YES
NO

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

- Partial uncovery of S/G tubes is acceptable in the following steps due to steaming faster than feeding.
- After the Low Steamline Pressure SI Signal is blocked, main steamline isolation will occur if the high steam flow rate setpoint is exceeded.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
*21.	Depressurize All Intact S/Gs To 140 PSIG As Follows:	
	a. Check Steam Dump to Condenser - AVAILABLE	a. Dump steam at maximum rate using STEAM LINE PORVs. Go To Step 21.c.
	b. Dump steam to Condenser at maximum rate	Distractor
	c. Check RCS Hot Leg Temperatures - LESS THAN 543°F	c. WHEN RCS hot leg temperatures less than 543°F, THEN perform Step 21.d. Go To Step 21.e.
	d. Defeat Low Tavg Safety Injection Signal as follows: 1) Momentarily place SAFETY INJECTION T-AVG Selector Switch to BLOCK position 2) Verify LO TEMP SAFETY INJECTION BLOCKED status light - ILLUMINATED	
	e. Check S/G pressures - LESS THAN 140 PSIG	e. IF S/G pressure is lowering, THEN observe NOTE prior to Step 19 and Go To Step 19. IF S/G pressure is rising, THEN Go To Step 28.

(CONTINUED NEXT PAGE)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

****

CAUTION

The SI Accumulator Discharge Valves must be closed when S/G pressure is less than 240 psig to prevent nitrogen injection into the RCS.

****

24. Depressurize Selected S/G With The Lowest Level To Less Than 600 PSIG By Dumping Steam At Maximum Rate Using One Of The Following Methods Listed In Order Of Preference:

Distractor

- Steam Dump to condenser via the pressure control mode

  OR

- Steam Line PORVs controlled by Instrument Air

  OR

- Steam Line PORVs controlled by Nitrogen per Attachment 2 of AOP-017, Loss of Instrument Air

4. 011 EK1.01 001

Which ONE(1) of the following completes the statement below?

During a LOCA, as RCS pressure and inventory are reduced the correct sequence for modes of core cooling is __(1)__ and a method to enhance these modes of core cooling is maintaining __(2)__.

A.✓ (1) Natural Circulation, then Reflux Boiling

(2) S/G levels

B. (1) Natural Circulation, then Reflux Boiling

(2) S/G pressure higher than RCS pressure

C. (1) Reflux Boiling, then Natural Circulation

(2) S/G levels

D. (1) Reflux Boiling, then Natural Circulation

(2) S/G pressure higher than RCS pressure

The correct answer is A.

A. Correct.

B. Incorrect - First part of distractor is correct. Steaming from the steam generators is preferred to enhance the cooling. The basis document for PATH-1 states that if the operator suspects fuel damage that it is advantageous to keep the secondary side pressure above the primary side pressure in order to minimize radiological releases.

C. Incorrect - Natural circulation should exist after the RCPs are tripped. As inventory is reduced such that the hot leg openings are uncovered, reflux boiling begins to take place. The second part of the distractor is correct.

D. Incorrect - Natural circulation should exist after the RCPs are tripped. As inventory is reduced such that the hot leg openings are uncovered, reflux boiling begins to take place. Steaming from the steam generators is preferred to enhance the cooling. The basis document for PATH-1 states that if the operator suspects fuel damage that it is advantageous to keep the secondary side pressure above the primary side pressure in order to minimize radiological releases.

Question 4
Tier/Group 1/1
K/A Importance Rating - RO 4.1 SRO 4.4

Knowledge of the operational implications of the following concepts as they apply to the Large Break LOCA : Natural circulation and cooling, including reflux boiling.

Reference(s) - Sim/Plant design, PATH-1 Basis Document
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-C.1-003
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.8 / 41.10 / 45.3
Comments -

Case A has been analyzed to a long term stable condition. For breaks in this category, the establishment of an equilibrium pressure where pumped SI equals break flow constitutes a safe and stable condition for the long term, provided that the steam generator heat sink is maintained until such time that the break flow and SI sensible heat can remove all the decay heat. Once equilibrium pressure was established, the core was covered and adequate flow existed to remove decay heat through the steam generator with a small amount of voiding. This stable and safe condition could go on without interruption for a long period of time. The only change in the primary system conditions through the transient for this case is a gradual decrease in fluid temperatures which is beneficial, since it indicates that adequate core cooling is being maintained.

The equilibrium pressure condition is stable for the long term provided that SI and auxiliary feedwater are available. Since the RCS pressure at the equilibrium condition is determined by a balance between break and SI flowrate, in order to depressurize to a cold shutdown condition it is necessary to cool the primary fluid further while stepping down the SI flowrate. Long-term cooldown/depressurization of the plant is performed using guideline ES-1.2, POST LOCA COOLDOWN AND DEPRESSURIZATION.

Breaks 3/8" < diameter <~ 1", maximum safety injection

Maximum safety injection (all high-head SI pumps operating) for a break in this range of size would have little impact on the results given for the previous case (Category 2) with minimum safety injection. The main effect would be a slightly higher equilibrium pressure where safety injection flow matches break flow. Therefore, this case was not included in the analysis.

Breaks ~ 1" < diameter <~ 13-1/2" ($1FT^2$)

For break sizes of one to two-inch in equivalent diameter, the RCS will rapidly depressurize early in the transient, and an automatic reactor trip and safety injection signal will be generated based on low pressurizer pressure. During the early stages of the depressurization, when the system is still full of two-phase liquid, the break flow, which also will be mostly liquid, is not capable of removing all the decay heat. Therefore, the early depressurization is limited by energy removal considerations, and the RCS pressure will temporarily hang up above the steam generator safety valve set pressure, assuming no steam dump is available. The RCS pressure stays at this level in order to provide a temperature difference from primary to secondary so that core heat may be removed by the steam generator. At this energy-balance controlled pressure, however, pumped safety injection flow is less than the break flow, and there is a net loss of mass in the RCS. Voiding throughout the primary side occurs and eventually the RCS begins to drain, starting from the top of the steam generator tubes. The rate of RCS drain is determined by the net loss of liquid inventory, a function of both SI flow and break size.

Prior to the occurrence of draining, heat is removed from the steam generator through continuous two-phase natural circulation, with two-phase mixture flowing over the top of the steam generator tubes. As the draining continues, the natural circulation mode of heat removal as just defined ceases, and core heat is removed through condensation of steam in the steam generator. This method of heat removal is called reflux and is discussed in Reference 2.

The condensation mode of heat removal is almost as efficient as continuous two-phase natural circulation in removing heat. However, condensation heat transfer coefficients may be lower than continuous two-phase natural circulation heat transfer coefficients. Thus, as the steam generator tubes drain, a slight increase in primary system pressure occurs to give a greater delta T from primary to secondary in order to remove all the decay heat. The steam generator secondary side pressurizes to the safety valve set pressure early in the transient, and remains there throughout the natural circulation and steam condensation heat removal modes. Eventually the mixture level on the primary side may drop completely below the steam generator tubes and begin to drain other regions in the RCS. Depending on the location of the break, the draining may partially uncover the core.

For example, for a cold leg break liquid in the crossover leg region (loop seal) will block steam from the break, and the core must partially uncover in order to create a vent path for steam to exit from the core, upper plenum, hot legs and steam generators through to the break. The RCS draining occurs until such time that the break location uncovers, and break flow switches from two-phase to all steam. For hot leg or pressurizer vapor space breaks, however, the steam vent path exists without the need for the crossover leg region (loop seal) to clear of all liquid. Thus, no core uncovery is predicted.

As soon as the break flow becomes all steam flow for breaks in this range of size, steam generated in the core can exit out the break, and further system depressurization occurs. Safety injection flow increases to greater than the break flow, and there is no longer a net loss of mass from the RCS. No further core uncovery will occur under these conditions. Once the break flow has become all steam flow, the volume removed through the break is greater, so that the RCS depressurizes. Because of the RCS depressurization the safety injection flow increases and results in additional cooling since the safety injection water is subcooled. The steam generator may still be relied upon for heat removal by the condensation mode. However, only a small amount of heat removal by the steam generator is necessary and, with minimum auxiliary feedwater available, the steam generator secondary side will now begin to slowly depressurize below the steam generator safety valve set pressure. The primary system will also slowly depressurize along with the secondary side, but will remain slightly above the secondary side in pressure to maintain the necessary delta T to remove a portion of core heat that the break and subcooled SI together cannot remove.

The RCS mixture level elevation will rise to the hot and cold leg elevations, and the break flow will oscillate from all steam flow to a two-phase flow. The RCS pressure will stabilize in the long term at the pressure at which the safety injection flow matches the break flow on a time averaged, or integral basis. This equilibration will not occur on an instantaneous basis since break flow will be oscillatory from steam to two-phase. But over an interval of time very long into the transient, when long term stability has been established, the relationship of safety injection equal to "averaged" break flow will exist.

Another sample transient has been analyzed to further illustrate and supplement the previous discussion. Although the sample transient is for a plant which includes charging pumps in the SI system, the basic plant behavior for a break this large is essentially the same as that for a plant which does not include the charging pumps in the SI system. The analysis assumptions and a description of the transient, with reference to the previous general discussion, is provided below.

Case B — Standard 4-loop type plant, two-inch equivalent diameter hole in the cold leg, minimum safeguards safety injection. Loss of offsite power is assumed to occur at the reactor trip time and it is assumed that the only means of venting steam on the secondary side is through the steam generator safety valves. Minimum auxiliary feedwater is available one minute after the reactor trip time. The analytical model and all other analysis assumptions are in conformance with Appendix K criteria.

This analysis demonstrates much of the phenomena discussed previously. The RCS pressure plot, Figure 6, shows a rapid depressurization to approximately 1200 psig at 5 minutes. The RCS pressure rises slightly from 1200 psig until approximately 30 minutes. The steam generator primary side drains during this period of slightly rising pressure. The crossover leg begins to drain at the time when the steam generator empties, and continues to drain until the flow path at the bottom of the crossover leg vents steam at about 30 minutes. This draining occurs because of the location of the break for this sample case, i.e., the cold leg.

Immediately after the draining of the crossover leg (clearing of loop seal), the break uncovers and the break flow becomes all steam. This can be seen by a rapid decrease in break flow at that time on the plot in Figure 7, indicating a change from two-phase to all steam flow. Because the location of the break in this sample transient is the cold leg, the core level also decreases in conjunction with the crossover leg draining (Figure 8). The core level will decrease to the point where the hydrostatic head developed between the downcomer and the core is greater than the hydrostatic head that develops between the upside and draining downside of the crossover leg. At this point steam generated in the core prefers to flow around the loop seal rather than to continue to force the level in the core downward, since this path has less hydrostatic head to push against. This action allows steam to flow around the crossover leg and exit out the break. As steam is relieved out the break, the core pressure decreases relative to the downcomer pressure, and the hydrostatic head in the downcomer recovers the core. Note that this core level behavior is characteristic of a cold leg break of this size only. A hot leg break of this size would not uncover the core.

The RCS depressurizes slightly immediately after the break flow becomes all steam, and the pumped safety injection becomes greater than the break flow. This can be seen by comparing the pumped safety injection and break flow plots (Figures 9 and 7, respectively). The core has recovered at this point, ~32 minutes, and the level continues its increasing trend. From 32 minutes until about 50 minutes a slow system depressurization occurs. The system is still relying on the steam generator to remove heat, but to a lesser extent, since safety injection flow has been increased.

Note from the secondary side pressure plot, Figure 10, that during this period of time, the secondary side pressure drops below the safety valve setpoint and continues to decrease slowly. After about 65 minutes into the transient, the break and subcooled SI can remove all decay heat, and the primary and secondary side pressure plots show that secondary pressure is now greater than primary pressure. At this point the system is in a stable mode. The subcooled SI is slowly reducing voids in the primary system. At 66.7 minutes, the core void fraction is 0.13 and reduces to 0.09 at 83.3 minutes.

GRID	WOG STEP	BASIS/DIFFERENCES
J-15		RNP STEP

RNP STEP

ISOLATE FEED FLOW TO S/G WITH HIGH RADIATION

WOG BASIS

BASIS: (Rev 1C)

At this point the RCS pressure is low (below the low-head SI pump shutoff head pressure) and the plant is on cold leg recirculation. However, the secondary side may still be relatively hot and at a pressure significantly higher than the RCS. If this is the case, the operator should cool down and depressurize the secondary side by dumping steam from any intact SGs to aid in further cooldown and depressurization of the RCS. Steam should be dumped to the condenser, if possible, or directly to atmosphere using intact SG PORVs. To minimize offsite radiation doses the operator is instructed to obtain a dose projection before dumping steam from any SG and not to dump steam from any SG with an unacceptable dose projection.

KNOWLEDGE:

The operator should be aware that as a general rule if fuel damage is suspected (from high core exit thermocouple indications or from primary coolant samples), it is advantageous to keep the secondary side pressure above the primary side pressure in order to minimize radiological releases.

BASIS: (DW-99-058)

At this point the RCS pressure is low (below the low-head SI pump shutoff head pressure) and the plant is on cold leg recirculation. However, the secondary side may still be relatively hot and at a pressure significantly higher than the RCS. If this is the case, the operator should cool down and depressurize the secondary side by dumping steam from any intact SGs to aid in further cooldown and depressurization of the RCS and to remove heat from containment. Steam should be dumped to the condenser, if possible, or directly to atmosphere using intact SG PORVs. To minimize offsite radiation doses the operator is instructed to obtain a dose projection from the plant engineering staff before dumping steam from any SG and not to dump steam from any SG with an unacceptable dose projection.

If fuel damage has occurred following a LOCA, there is a potential for releasing appreciable quantities of radionuclides from the RCS through pre-existing SG tube leakage, if primary-to-secondary differential pressure is established. In order to prevent such a release, SG pressures must be maintained greater than RCS pressure when RCS activity is high. The plant engineering staff will determine dose projections based on current values of SG activity, RCS activity and containment activity. The extent of SG depressurization allowed in this step is based on those dose projections.

KNOWLEDGE:

Distractor

- o The operator should be aware that as a general rule if fuel damage is suspected (from high core exit thermocouple indications or from primary coolant samples), it is advantageous to keep the secondary side pressure above the primary side pressure in order to minimize radiological releases.

Additionally, portions of the Executive Volume Generic Issue "Evaluations By Plant Engineering Staff", section "Evaluating Offsite Dose Prior to Intentional Release", will be revised to read as follows:

5. 015 AK2.08 001

Given the following plant conditions:

At time 1852
- The plant experienced a reactor trip from 100% RTP.
- 480V Bus E-2 de-energized and operators manually energized the bus from its associated EDG.

At time 1918
- PCV-1716, Instrument Air Isolation to CV, failed closed and Air Operated Valves in Containment are repositioning to their fail position.

Which ONE (1) of the following completes the statement below?

At time 1933, RCP motor bearing temperatures will __(1)__ and RCP seal leakoff temperatures will __(2)__ the associated alarm setpoint.

A. (1) rise

(2) rise above

B. (1) rise

(2) remain below

C. (1) remain approximately constant

(2) rise above

D.✓ (1) remain approximately constant

(2) remain below

The correct answer is D.

A. Incorrect - In this situation, CVC-310A will fail open due to the loss of IA to containment. This will cause an initial increase in the charging flow through the charging path and a momentary lowering of the seal injection flow. The reduction in seal injection flow will cause the seal leakoff temperatures to rise approximately 1°F and then eventually lower back to the original value. A momentary loss of E-2 will cause a momentary loss of the ability to run "C" CCW pump. However, "A" and "B" CCW pumps are available and CCW flow to the RCPs will not be impacted. The motor bearing temperatures will remain relatively constant. To make this selection the candidate would have to assume that CCW was impacted by the events described.

B. Incorrect - See discussion in "A" above. To make this selection the candidate would have to assume that CCW was impacted and seal injection flow remained the same. The candidate must demonstrate knowledge of air operated valve fail positions and their impact on plant operations. The second half of distractor is correct.

C. Incorrect - The first part of distractor is correct. In this situation, CVC-310A will fail open due to the loss of IA to containment. This will cause an initial increase in the charging flow through the charging path and a momentary lowering of the seal injection flow. The reduction in seal injection flow will cause the seal leakoff temperatures to rise approximately 1°F and then eventually lower back to the original value. With two charging pumps running the PZR level will remain in its normal band. RCP Seal Leakoff temperatures are usually between 115°F and 130°F and will only rise a maximum of one degree before beginning to lower. The alarm setpoint for the RCP Seal Leakoff is 170°F.

D. Correct

Question 5
Tier/Group 1 / 1
K/A Importance Rating - RO 2.6 SRO 2.6

Knowledge of the interrelations between the Reactor Coolant Pump Malfunctions (Loss of RC Flow) and the following: CCWS

Reference(s) - Sim/Plant design, AOP-018, AOP-017, System Description, CVCS P&ID
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-014-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7
Comments - **Approved by MAB. Revised per phone discussion on 10/12/11 to test whether the seal leakoff temperatures rise or remain the same. Subsequently, further runs were performed on the simulator and determined that seal leakoff temperatures only rise about 1°F and then begin to lower. Never approached the Seal Leakoff High Temperature alarm.**

ATTACHMENT 1

MAJOR COMPONENTS AFFECTED BY LOSS OF IA

(Page 1 of 5)

1. Chemical and Volume Control System Components FAIL POSITION

   a. APP-003-F3, CHG PMP LO SPEED - ILLUMINATED (Loss of air to pressure switch downstream of I/P Convertor)

   b. CHARGING PUMP SPEED CONTROL - NO FAILURE (Back-Up Air)

   c. CVC-200 A, B & C, LTDN ORIFICES - CLOSED

   d. CVC-204 A & B, LTDN LINE ISOs - CLOSED

   e. CVC-303 A, B & C, SEAL LEAKOFFS - OPEN

   f. CVC-307, PRI SEAL BYP ISO - CLOSED

   g. CVC-310A, LOOP 1 HOT LEG CHG - OPEN

   h. CVC-310B, LOOP 2 COLD LEG CHG - OPEN

   i. CVC-311, AUX PZR SPRAY - CLOSED

   j. CVC-387, EXCESS LTDN STOP - CLOSED

   k. CVC-389, EXCESS LTDN DIV - FAILS TO VCT

   l. CVCS HUT LEVEL CONTROLLERS - FORCED LOW

   m. FCV-113A, BA TO BLENDER - OPEN

   n. FCV-113B, BLENDED MU TO CHG SUCTION - CLOSED

   o. FCV-114A, PW TO BLENDER - CLOSED

   p. FCV-114B, BLENDED MU TO VCT - CLOSED

   q. HCV-105, BORIC ACID TK B RECIRC - CLOSED

   r. HCV-110, BORIC ACID TK A RECIRC - CLOSED

   s. HCV-121, CHARGING FLOW - OPEN

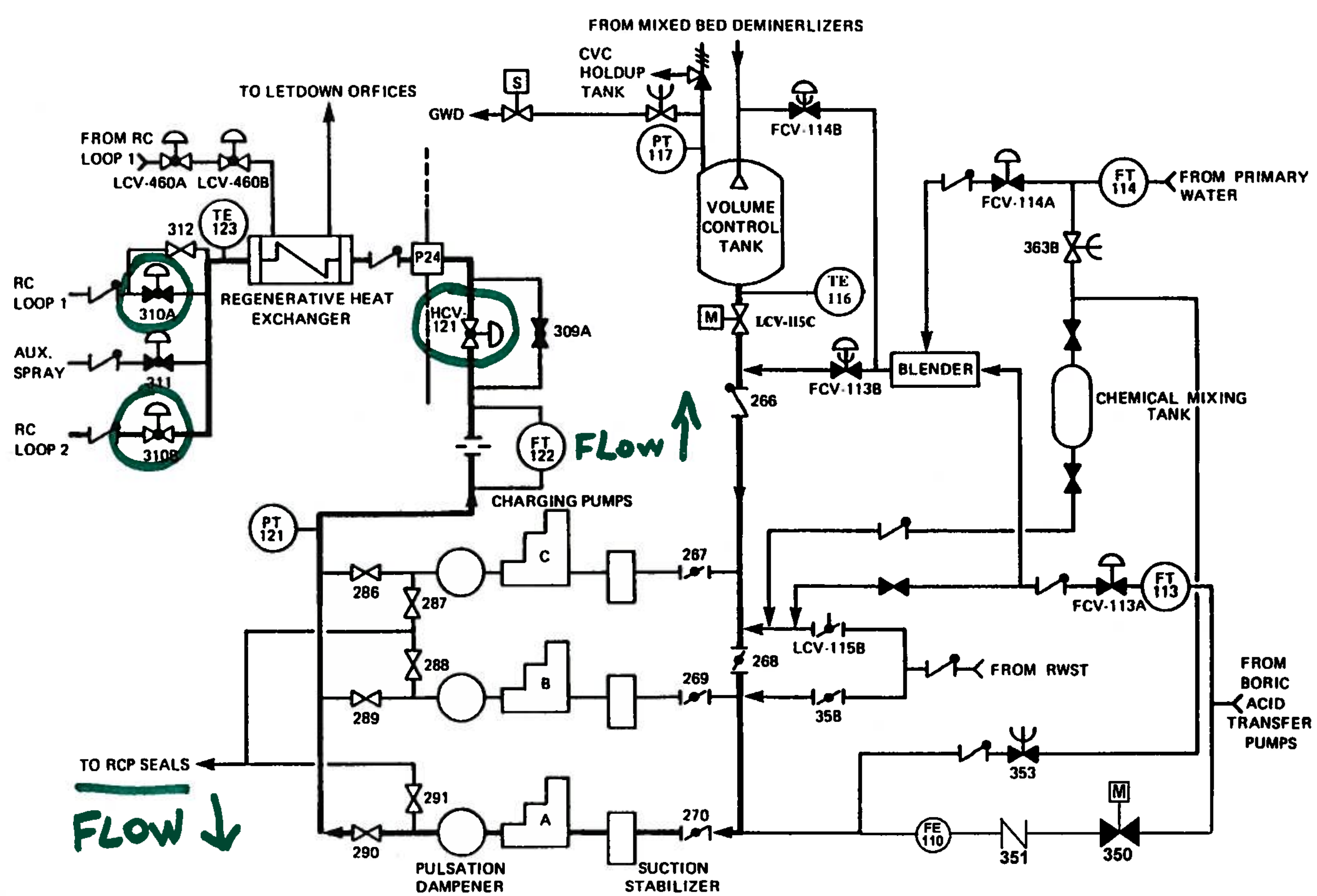
   t. HCV-137, EXCESS LTDN FLOW - CLOSED

   u. LCV-115A, VCT/HLDP TK DIV - FAILS TO VCT

(CONTINUED NEXT PAGE)

NORMAL CHARGING

CVCS-FIGURE-4



CVCSF04

INFORMATION USE ONLY

intermediate system between the reactor coolant and the SW cooling system. This double barrier arrangement reduces the probability of leakage of high pressure radioactive coolant to the SW System.

The CCW Radioactive Liquid Monitor (R-17) samples the CCW at the inlet of the CCW pumps and will alarm if excess radioactivity is detected as may occur following a leak into the CCW System (i.e., non-regenerative heat exchanger or RCP thermal barrier leak).

Most of the CCW System piping within the containment building is located outside the concrete shield wall. This location provides radiation shielding which allows for maintenance and inspections to be performed during power operation.

The surge tank accommodates expansion, contraction and in-leakage of water, and ensures a continuous CCW supply until a leaking cooling line can be isolated. The tank is vented to the Waste Holdup Tank.

The surge tank relief valve is sized to relieve the maximum flow rate of water which enters the surge tank following a rupture of a RCP thermal barrier cooling coil. The relief valve discharges to the Waste Holdup Tank.

In event of leakage or failure of the RCP thermal barrier cooling coil, the relief valves downstream are designed to maintain the RCS pressure boundary with closure of the associated isolation valves.

The relief valves on the cooling water line downstream from the waste gas compressor, boric acid evaporator, excess letdown, seal water return, non-regenerative, spent fuel pit and RHR heat exchangers are sized to relieve the volumetric expansion which would occur if the heat exchanger were isolated.

Makeup to the CCW surge tank is available from the primary water pumps (normal) and from the demineralized water system (backup).

3.0 COMPONENT DESCRIPTION

3.1 Component Cooling Water Pumps

Quantity	3
Type	Horizontal Centrifugal
Rated Capacity	6000 gpm
Rated Head	180 ft H_2O
Motor Horsepower	350 HP
Casing Material	Cast Iron
Design Temperature	200°F
Power Supply	

Pump "A"	480V DS Bus, Westinghouse type DS switchgear & ACB
Pump "B"	480V Bus E-1, Westinghouse type DB switchgear & ACB
Pump "C"	480V Bus E-2, Westinghouse type DB switchgear & ACB

The CCW pumps are located in the CCW Heat Exchanger Room, first level of the Auxiliary Building. The three single stage centrifugal pumps have mechanical seals on both sides of the casings. The pumps are driven by a 480 volt 350 HP, 3 phase AC motors. Minimum flow for CCW pumps during continuous operation should be greater than 2200 gpm per pump to minimize the potential for pump cavitation and excessive vibration. The CCW pump motors are provided with overcurrent and undervoltage protection by its breakers tripping open. All three CCW pumps are provided with auto start features on a CCW low pressure signal. On a loss of offsite power, only the CCW pumps supplied from the emergency buses receive power such that they can start on demand. Refer to Section 5.1, CCW Pump Controls, for more details on the above features. Starting limitations for the CCW pump motors are included in appropriate Operating Procedures.

3.2 Component Cooling Water Heat Exchangers

Quantity 2
Type Shell and Straight Tube
Heat Transferred (Shutdown condition) 29.35×10^6 BTU/hr

Shell Side (CCW)	
Inlet Temperature	115°F
Outlet Temperature	108°F
Design Flow Rate	4.46×10^6 lb/hr
Design Temperature	200°F
Design Pressure	150 psig
Material	Carbon Steel
Tube Side (SW)	
Inlet Temperature	95°F (99°F after ESR 98-362, summer '99)
Outlet Temperature	101°F
Design Flow Rate	4.96×10^6 lb/hr
Design Pressure	150 psig
Design Temperature	200°F
Material	90/10 Copper Nickel

The CCW heat exchangers are arranged in parallel. They are single pass shell and tube heat exchangers. Component cooling water flows on the shell side while SW flows

ATTACHMENT 1

MAJOR COMPONENTS AFFECTED BY LOSS OF IA

(Page 2 of 5)

1. (CONTINUED)

   v. LCV-115B, EMERG MU TO CHG SUCTION - NO FAILURE (Back-Up Air)

   w. LCV-460 A & B, LTDN LINE STOPS - CLOSED

   x. PCV-145, LETDOWN PRESSURE PCV - OPEN

   y. TCV-143, VCT/DEMIN DIV - FAILS TO VCT

   z. TCV-144, NON-REG HX OUTLET TEMP CONTROL - OPEN

2. Component Cooling Water System Components FAIL POSITION

   a. CC-739, CCW FROM EXCESS LTDN HX - CLOSED ONLY CCW AOV.

3. Containment Ventilation System Components FAIL POSITION

   a. CV VENTILATION ISOLATION VALVES - CLOSED

4. Feedwater and Condensate System Components FAIL POSITION

   a. FEED REG VALVES - CLOSED

   b. FEED REG BYPASS VALVES - CLOSED

   c. HCV-1459, LP HEATERS BYP - OPEN

   d. LCV-1417A, HOTWELL LEVEL CONTROL VALVE - OPEN

   e. LCV-1530A, HEATER DRAIN TANK LEVEL CONTROL VALVE - AS IS

   f. LCV-1530B, HEATER DRAIN PUMPS SUCTION DUMP TO CONDENSER - OPEN

   g. FCV-1596, COND QUENCH TO HDT "A" REG - OPEN

   h. FCV-1597, COND QUENCH TO HDT "B" & DRAIN PUMPS SUCT REG - OPEN

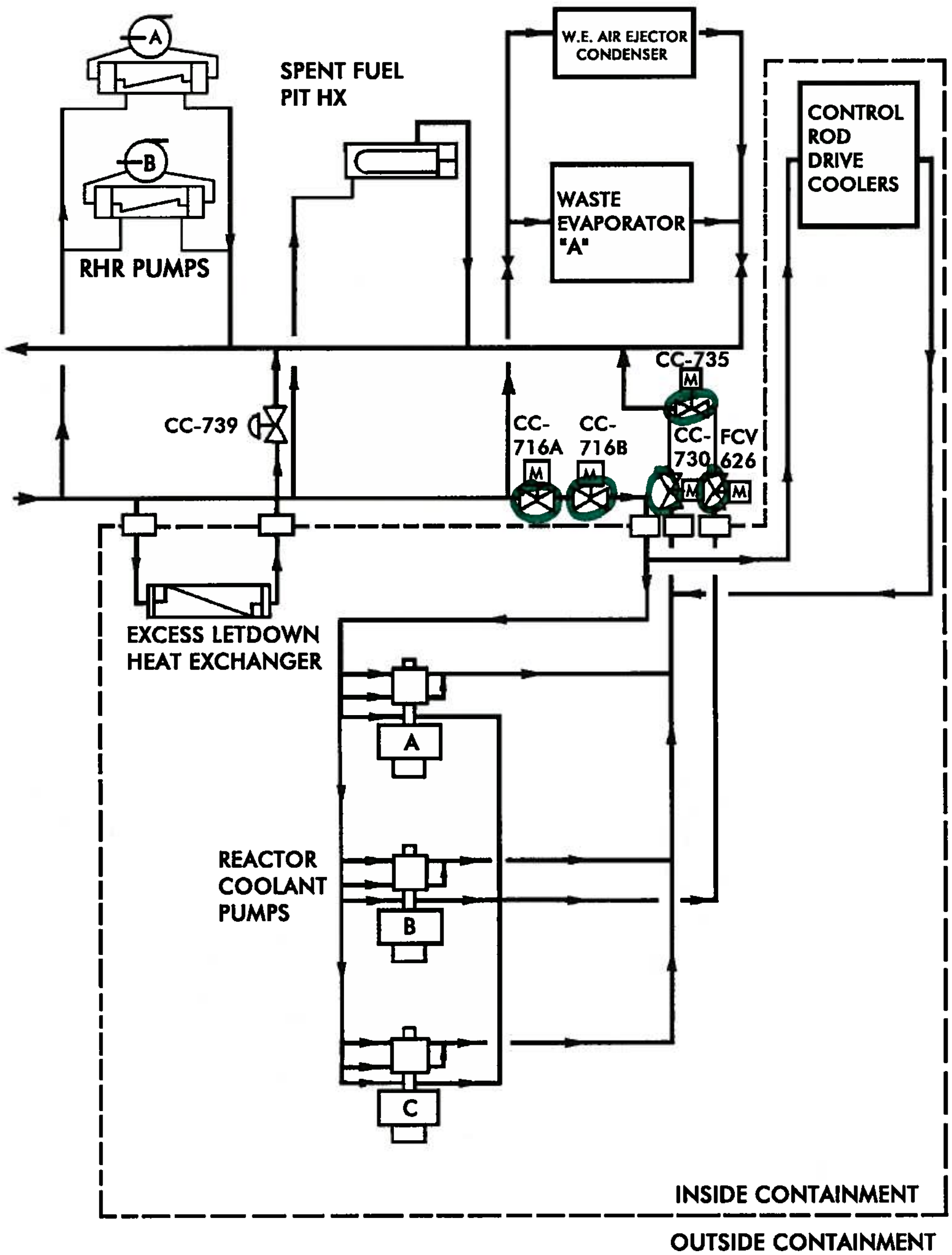
   i. QCV-10426, COND POL SEC BYP - OPEN

5. Instrument Air System Components FAIL POSITION

   a. PCV-1716, INSTRUMENT AIR ISO TO CV - CLOSED

COMPONENT COOLING WATER SYSTEM

CCW-FIGURE-3



CCW remains Aligned to the RCPs.

6. 022 AA2.03 001

Given the following plant conditions:

- The plant is operating at 100% RTP.
- RCS Makeup System is properly aligned and an Auto makeup is in progress.
- The following indications are noted:
    - BA Transfer Pump "A" is running.
    - PW Pump "A" is running.

FCV-113A, BA FLOW	OPEN
FCV-113B, BLENDED MU TO CHG SUCT	CLOSED
FCV-114A, PRIMARY WTR FLOW DILUTE MODE	OPEN
FCV-114B, BLENDED MU TO VCT	CLOSED
LC-112, VCT LEVEL	0% Output
LCV-115A, VCT/HLDP TK DIV	AUTO

- 45 seconds later:
    - APP-003-D5, BA FLOW DEV alarm has illuminated.
    - APP-003-E5, MAKEUP WATER DEV alarm has illuminated.

- BOTH VCT level channels are lowering and currently indicate 15 inches.

Which ONE (1) of the following has caused the alarms and indications?

A. The Charging Pump suction has swapped to the RWST.

B.✓ The air supply line to FCV-113B has failed, causing the valve to fail CLOSED.

C. The air supply line to FCV-114B has failed, causing the valve to fail CLOSED.

D. LC-112 has failed causing all letdown flow to divert to the CVCS Holdup Tank.

The correct answer is B.

A. Incorrect - Swapover setpoint is 12.4 inches. NO swapover should have occurred.

B. Correct.

C. Incorrect - During an auto-makeup FCV-114B should be in the CLOSED position. For the indications given, AOP-003 will direct the operator to open FCV-114B to allow for makeup to the VCT.

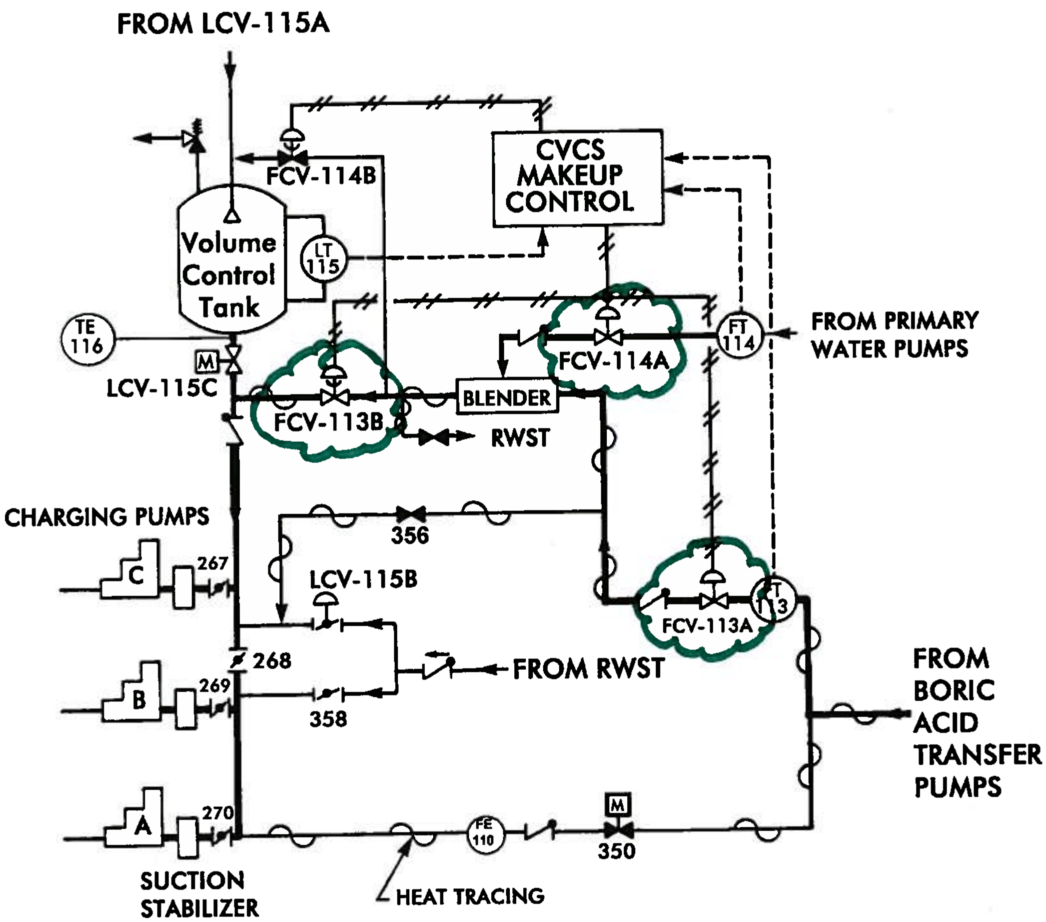
D. Incorrect - The output from LC-112 is expected for the conditions given. As output on the controller rises LCV-115A will re-position to divert letdown flow to the CVCS HUT.

Question 6
Tier/Group 1/1
K/A Importance Rating - RO 3.1 SRO 3.6

Ability to determine and interpret the following as they apply to the Loss of Reactor Coolant Makeup: Failures of flow control valve or controller

Reference(s) - Sim/Plant design, OP-301, AOP-003, APP-003-E5, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-003-004
Question Source - BANK (Not used on an NRC Exam from 2004 to present.)
Question Cognitive Level - H
10 CFR Part 55 Content - 43.5 / 45.13
Comments -

AUTOMATIC (NORMAL) MAKEUP FLOWPATH
CVCS-FIGURE-6



CVCSF06

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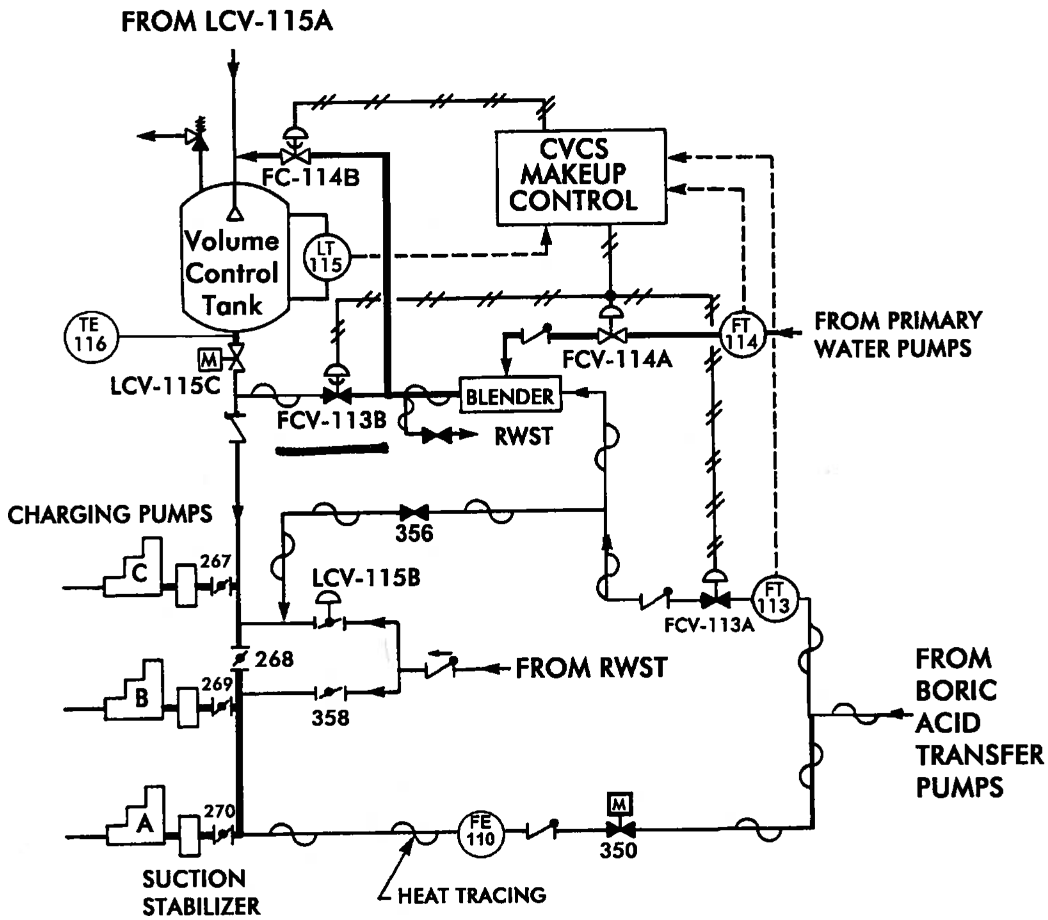
DILUTION FLOWPATH

CVCS-FIGURE-7



cvcsf07

INFORMATION USE ONLY

VCT LEVEL CONTROL

SWITCH POSITION	LEVEL TRANSMITTER	SETPOINT	FUNCTION
NORMAL	LT-115	20.2"	AUTO MAKEUP START
	LT-115	24.4"	AUTO MAKEUP STOP
	LT-112	VARIABLE*	LCV-115A CONTROL
	LT-115	51.6"	LCV-115A OVERRIDE TO HUT
	LT-115	45.6"	LCV-115A OVERRIDE REMOVED
	LT-112 AND LT-115 (BOTH REQUIRED)	12.4"	LOW-LOW LEVEL, LCV-115B OPENS LCV-115C SHUTS
	LT-112 AND LT-115 (BOTH REQUIRED)	16.6"	LOW-LOW LEVEL CLEARS (VALVES REPOSITION)
LT-112	LT-112		ALL FUNCTIONS ABOVE
LT-115	LT-115		ALL FUNCTIONS ABOVE

Distractor

*Divert setting for LCV-115A set by potentiometer on LC-112

INFORMATION USE ONLY

ALARM

MAKEUP WATER DEV

AUTOMATIC ACTIONS

1. DILUTE MODE: FCV-114B, BLENDED MU TO VCT, closes
2. ALT DILUTE MODE: FCV-113B, BLENDED MU TO CHG SUCT, **AND** FCV-114B, BLENDED MU TO VCT, close
3. AUTO MODE: FCV-113B, BLENDED MU TO CHG SUCT, closes

CAUSE

1. Improper control of FCV-114A or positioner failure (P.W. flow)
2. Inadequate flow from Primary Water Makeup Pumps
3. Measured PW flow is not within 5 gpm of set PW flow (45 sec. TD).

OBSERVATIONS

1. Primary Water Flow (FR-114)
2. Position of FCV-114A for Primary Water Flow
3. Primary Water Makeup Pumps operating

ACTIONS	CK (✓)
1. **IF** alarm is due to intentional operator action, **THEN** no other actions are necessary.	_____
2. **IF** the alarm is due to a Malfunction of Makeup Control, **THEN REFER TO** AOP-003.	_____

DEVICE/SETPOINTS

1. FC-114 /±5 gpm

POSSIBLE PLANT EFFECTS

1. Overboration of RCS during blended makeup

REFERENCES

1. AOP-003, Malfunction of Reactor Makeup Control
2. CWD B-190628, Sheet 481, Cable Z

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
22.	Verify Proper Operation Of Auto Make Up As Follows:	
	a. Verify Primary Water Pump - RUNNING	
	b. Verify Boric Acid Pump aligned for blend - RUNNING	b. <u>IF</u> the pump aligned for blend can <u>NOT</u> be started, <u>THEN</u> perform the following: 1) Place the RCS MAKEUP MODE Switch to STOP. 2) Align the alternate Boric Acid Pump for blend using OP-301, Chemical And Volume Control System (CVCS), attachment titled Boric Acid Tank to Blend Valve Alignment. 3) <u>WHEN</u> the alternate pump has been aligned for blend, <u>THEN</u> Go Step 19.
	c. Verify FCV-113A, BA TO BLENDER - MODULATED OPEN	
	d. Verify FCV-114A, PW TO BLENDER - MODULATED OPEN	

(CONTINUED NEXT PAGE)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
22.	(CONTINUED)	
	e. At the RTGB, Verify FCV-113B, BLENDED MU TO CHG SUCT - OPEN NO	e. IF FCV-113B has failed, THEN perform the following: Y 1) Place FCV-114B, BLENDED MU TO VCT, Control Switch to OPEN 2) Restart Automatic Makeup As Follows: a) Momentarily place the RCS MAKEUP SYSTEM Switch to STOP b) Momentarily place the RCS MAKEUP SYSTEM Switch to START c) Verify Automatic Makeup is initiated d) Return to procedure and step in effect
	f. Verify LCV-115A, VCT/HLDP TK DIV Valve - CLOSED (Positioned To The VCT)	
	g. Go To Step 24	

7. 025 AK3.01 001

Which ONE (1) of the following identifies the basis for closing FCV-605, RHR HX Bypass Valve, and HCV-758, RHR HX Outlet Flow To Cold Legs, prior to starting the standby RHR Pump IAW AOP-020, Loss of RHR (Shutdown Cooling), Section E, Loss of RHR Flow or Temperature Control?

A. Prevent cavitation of the pump.

B.✓ Reduce the pump starting current and prevent pump runout.

C. Prevent water hammer damage to the RHR Heat Exchangers.

D. Control the introduction of cooler water from the stagnant water in the suction and discharge piping of the standby pump.

The correct answer is B.

A. Incorrect - Several AOPs and other Operations procedures address RHR pump cavitation as a concern. In this case there was no impact to NPSH, so cavitation is not a concern.

B. Correct - AOP-020 basis document states that the valves are closed to limit the starting current on the pump. OP-201 states that a RHR Pump should not be started with FCV-605 in automatic as this could allow runout of the pump before the control valve could respond.

C. Incorrect - Although some water hammer effects may be felt, this is not the basis for the decision for closing the stated valves. Additionally, the RHR Heat Exchangers will be exposed to a pressure transient when starting the standby pump since the stated valves are downstream of the RHR Heat Exchangers.

D. Incorrect - Although some cooler water may be present in the discharge and suction line of the stagnant pump, this is not the basis for the actions.

Question 7
Tier/Group 1/1
K/A Importance Rating - RO 3.1 SRO 3.4

Knowledge of the reasons for the following responses as they apply to the Loss of Residual Heat Removal System: Shift to alternate flowpath

Reference(s) - Sim/Plant design, AOP-020BD, OP-201, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-020-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 41.10 / 45.6 / 45.13
Comments - Discussion with P. Capehart on 6/15/11: Discussed that RNP does not have alternate flowpaths or other inter-connected systems. Agreed to prepare a question based on losing one operating pump and having to take action to place the standby train in service.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

Section E

Loss Of RHR Flow Or Temperature Control

(Page 6 of 29)

18. Determine RHR Status As Follows:

INSTRUCTIONS	RESPONSE NOT OBTAINED
a. Check CCW - AVAILABLE	a. Go To Step 34.
b. Adjust FC-605, RHR HX BYPASS FLOW Controller To 0% (Closed)	
c. Adjust HIC-758, RHR HX DISCH FLOW, To 0% (Closed)	
d. Adjust HIC-142, PURIFICATION FLOW, To 0% (Closed)	
e. Attempt to start the standby RHR pump	
f. Check RHR Pumps - ONE RUNNING	f. <u>IF</u> a standby RHR Pump is available, <u>THEN</u> attempt to start the standby RHR Pump. Perform the following 1) <u>IF</u> ONE RHR Pump is Running, <u>THEN</u> Go To Step 18.g 2) <u>IF</u> NO RHR Pumps are Running, <u>THEN</u> GO To Step 43
g. Adjust FC-605, RHR HX BYPASS FLOW Controller, To Restore Flow Between 3000 gpm And 3750 gpm	

(CONTINUED NEXT PAGE)

Step	Description	SECTION E

14 This step was added to expedite the restoration of Instrument Air and 125V DC. If a loss of power (LOOP) was the cause of procedure entry, future problems due to loss of air or DC power are possible if solely relying on the APPs to direct restoration. Instrument air is needed for operation of FCV-605 and HCV-758. This step will also restore a Charging Pump is one was running. The Charging Pump would strip and not aito start on a LOOP.

N15 This note describes what an Idle RHR Pump configuration is. During portions of GP-002 and GP-007, an RHR Pump is in an idled configuration.

15-17 These steps checks to determine if an RHR Pump is idled, the idled RHR Pump needed for core cooling, and then directs performance of the attachment that will realign an idled pump.

18 If power is available to the pumps, the conditions needed for starting the pumps are checked. If all conditions are satisfied the standby pump is started. The pump discharge valves are closed to reduce pump starting current. (The standby pump is the pump which was NOT running at the start of the event). If the reason for RHR pump loss is a loss of CCW, the step will transition the operator to the section dealing with CCW loss. If a pump can not be started the operator continues with diagnostics.

C19 This note (ARG-1, NOTE Step 1) informs the operator that changes in RCS pressure can affect RCS level indication.

N19 The note gives the operator indications of RHR pump cavitation which will be useful in the next step. (SOER 88-03, Rec 3)

19 This step checks for RHR Pump cavitation by evaluating indications of RCS level, RHR System flow, and RHR Pump discharge pressure. If level is below the minimum level required to operate a pump the pumps are stopped to preclude damage and the operator transferred to the reduced inventory section. If cavitation is not present the operator proceeds in the procedure to determine other possible causes of loss of flow.

20 If cavitation is present with level above the minimum required for RHR operation the flow is throttled to the minimum in order to attempt to stop the cavitation. If the cavitation can not be eliminated the operator will stop the pumps and transition to steps to initiate SI to cool the core.

5.10 **IF** CCW is **NOT** available to the RHR pump seal coolers, **THEN** the RHR pumps **SHALL NOT** be operated with pump discharge temperature greater than 135°F. With CCW available to the RHR pump seal coolers there is no time limit for running a single pump with flow only through the heatup recirculation line. It will be necessary to rotate the RHR pumps to avoid exceeding the 50°F ΔT limit between RHR loops as stated in GP-007. Based on the investigation performed for NCR 00222886, the normal operating value for CCW cooling flow to the RHR pump seal should be controlled to 10 gpm minimum. Per APP-001-B7/C7, the setpoint for the low flow alarm is 7 gpm. Also based on the above, the minimum seal cooling flow for operability of the RHR pump is 5 gpm. Note that this is based on the WCAP guidance as well as some margin (approximately 2 gpm) to the vendor stated requirements.

5.11 RHR pump flowrates of less than 2,800 gpm have been shown to increase pressure and flow fluctuations and should be avoided when plant conditions permit. This does **NOT** apply during recirculation operation. (ACR 91-078)

5.12 With the exception of swapping running pumps, when RHR is aligned for core cooling, both RHR Pumps should **NOT** be run simultaneously on recirculation when forward flow is **NOT** established to prevent pump over heating from dead heading of the weaker pump. (CR 98-01791)

5.13 With no flow in the RHR system, an RHR Pump should **NOT** be started with FCV-605 in automatic. This could allow runout of the pump before FCV-605 could respond to control flow.

5.14 RHR-750 **AND** RHR-751 shall **NOT** be operated (electrically or manually) in a dry condition. Damage to the valve seat may result without water to provide lubrication. For this reason, any maintenance activities occurring to the RHR System should either ensure water is maintained **OR** will be restored to both sides of these valves prior to operation.

5.15 The principles of **ALARA** shall be used in planning and performing work and operations in the Radiation Control Area. Access to the drain valves located under the RHR heat exchangers should involve RC removing the necessary shielding, opening the barrier access door, and evaluating radiological conditions.

5.16 This procedure has been screened IAW PLP-037 criteria and determined **NOT** applicable to PLP-037.

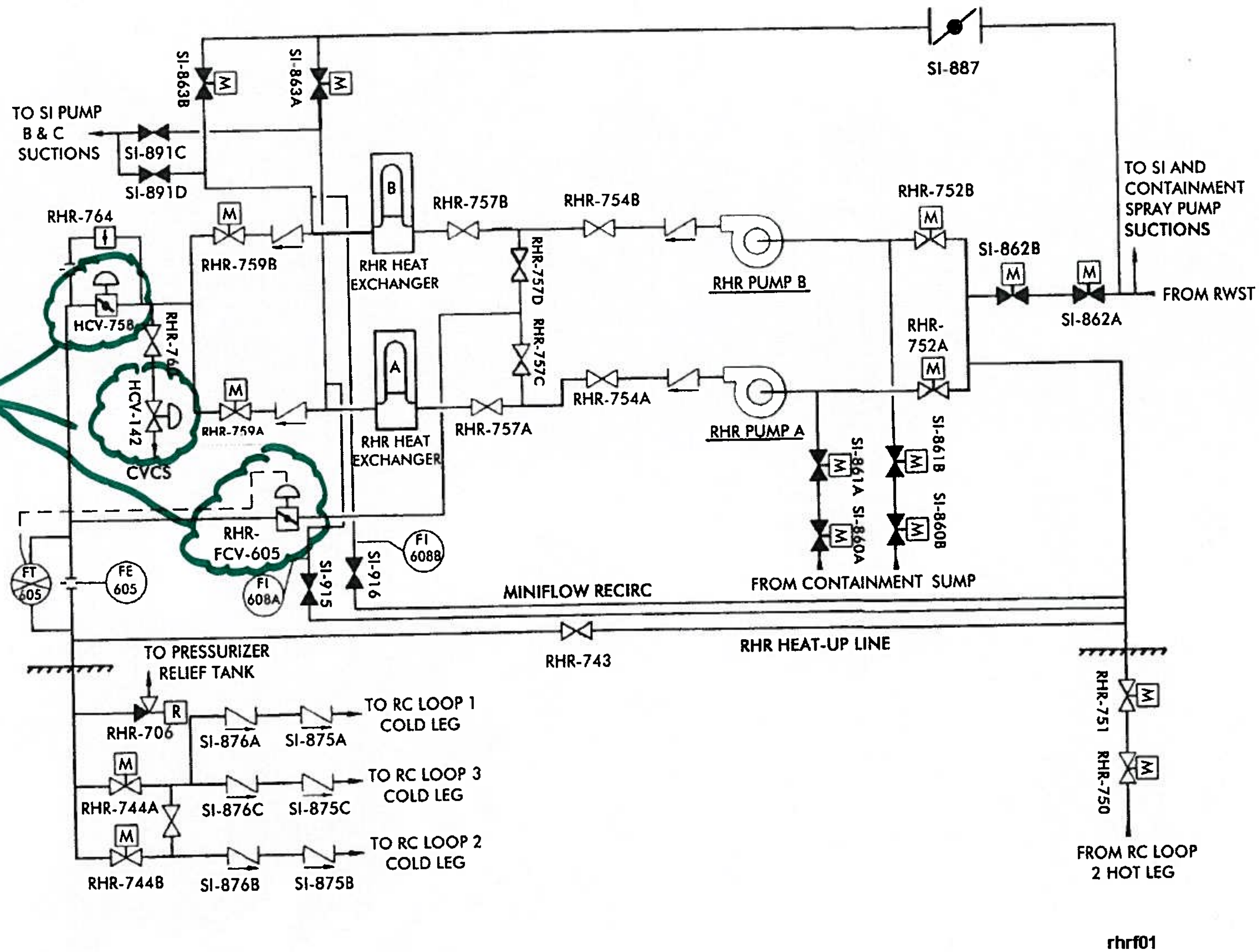
5.17 When operating RHR-754 A and RHR-754 B are operated via a reach rods AND care SHALL be used to ensure correct valve position.

5.18 Vent and drain valves operated in a closed loop system require administrative controls IAW GID/90-181/00/RCI Appendix D. Reference OP-923 for valves which meet this criteria. (NCR 365293)

RHR SYSTEM-CORE COOLING LINEUP

RHR-FIGURE-1

Closed Prior to Starting STBY Pmp.



INFORMATION USE ONLY

8. 027 AA1.05 001

Given the following plant conditions:

- EPP-1, Loss of All AC Power, is being implemented.
- The DS Bus has been energized IAW EPP-1, Attachment 6, Restoring AC Power At the DSDG Generator Control Panel.
- EPP-22, Energizing Plant Equipment Using DSDG, Attachment 1, Energizing Pressurizer Heaters from DS Bus, has been completed and specified heaters energized.
- PC-444J, PZR PRESS, has **FAILED** to 0% output.

Which ONE(1) of the following identifies the alternate method to control pressurizer heaters IAW EPP-22 based on the conditions given above?

A. Operate breakers on Pressurizer Htr Panel #3 Control Group

B. Operate breaker 52/15B, 480V Bus 3 Main Bkr from the RTGB

C✓ Operate breaker 52/12B, 480V Bus 2B-3 Tie Bkr from the RTGB

D. Operate the PZR Heater Emergency Control Station in the Rod Control Room

The correct answer is C.

A. Incorrect - This action would control power to the control group heaters, however, this panel is in the Rod Control Room and would not provide desired control to the control board operators. Additionally, this option is not specified in EPP-22.

B. Incorrect - Opening this breaker would remove power to 480V Bus 3 and 2B and thus the control group heaters. This is not a desired method due to other loads that may have been started on 480V Bus 3 when it was energized by the DSDG.

C. Correct. The preferred method is to adjust PC-444J in manual to control the amount of firing to the control group heaters. However, since PC-444J has failed to 0% output the heaters will be receiving full firing rate when energized.

D. Incorrect - Two PZR Heater Emergency Control Stations are located in the Rod Control Room. These control stations are utilized in AOP-004, Control Room Inaccessibility, to control the heaters. The Emergency Control Stations control Backup Group A and Backup Group B.

Question 8
Tier/Group 1/1
K/A Importance Rating - RO 3.3 SRO 3.2

Ability to operate and / or monitor the following as they apply to the Pressurizer Pressure Control Malfunctions: Transfer of heaters to backup power supply

Reference(s) - Sim/Plant design, EPP-22, System Descriptions
Proposed References to be provided to applicants during examination - None
Learning Objective - EPP-22-006
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.5 / 45.6
Comments - Discussed with P. Capehart on 6/15/11: Discussed that RNP does not have an installed, dedicated backup power supply to pressurizer heaters. Agreed to write question based on manipulating electric plant lineup to supply alternate power to pressurizer heaters in accordance with applicable EOP procedure(s).

The control bank and both backup groups are operated from the RTGB.

Power Supply:	Control Bank	- 480V BUS 2B
	Backup Group A	- 480V BUS 1
	Backup Group B	- 480V BUS 2A

The capability exists to power 150 kW of PZR heaters from Emergency Bus E1 and another 150 kW of heaters from emergency bus E2. This capability would be used during a loss of offsite power event to ensure proper RCS pressure control capability is maintained. The power supply must be manually transferred to the selected emergency bus following the loss of offsite power to ensure that the PZR temperature remains above the RCS temperature. Once the power supply is transferred, the heaters are controlled from the RTGB. If the PZR heaters are being powered from one of the emergency busses, they will automatically trip upon receipt of a Safety Injection Signal, to ensure the Emergency Diesel Generators are not overloaded by these non-safety related loads. This trip feature is enabled by the PZR Heater "Arm" switch in the E1/E2 room. PZR control group heaters can also be energized from the DS bus in the event of a loss of all AC power.

3.3 PZR Spray Lines

Spray nozzle press drop at max. flow	15.0 psi at 70°F
Continuous spray rate	1 gpm
Pipe Diameter	4 in.
Pipe Schedule	160
Design Pressure	2485 psig
Design Temperature	650°F

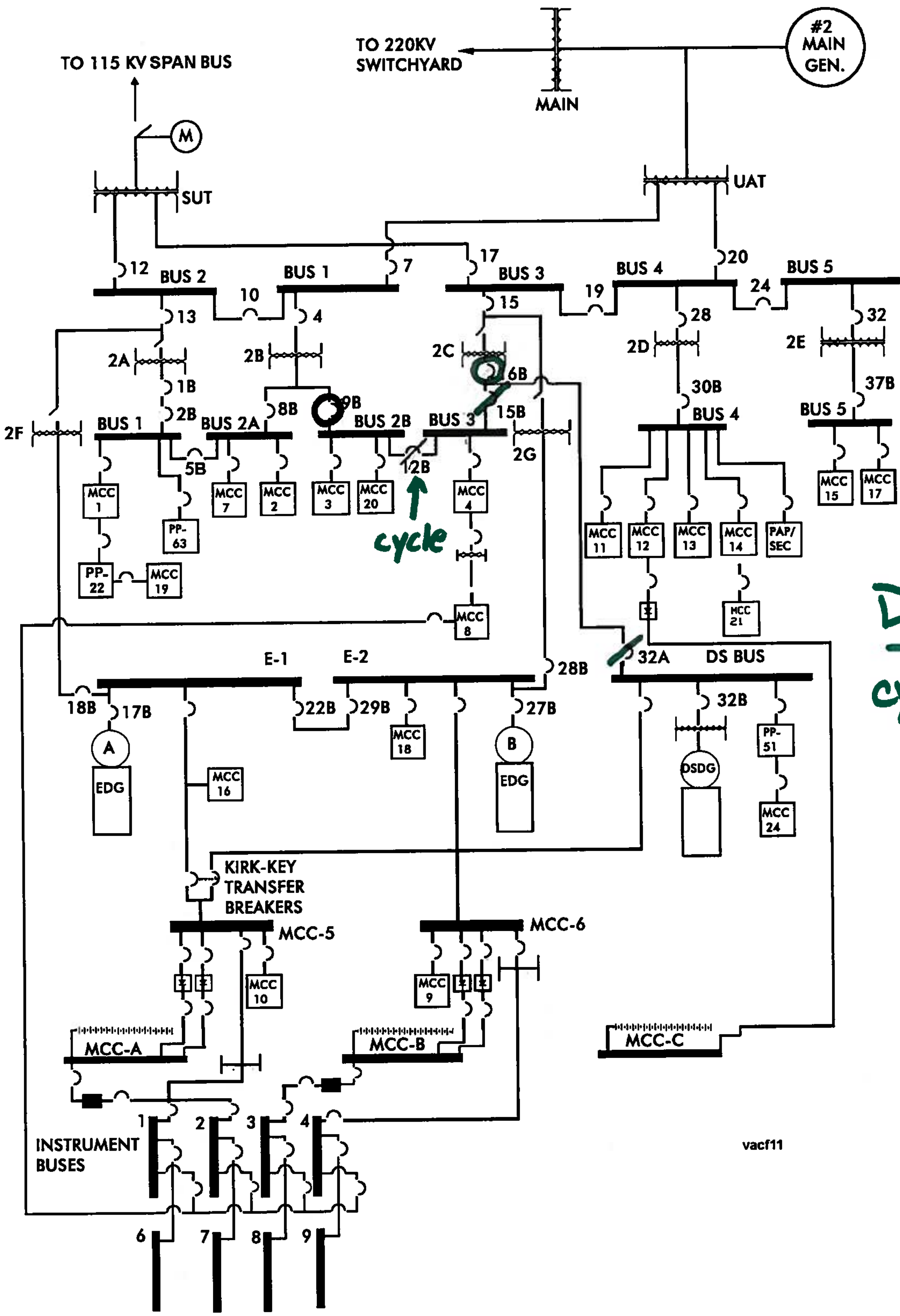
The PZR spray system is designed to pass a total flow of 600 gpm, 300 gpm per valve. The driving force of the spray water is a combination of the differential pressure between the hot and cold legs and the velocity head obtained by using a scoop in the reactor coolant piping.

The spray nozzle, which is also protected with a thermal sleeve, is connected to the head of the PZR. It is designed to produce a narrow angle cone spray pattern that prevents cold water impingement on the PZR walls.

The spray water is drawn from cold legs of loops B and C. The two lines tie together downstream of the control valves, form a loop seal, and supply water through a single spray nozzle. The loop seal is provided to prevent the backup of steam into the piping when the spray valves are closed. A small continuous spray flow is provided, by means of the throttle valves (needle valves) which bypass the spray valves, to help ensure that the PZR liquid is in chemical equilibrium with the rest of the reactor coolant system (RCS) and to prevent thermal shock of the spray piping and the auxiliary spray connection.

PLANT AC DISTRIBUTION

VAC-FIGURE-11



Distractor

cycle 15B

INFORMATION USE ONLY

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

ENERGIZING PRESSURIZER HEATERS FROM DEDICATED SHUTDOWN BUS

(Page 1 of 7)

NOTE

- 480V Breakers are opened locally by depressing the TRIP Pushbutton near the center of the breaker.
- Instructions for closing 480V breakers locally are provided in Attachment 2.
- TERMINAL BLOCK B is located at the rear of the Dedicated Shutdown Bus behind the door on the right (while facing rear of DS Bus).

1. Notify I&C Personnel To Perform The Following:

   a. Obtain the following equipment:

      - Flat head screwdiver
      - 12 inch jumper with alligator clips

   b. Perform the following at the DEDICATED SHUTDOWN BUS:

      1) Lift wire marked Z9 from Terminal Block B, Terminal 3

      2) Jumper Terminal Block B, Terminal 23 to Terminal Block B, Terminal 3

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

ENERGIZING PRESSURIZER HEATERS FROM DEDICATED SHUTDOWN BUS

(Page 2 of 7)

2. From The RTGB, Verify The Following Breakers - OPEN:

   - SST-2C TO 480V SYSTEM BKR 52/16B
   - 480V BUS 3 MAIN BKR 52/15B
   - 480V BUS 2B MAIN BKR 52/9B

   RESPONSE NOT OBTAINED: IF any breaker can NOT be opened from the RTGB, THEN locally open the breaker.

3. Obtain The Following:

   - Large Fuse Pullers
   - Two-Way Radio
   - Flashlight

4. Locally Verify The Following Breakers At 480V Bus 2B - OPEN:

   - ROD DRIVE MOTOR GENERATOR SET A (CMPT-10B)
   - PRESSURIZER HEATER CONTROL GROUP (CMPT-10C)
   - FEED TO MCC-3 (CMPT-11A)
   - STATION AIR COMPRESSOR (CMPT-11B)
   - FEED TO MCC-20 (CMPT-11C)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

ENERGIZING PRESSURIZER HEATERS FROM DEDICATED SHUTDOWN BUS

(Page 3 of 7)

3. Perform The Following:

a. Locally verify the following breakers at 480V Bus 3 - OPEN:

- SPARE (CMPT-13A)
- FEED TO MCC-4 (CMPT-13B)
- SPENT FUEL PIT COOLING PUMP A (CMPT-13C)
- ROD DRIVE MOTOR GENERATOR SET B (CMPT-14A)
- MOTOR DRIVEN FIRE PUMP (CMPT-14C)
- CONDENSER VACUUM PUMP B (CMPT-15A)

b. Remove control power fuses from the following breakers:

- MOTOR DRIVEN FIRE PUMP (CMPT-14C)
- CONDENSER VACUUM PUMP B (CMPT-15A)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

ENERGIZING PRESSURIZER HEATERS FROM DEDICATED SHUTDOWN BUS

(Page 4 of 7)

6. Perform The Following In The Rod Control Room:

a. Open all breakers on PRESSURIZER HEATER PANEL #3 CONTROL GROUP

b. Close the following breakers on PRESSURIZER HEATER PANEL #3 CONTROL GROUP:

- Breaker 1
- Breaker 2
- Breaker 3

Distractor

b. IF any listed breaker can NOT be closed, THEN close any three breakers from list below:

- Breaker 1
- Breaker 2
- Breaker 3
- Breaker 4
- Breaker 6
- Breaker 7

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

ENERGIZING PRESSURIZER HEATERS FROM DEDICATED SHUTDOWN BUS

(Page 5 of 7)

NOTE

Control power is removed from BKR 52/15B in the following step to ensure it will remain closed if an SI signal exists or occurs coincidental with an undervoltage condition on Bus E-2.

Ø

7. Energize 480V BUS 3 By Performing The Following In The 4160V Switchgear Room:

a. Remove Breaker control power fuses from FEED TO 480V BUS 3 (CMPT-15B), at 480V Bus 3

b. Manually close FEED TO 480V BUS 3 (CMPT-15B)

c. Place 52/32A SI+UV BYPASS CONTROL SWITCH to BYPASS SI/UV position at the DEDICATED SHUTDOWN DIESEL GENERATOR CONTROL PANEL

d. Check I&C actions directed in STEP 1 of this attachment - COMPLETE

  RNO: d. WHEN I&C actions are complete, THEN Go To Step 7.e.

e. Manually close FEED TO 480V BUS DS (CMPT-32A) as follows:

  1) Check Closing Spring status - SPRING CHARGED

    RNO: 1) Charge spring by pulling Closing Spring Charging Lever in the DOWN direction (requires multiple pulls).

  2) Depress PUSH TO CLOSE Pushbutton

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

ENERGIZING PRESSURIZER HEATERS FROM DEDICATED SHUTDOWN BUS

(Page 6 of 7)

NOTE

52/10C is closed manually with control power removed due to LC-459C1-X relay being de-energized, which maintains the trip coil energized for the breaker.

8. Perform The Following To Close PRESSURIZER HEATER CONTROL GROUP (CMPT-10C) Breaker.

   a. Remove the Control Power Fuses from PRESSURIZER HEATER CONTROL GROUP (CMPT-10C)

   b. Remove the metal cover plate for the breaker closure mechanism located on the breaker face plate below the TRIP pushbutton. (Refer to the drawing at the end of Attachment 2)

   c. Insert the DB-50 breaker operating tool AND press inward to ingage the mechanical closure mechanism.

   d. Rotate the operating tool CLOCKWISE until 52/10C closes AND latches.

   e. Check the 52/10C breaker position indicator on the face plate indicates CLOSED.

   f. Depress the latching mechanism in breaker operating tool AND remove the tool.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

ENERGIZING PRESSURIZER HEATERS FROM DEDICATED SHUTDOWN BUS

(Page 7 of 7)

9. Perform The Following From The RTGB:

   a. Adjust PC-444J, PZR PRESS Controller, to obtain maximum output on Control Group Heaters as follows:

      1) Place PC-444J in MAN

      2) Adjust controller output to minimum demand (0%)

10. Check PZR Level - GREATER THAN 14.4%

    RNO: WHEN PZR level is greater than 14.4%, THEN Go To Step 11

11. Perform The Following From The RTGB:

    a. Verify 52/12B, 480V BUS 2B-3 TIE BKR - CLOSED

    RNO: a. IF breaker can NOT be closed from the RTGB, THEN locally close the breaker.

> **NOTE**
>
> If required, the Control Group Heaters can be de-energized by opening 52/12B.

12. Operate PZR Heaters As Required To Control RCS Pressure:

    - PC-444J in MAN → FAILED
    - Operate 52/12B

- END -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 1

AUXILIARY BUILDING OPERATOR

(Page 8 of 9)

NOTE

If an additional operator is not available, the Auxiliary Building Operator is expected to periodically monitor PZR pressure in the Charging Pump Room AND operate PZR Heaters in the Rod Control Room.

*22. Check PZR Pressure Indicated On PI-607-E1 In The Charging Pump Room - BETWEEN 2200 PSIG AND 2250 PSIG

Perform the following:

a. Contact the SM/CRS and request an additional operator with a radio.

b. Station the additional operator in the Rod Control Room to operate PZR Backup Heaters AND establish radio contact.

DISTRACTOR

c. Direct the operation of the PZR Backup Heaters as follows:

1) Place the LOCAL/REMOTE switches for the PZR Backup Group Heaters at their respective EMERG-CONTR-STA in the LOCAL position.

2) Operate the PZR Heaters using the START/STOP Pushbuttons.

d. WHEN the PZR pressure is being controlled between 2200 psig and 2250 psig, THEN perform Step 23.

23. Notify The SM/CRS That PZR Pressure Is Being Controlled Between 2200 PSIG And 2250 PSIG

21 This step has the operator inform the SM/CRS that PZR level in being maintained between 24% and 71%.

N22 This note is a reminder to the operator that he is expected to periodically monitor PZR pressure and operate the PZR heaters, unless another operator is assigned this responsibility.

22 This continuous action step checks PZR pressure being maintained between 2200 and 2250 psig. The RNO provides the instructions for establishing pressure control. The pressure control band is based on the nominal HSD PZR pressure band, adjusted to the increments available on local indication.

23 This step has the operator inform the SM/CRS that pressure control has been established.

24 The operator is looped back to steps checking SR indication. As stated earlier, it is expected that on the initial pass through the procedure flux will not be in the SR. This transition provides transition back in the procedure to check indications and establish required charging flow based on flux. The loop will remain in effect until the Control Room has been made assessable.

ATTACHMENT 2, Turbine Building Operator

1 This step directs the operator to obtain certain items, from the location specified, that may become necessary while performing this attachment.

2 This step has the operator check that the Turbine was tripped prior to Control Room evacuation. The step is provided should the Control Room actions be unsuccessful. Tripping of the turbine will prevent excessive plant cooldown.

3-4 The main Generator Lockout is an automatic signal that occurs 1 minute after the Turbine trip signal. It is not intended by this procedure that the operators remain in the Control Room to observe the Generator Lockout because there may not be time available to do this. However, if the lockout occurs prior to exiting the Control Room and it has been successfully verified, there is no reason to dispatch a valuable resource to the switchyard to verify that the Unit Output OCBs are open. If the lockout has already been verified, then these steps will bypass the action to go to the switchyard.

5 This step has the operator locally check Unit Output OCBs 52/9 and 52/8 open to assure separation of the generator from the grid. The RNO has the operator locally open them if he finds that they are not open.

6 Notifying the SM/CRS that the Switchyard breakers are open assists the SM/CRS in maintaining control of the evolution.

N7 This note informs the operator that if there was a fire in the Control Room, the ventilation exhaust fan is de-energized to reduce the amount of oxygen available to the Control Room for combustion.

INIT

8.2 Equipment Tested When RCS Temperature is less than 350°F(Mode 4 or Mode 5) with a Bubble in the Pressurizer

Distractor

8.2.1 Rod Control Cabinet Room Local Control Station Test (ITS SR 3.3.4.2 TBL 3.3.4-1 Item 2b)

1. Test the EMERG CONTR-STA PRESS-BACK-UP-GROU-"A" local control station as follows:

NOTE:	PZR pressure shall be carefully monitored while testing PZR Heaters.

a. Verify PZR HTR BACKUP HEATERS GROUP "A" is deenergized at RTGB. ____

b. Check green light ILLUMINATED at local control station. ____

c. Place the EMERG CONTR-STA PRESS-BACK-UP-GROU-"A" LOCAL/REMOTE Control Selector Switch to LOCAL. ____

d. Check APP-036-J6, SHUTDOWN EQUIP IN LOCAL CONT, ILLUMINATED. ____

e. Check PZR HTR BACKUP HEATERS GROUP "A" RTGB indication EXTINGUISHED. ____

f. At the local control station, perform the following:

1) Energize PZR HTR Backup Heaters Group "A". ____

2) Check red light ILLUMINATED. ____

3) Deenergize PZR HTR Backup Heaters Group "A". ____

4) Check green light ILLUMINATED. ____

8.2.1.1 (Continued) INIT

g. Return the LOCAL/REMOTE Control Selector Switch to REMOTE. ____

h. Check APP-036-J6, SHUTDOWN EQUIP IN LOCAL CONT, alarm EXTINGUISHED. ____

i. Check PZR HTR BACKUP HEATERS GROUP "A" RTGB indication ILLUMINATED. ____

j. Return PZR HTR BACKUP HEATERS GROUP "A" to service as required.

OFF / AUTO / ON ____
(Circle one)

2. Test the EMERG CONTR-STA PRESS-BACK-UP-GROU-"B" local control station as follows:

NOTE:	PZR pressure shall be carefully monitored while testing PZR Heaters.

a. Verify PZR HTR BACKUP HEATERS GROUP "B" is deenergized at RTGB. ____

b. Check green light ILLUMINATED at local control station. ____

c. Place the EMERG CONTR-STA PRESS-BACK-UP-GROU-"B" LOCAL/REMOTE Control Selector Switch to LOCAL. ____

d. Check APP-036-J6, SHUTDOWN EQUIP IN LOCAL CONT, ILLUMINATED. ____

e. Check PZR HTR BACKUP HEATERS GROUP "B" RTGB indication EXTINGUISHED. ____

8.2.1.2 (Continued) INIT

f. At the local control station, perform the following:

1) Energize PZR HTR Backup Heaters Group "B". ____

2) Check red light ILLUMINATED. ____

3) Deenergize PZR HTR Backup Heaters Group "B". ____

4) Check green light ILLUMINATED. ____

g. Return the LOCAL/REMOTE Control Selector Switch to REMOTE. ____

h. Check APP-036-J6, SHUTDOWN EQUIP IN LOCAL CONT, alarm EXTINGUISHED. ____

i. Check PZR HTR BACKUP HEATERS GROUP "B" RTGB indication ILLUMINATED. ____

j. Return PZR HTR BACKUP HEATERS GROUP "B" to service as required.

OFF / AUTO / ON ____
(Circle one)

9. 029 EG2.4.49 001

Given the following plant conditions:

- An ATWS has occurred.
- The crew is performing immediate actions of FRP-S.1, Response to Nuclear Power Generation/ATWS.
- A manual reactor trip using both RTGB pushbuttons was unsuccessful.
- Rods are being inserted in MANUAL.
- Main Turbine Governor and Stop Valves indicate open.
- Manual trip of turbine was unsuccessful.

Which ONE (1) of the following identifies the **NEXT** required action that must be taken IAW FRP-S.1?

A. Close all MSIVs and MSIV Bypasses.

B. Depress and hold the GV Down and GV Fast pushbuttons.

C. Depress the turbine manual pushbutton and then depress and hold the the GV Down pushbutton ONLY.

D✓ Depress the turbine manual pushbutton and then depress and hold the GV Down and GV Fast pushbuttons.

The correct answer is D.

A. Incorrect. A turbine run back is to be attempted prior to closing the MSIVs and MSIV bypasses.

B. Incorrect. The turbine manual pushbutton must be depressed and released prior to performing the action given in this distractor.

C. Incorrect. These actions will begin to run back the turbine, but not at maximum rate as called for in FRP-S.1. In order to go at the maximum rate, the GV Fast pushbutton must be depressed.

D. Correct.

Question 9
Tier/Group 1/1
K/A Importance Rating - RO 4.6 SRO 4.4

Anticipated Transient Without Scram (ATWS): Ability to perform without reference to procedures those actions that require immediate operation of system components and controls.

Reference(s) - Sim/Plant design, FRP-S.1, PATH-1, OMM-022, Sys. Description
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-S.1-003
Question Source - BANK (Not used on NRC Exam from 2004 to present.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 43.2 / 45.6
Comments -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
2.	Check Turbine Trip As Follows: • BOTH Turbine Stop Valves - CLOSED No OR • All Governor Valves - CLOSED No	Perform the following: a. Manually trip the Turbine by simultaneously depressing the THINK and TURBINE TRIP Pushbuttons. No b. IF Turbine will NOT trip, THEN run back Turbine at maximum rate until the Governor Valves are closed. c. IF Turbine can NOT be run back, THEN verify CLOSED the following: Distractor • All MSIVs • All MSIV BYPs
3.	Verify All AFW Pumps - RUNNING	

8.3.2 (Continued)

11. Broadcasting of the Turbine Trip function should include the following:

   - If an Automatic Trip occurred:
     1) All four Governor Valves Closed

        OR

     2) Both Turbine Stop Valves Closed
   - If an Automatic Trip did not occur, the Turbine should be Shutdown in the following order:
     1) Simultaneously depress the THNK and TURBINE TRIP Pushbuttons
     2) Manually runback the Turbine at the maximum rate until all four Governor Valves indicate Closed
     3) Close the MSIV and MSIV Bypass Valves

8.3.3 Performance of EOP Steps Early

1. Performing EOP steps early is allowed, but must be done with caution so as not to mask symptoms or defeat the intent of the EOPs being used.

2. Crews may take early operator action per site specific direction that mitigate the consequence of the event but do not interfere with recovery strategies. A second SRO will concur prior to the commencement of early operator action. Applicable procedures will be referenced.

3. Additional guidelines must be met in order to perform actions prior to being directed by the EOP Network.

   - All EOP immediate actions must be completed (and verified) prior to taking any early action or non-EOP action.
   - The action can **NOT** defeat the intent of the procedure or the WOG mitigative strategy.
   - Personnel are available to perform the action to the extent that performance of the action will not hinder or delay the performance of the required actions.

will allow the reference counter to match actual turbine speed. Once the speed values are matched, the resultant speed error will be reduced and the turbine could be returned to Auto.

q. SETTER INDICATION indicates what the operator wants the system to do by utilizing the REF Increase or REF Decrease push buttons on the EH turbine control panel. The values displayed are the same as for reference indication above.

r. MEGAWATT LOAD INDICATION indicates gross megawatt load on the generator.

4.2 Indicating Lights and Switches on the EH Turbine Control Panel

a. LATCH - Depressing this button latches the overspeed trip oil drain which causes the turbine stop valves, reheat and intercept valves to open and blocks the low vacuum trip. When the turbine is latched, the light in the push-button will be on solid.

b. TURBINE MANUAL - If the light is ON, the turbine is in MGVC. If in AGVC, pushing this button will transfer governor control to MANUAL.

c. GOVERNOR VALVE INCREASE - This button is used to open the governor valves when in MGVC. The valves will only move while the button is depressed.

d. GOVERNOR VALVE DECREASE - This button is used to close the governor valves when in MGVC. The valves will only move while the button is depressed.

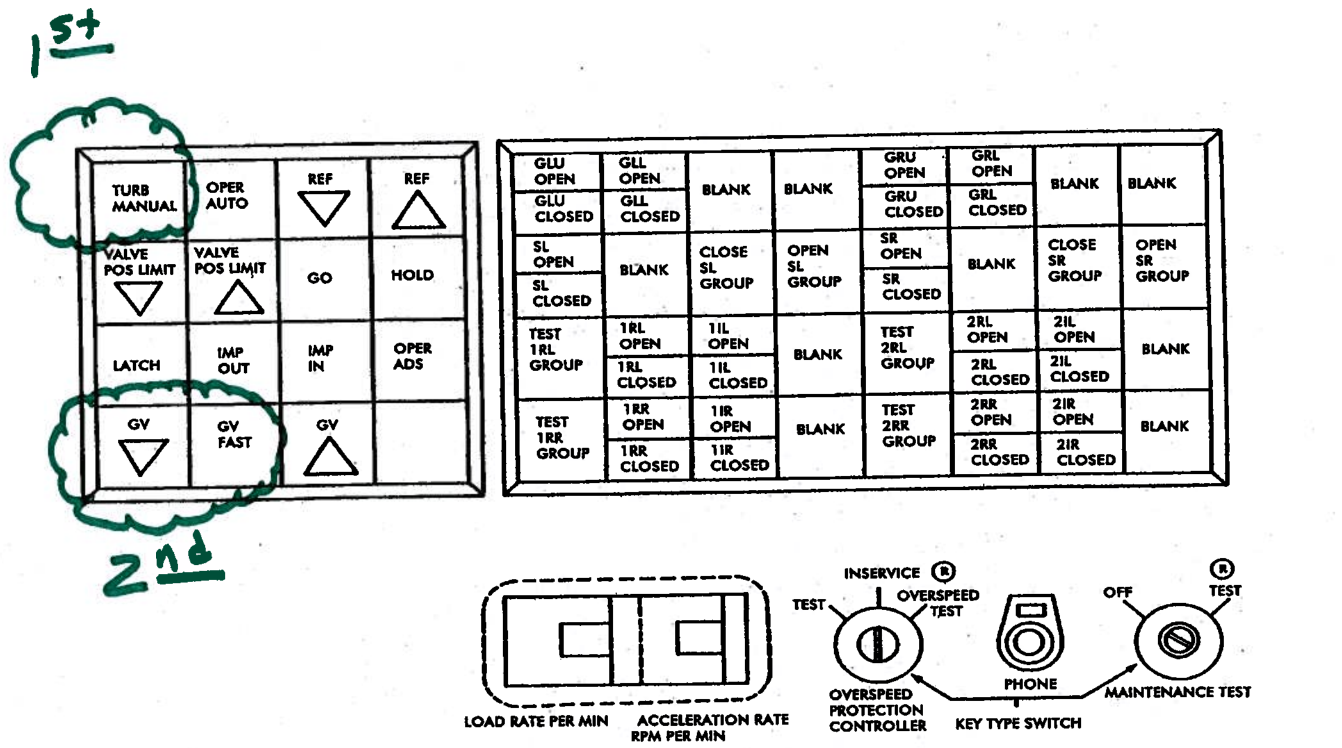
e. GOVERNOR VALVES FAST - This button is used in conjunction with c and d above. Depressing this button with either of the other two will cause the governor valves to operate more quickly. This can only be used when in MGVC.

f. AUTO - Pushing this button will transfer the system from MGVC to AGVC. The system will be in AGVC when the light remains on solid. During startup, if turbine speed is going up due to Governor Valve leakby, taking control to Auto will lock in the current rpm, creating an error between actual rpm and indicated rpm. This is an undesirable condition and should be avoided. (See 4.1 p. REFERENCE INDICATION)

g. REF INCREASE - Pushing this button, the value displayed in the SETTER window will increase in value exponentially as long as button is

EH CONTROL PANEL

EHC-FIGURE-15



ehcf15

INFORMATION USE ONLY

10. 038 EK1.04 001

Given the following plant conditions:

- The plant was operating at 100% RTP.
- The plant has experienced a S/G tube rupture with a Loss of Coolant Accident.
- Current RCS level is at the hot leg centerline.
- No SI flow exists due to multiple malfunctions.

Which ONE (1) of the following identifies how heat is removed from the core for the given conditions?

Boiling in the core produces steam which condenses in....

A. the high points in the RCS loops and flows down the hot and cold legs back to the core.

B. the upper head and re-floods the core via the upper internals.

C. the S/G tubes and flows down the cold leg back to the core.

D✓ the S/G tubes and flows down the hot leg back to the core.

The correct answer is D.

A. Incorrect - Steam flows along the top of the hot legs to the steam generator where it condenses and returns to the core via the bottom of the hot leg piping.

B. Incorrect - If the upper head was cool the steam could condense and return to the core. However, the upper head will remain at a high temperature following a LOCA and minimal condensation will occur in the reactor vessel.

C. Incorrect - Steam flows along the top of the hot legs to the steam generator where it condenses and returns to the core via the bottom of the hot leg piping. It would seem intuitive that the condensation would re-enter the reactor vessel via the normal flowpath which is the cold leg, however, based on elevation changes, etc., this is not the case.

D. Correct.

Question 10
Tier/Group 1/1
K/A Importance Rating - RO 3.1 SRO 3.3

Knowledge of the operational implications of the following concepts as they apply to the SGTR: Reflux boiling

Reference(s) - Sim/Plant design, PATH-1-BD
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-C.1-003
Question Source - BANK (Similar question used on 2007 NRC Exam. Question modified significantly.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.8 / 41.10 / 45.3
Comments - Discussed with P. Capehart on 6/15/11: Discussed concern with having two K/As selected that addressed reflux boiling. (see T1G1 011EK1.01) Agreed to attempt to write a question on the operational implication of reflux boiling associated with a SGTR. K/A may be replaced at a later date if extreme difficulty is experienced in developing an acceptable question.

Case A has been analyzed to a long term stable condition. For breaks in this category, the establishment of an equilibrium pressure where pumped SI equals break flow constitutes a safe and stable condition for the long term, provided that the steam generator heat sink is maintained until such time that the break flow and SI sensible heat can remove all the decay heat. Once equilibrium pressure was established, the core was covered and adequate flow existed to remove decay heat through the steam generator with a small amount of voiding. This stable and safe condition could go on without interruption for a long period of time. The only change in the primary system conditions through the transient for this case is a gradual decrease in fluid temperatures which is beneficial, since it indicates that adequate core cooling is being maintained.

The equilibrium pressure condition is stable for the long term provided that SI and auxiliary feedwater are available. Since the RCS pressure at the equilibrium condition is determined by a balance between break and SI flowrate, in order to depressurize to a cold shutdown condition it is necessary to cool the primary fluid further while stepping down the SI flowrate. Long-term cooldown/depressurization of the plant is performed using guideline ES-1.2, POST LOCA COOLDOWN AND DEPRESSURIZATION.

Breaks 3/8" < diameter <~ 1", maximum safety injection

Maximum safety injection (all high-head SI pumps operating) for a break in this range of size would have little impact on the results given for the previous case (Category 2) with minimum safety injection. The main effect would be a slightly higher equilibrium pressure where safety injection flow matches break flow. Therefore, this case was not included in the analysis.

Breaks ~ 1" < diameter <~ 13-1/2" (1FT^2)

For break sizes of one to two-inch in equivalent diameter, the RCS will rapidly depressurize early in the transient, and an automatic reactor trip and safety injection signal will be generated based on low pressurizer pressure. During the early stages of the depressurization, when the system is still full of two-phase liquid, the break flow, which also will be mostly liquid, is not capable of removing all the decay heat. Therefore, the early depressurization is limited by energy removal considerations, and the RCS pressure will temporarily hang up above the steam generator safety valve set pressure, assuming no steam dump is available. The RCS pressure stays at this level in order to provide a temperature difference from primary to secondary so that core heat may be removed by the steam generator. At this energy-balance controlled pressure, however, pumped safety injection flow is less than the break flow, and there is a net loss of mass in the RCS. Voiding throughout the primary side occurs and eventually the RCS begins to drain, starting from the top of the steam generator tubes. The rate of RCS drain is determined by the net loss of liquid inventory, a function of both SI flow and break size.

Prior to the occurrence of draining, heat is removed from the steam generator through continuous two-phase natural circulation, with two-phase mixture flowing over the top of the steam generator tubes. As the draining continues, the natural circulation mode of heat removal as just defined ceases, and core heat is removed through condensation of steam in the steam generator. This method of heat removal is called reflux and is discussed in Reference 2.

The condensation mode of heat removal is almost as efficient as continuous two-phase natural circulation in removing heat. However, condensation heat transfer coefficients may be lower than continuous two-phase natural circulation heat transfer coefficients. Thus, as the steam generator tubes drain, a slight increase in primary system pressure occurs to give a greater delta T from primary to secondary in order to remove all the decay heat. The steam generator secondary side pressurizes to the safety valve set pressure early in the transient, and remains there throughout the natural circulation and steam condensation heat removal modes. Eventually the mixture level on the primary side may drop completely below the steam generator tubes and begin to drain other regions in the RCS. Depending on the location of the break, the draining may partially uncover the core.

For example, for a cold leg break liquid in the crossover leg region (loop seal) will block steam from the break, and the core must partially uncover in order to create a vent path for steam to exit from the core, upper plenum, hot legs and steam generators through to the break. The RCS draining occurs until such time that the break location uncovers, and break flow switches from two-phase to all steam. For hot leg or pressurizer vapor space breaks, however, the steam vent path exists without the need for the crossover leg region (loop seal) to clear of all liquid. Thus, no core uncovery is predicted.

11. 054 AA1.04 001

Given the following plant conditions:

- The crew is performing actions of FRP-H.1, Response to Loss of Secondary Heat Sink.
- Plant conditions require that an RCS Bleed and Feed be performed.

Which ONE(1) of the following completes the statement below?

To ensure adequate RCS Injection flow a MINIMUM of __(1)__ safety injection pump(s) are/is required to be running AND __(2)__ PZR PORV(s) will be opened to provide an adequate RCS Bleed path.

A. (1) one

(2) one

B.✔ (1) one

(2) two

C. (1) two

(2) one

D. (1) two

(2) two

The correct answer is B.

A. Incorrect - The first part of the distractor is correct. Per FRP-H.1 basis document the RCS may not depressurize sufficiently to permit adequate feed of subcooled SI flow to remove core decay heat. If both PORVs cannot be opened, FRP-H.1 will direct the operator to open the RV head and PZR vents.

B. Correct.

C. Incorrect - FRP-H.1 will direct the operator to initiate a safety injection signal. This should start both SI pumps. However, FRP-H.1 later has the operator verify that at least one SI pump is running. Per FRP-H.1 basis document the RCS may not depressurize sufficiently to permit adequate feed of subcooled SI flow to remove core decay heat. If both PORVs cannot be opened, FRP-H.1 will direct the operator to open the RV head and PZR vents.

D. Incorrect - FRP-H.1 will direct the operator to initiate a safety injection signal. This should start both SI pumps. However, FRP-H.1 later has the operator verify that at least one SI pump is running. The second part of the distractor is correct.

Question 11
Tier/Group 1/1
K/A Importance Rating - RO 4.4 SRO 4.5

Ability to operate and / or monitor the following as they apply to the Loss of Main Feedwater (MFW): HPI, under total feedwater loss conditions

Reference(s) - Sim/Plant design, FRP-H.1, FRP-H.1BD
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-H.1-004
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7 / 45.5 / 45.6
Comments - Discussion with P. Capehart on 6/15/11: Confirmed that it would be acceptable to focus on Bleed and Feed conditions / actions for a loss of Heat Sink to address "HPI, under total feedwater loss conditions."

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

****

CAUTION

Feed flow is not re-established to any faulted S/G if an intact S/G is available.

****

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Check Total Feed Flow - LESS THAN 300 GPM DUE TO OPERATOR ACTION	Go To Step 3.
2.	Reset SPDS And Return To Procedure And Step In Effect	
3.	Determine If Secondary Heat Sink Is Required As Follows:	
	a. Check RCS pressure - GREATER THAN ANY NON-FAULTED S/G PRESSURE	a. Reset SPDS and Go To PATH-1, Entry Point C.
	b. Check RCS temperature - GREATER THAN 350°F [310°F]	b. Perform the following: 1) Place RHR System in service using Supplement I. 2) WHEN adequate cooling with RHR is established, THEN reset SPDS and return to procedure and step in effect.
* 4.	Check Any Two S/G Wide Range Levels - LESS THAN 10% [19%]	IF any two S/G Wide Range Levels lower to less than 10% [19%], THEN Go To Step 5. Go To Step 6.
5.	Perform The Following: a. Stop all RCPs b. Observe CAUTION prior to Step 31 and Go To Step 31	

Bleed & Feed CRITERIA

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
29.	Determine If Condensate Flow Is Adequate:	
	a. Check the following: • Core Exit T/C temperature - LOWERING OR • S/G Wide Range level - RISING IN AT LEAST ONE S/G	a. Go To Step 30.
	b. Maintain FW flow to restore S/G level to greater than 8% [18%]	
	c. Reset SPDS And Return To Procedure And Step In Effect	
*30.	Any Two S/G Wide Range Levels - LESS THAN 10% [19%]	IF FW flow is restored during steps prior to step 31, THEN Go To Step 28. Go To Step 3.

****

CAUTION

Steps 31 through 35 must be performed quickly in order to establish RCS heat removal by RCS bleed and feed.

****

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
31.	Depress the INITIATE SAFETY INJECTION Pushbutton	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
32.	Verify RCS Injection Path As Follows:	
	a. Verify SI Pumps - AT LEAST ONE RUNNING	a. Go To Step 6.
	b. At the RTGB, verify SI Valves for at least one flow path - ALIGNED FOR COLD LEG INJECTION	b. Perform the following: 1) Locally align valves. 2) Continue efforts to establish feed flow. 3) <u>IF</u> Cold Leg Injection can <u>NOT</u> be verified, <u>THEN</u> Go To Step 6.
33.	Establish Instrument Air To CV As Follows:	
	a. Verify APP-002-F7, INSTR AIR HDR LO PRESS - EXTINGUISHED	a. Start Instrument Air Compressors as required to extinguish APP-002-F7. <u>IF</u> instrument air header pressure can <u>NOT</u> be established, <u>THEN</u> Go To Step 34.
	b. Place IA PCV-1716, INSTRUMENT AIR ISO TO CV Control Switch to the OVERRIDE position	
34.	Establish RCS Bleed Path As Follows:	
	a. Verify power to PZR PORV Block Valves - AVAILABLE	
	b. Place all PZR Heater Control Switches to the OFF position	
	c. Verify PZR PORV Block Valves - BOTH OPEN	
	d. Open both PZR PORVs	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
35.	Verify Adequate RCS Bleed Path As Follows: • PZR PORVs - BOTH OPEN • PZR PORV Block Valves - BOTH OPEN	Go To Step 37.
36.	Go To Step 41	
37.	Place the Key Switches for the following Vent Valves to the OPEN Position: • RC-568, HEAD VENT • RC-570, PZR VENT • RC-572, CV ATMOS • RC-567, HEAD VENT • RC-569, PZR VENT • RC-571, PRT ISO	
38.	Depressurize At Least One Intact S/G To Atmospheric Pressure Using Steam Line PORVs	

12. 055 EG2.1.31 001

Given the following plant conditions:

- Reactor power is at 100% RTP.
- A Generator Lockout occurs simultaneously with a loss of the Startup Transformer.
- Both EDGs fail to start.

Which ONE (1) of the following completes the statements below?

For the conditions given above, IAW EPP-1, Loss of All AC Power, steam is verified isolated to the Turbine by __(1)__ and __(2)__ are required to be CLOSED to isolate letdown flow.

A.✓ (1) closing the MSIVs AND MSIV Bypasses

(2) LCV-460A/B, Letdown Line Stop Valves

B. (1) closing the MSIVs and MSIV Bypasses

(2) CVC-204A/B, Letdown Line Isolation Valves

C. (1) verifying BOTH Turbine Stop Valves CLOSED

(2) LCV-460A/B, Letdown Line Stop Valves

D. (1) verifying BOTH Turbine Stop Valves CLOSED

(2) CVC-204A/B, Letdown Line Isolation Valves

The correct answer is A.

A. Correct.

B. Incorrect - First part of distractor is correct. The MSIVs must be closed. The loss of the SUT will cause the EH Control Panel to be de-energized and the operator will be unable to confirm that the Turbine Stop Valves are closed. This will require that the MSIVs be closed. CVC-204A/B will isolate letdown if closed, however, EPP-1 directs the operator to close LCV-460A/B. If LCV-460A/B cannot be closed the RNO is to close CVC-200A,B,C.

C. Incorrect - The MSIVs must be closed. The loss of the SUT will cause the EH Control Panel to be de-energized and the operator will be unable to confirm that the Turbine Stop Valves are closed. This will require that the MSIVs be closed. The second part of the distractor is correct.

D. Incorrect- The MSIVs must be closed. The loss of the SUT will cause the EH Control Panel to be de-energized and the operator will be unable to confirm that the Turbine Stop Valves are closed. This will require that the MSIVs be closed. CVC-204A/B will isolate letdown if closed, however, EPP-1 directs the operator to close LCV-460A/B. If LCV-460A/B cannot be closed the RNO is to close CVC-200A,B,C.

Question 12
Tier/Group 1 / 1
K/A Importance Rating - RO 4.6 SRO 4.3

Loss of Offsite and Onsite Power (Station Blackout): Ability to locate control room switches, controls, and indications, and to determine that they correctly reflect the desired plant lineup.

Reference(s) - Sim/Plant design, EPP-1, PATH-1
Proposed References to be provided to applicants during examination - None
Learning Objective - EPP-1-003
Question Source - RNP Bank (Not used on NRC Exam from 2004 to present.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 45.12
Comments - K/A match because candidate is given the EH Turbine Control indications that show two governor valves open and one stop valve open after a reactor trip followed by a Station Blackout. The candidate must evaluate the indications and determine that the MSIVs and MSIV Bypass Valves must be closed.

Reviewed and approved by MAB.

13. 056 AK1.03 001

Given the following plant conditions:

- The reactor has tripped due to a loss of off-site power.
- Natural circulation flow is being established.
- The Subcooling Monitor indicates the following information:
  - T/C at B07 558°F
  - T/C at H04 555°F
  - T/C at D05 556°F
  - T/C at R08 554°F
- The RTGB indicates the following information:
  - PI-445: 1800 psig
  - PI-456: 1785 psig
  - PI-457: 1795 psig

Determine the current value of subcooling that will be utilized while in the EOP Network.

A.✓ 62 - 63.5°F

B. 64 - 65.5°F

C. 66 - 67.5°F

D. 68 - 69.5°F

The correct answer is A.

A. Correct. The lowest pressure of 1785 psig and the highest temperature of 558°F are to be used to calculate subcooling. 1785 psig equates to 1800 psia, which has a Tsat of 621.02°F. Subtracting 558°F from 621.02°F equals 63.02°F of subcooling.

B. Incorrect. For this distractor the candidate utilizes the highest temperature and the highest pressure. 1800 psig equates to 1815 psia, which has a Tsat of 622.2°F. Subtracting 558°F from 622.2°F equals 64.2°F of subcooling.

C. Incorrect. The candidate would have to incorrectly utilize the lowest indicated pressure of 1785 psig and the lowest given temperature of 554°F to calculate S/C. 1785 psig equates to a Tsat of approximately 621.02°F. Subtracting 554°F from 621.02°F equals 67.2°F subcooling.

D. Incorrect. The candidate would have to incorrectly utilize the highest indicated pressure of 1800 psig and the lowest given temperature of 554°F to calculate S/C. 1800 psig equates to a Tsat of approximately 622.2°F. Subtracting 554°F from 622.2°F equals 68.2°F subcooling.

Question 13
Tier/Group 1/1
K/A Importance Rating - RO 3.1 SRO 3.4

Knowledge of the operational implications of the following concepts as they apply to Loss of Offsite Power: Definition of subcooling: use of steam tables to determine it

Reference(s) - Sim/Plant design, Steam Tables, OP-307
Proposed References to be provided to applicants during examination - None
Learning Objective - EPP-1-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.8 / 41.10 / 45.3
Comments -

3.0 **RESPONSIBILITES**

3.1 Operations personnel are responsible for component manipulations as directed by this procedure.

4.0 **PREREQUISITES**

4.1 The Electrical System has been lined up to supply power to the Instrument Buses in accordance with OP-603, Electrical Distribution System, and OP-001, Reactor Coolant and Protection System.

4.2 The Reactor Vessel Level Instrumentation System (RVLIS) sensors and sensing lines have been filled and vented in accordance with MRP-008.

4.3 The RVLIS system has been calibrated in accordance with LP-042.

5.0 **PRECAUTIONS AND LIMITATIONS**

5.1 Operating personnel should refer to Section 8.4 for determining Saturation Margin if the Inadequate Core Cooling System becomes inoperative.

5.2 Under normal conditions, the pressurizer temperature is the saturation temperature corresponding to pressurizer pressure; therefore, the difference between pressurizer temperature and hot leg temperature is approximately the margin to saturation in °F. This may be used as a rapid backup method for determining saturation margin. However, this method will not be valid in the event that the hottest spot in the RCS should shift to another point in the system, such as formation of a void in the reactor vessel head.

5.3 When manually determining saturation margin, each temperature and pressure indication must be carefully evaluated for its validity. The highest valid temperature indication and lowest valid pressure indication should be used for a conservative determination of saturation margin.

8.4 INFREQUENT OPERATIONS

INIT

8.4.1 Manual Calculation of Margin to Saturation

1. This revision has been verified to be the latest revision available.

Name (Print)	Initial	Signature	Date

2. Determine primary pressure using the lowest valid pressure indication. ________ psig ____
3. Convert pressure to absolute by adding 14.7 psi to value determined in Step 8.4.1.2. ________ psia ____
4. Enter, from the Saturated Steam Tables, the saturation temperature corresponding to the pressure shown in Step 8.4.1.3 to determine the corresponding temperature. ________ °F ____
5. Determine primary temperature using the highest valid core exit thermocouple temperature indication. ________ °F ____
6. Subtract the temperature of Step 8.4.1.5 from the temperature of Step 8.4.1.4 to determine the margin to saturation in °F. ________ °F ____

	Initials	Name(Print)	Date
Performed By:	________	________________________	________
	________	________________________	________
	________	________________________	________

Approved By: ________________________________ ________
Unit 2 - Superintendent Shift Operations   Date

200.0	381.80	0.01839	2.2689	2.2873	355.5	842.8	1198.3	0.5438	1.0016
210.0	385.91	0.01844	2.16373	2.18217	359.9	839.1	1199.0	0.5490	0.9923
220.0	389.88	0.01850	2.06779	2.08629	364.2	835.4	1199.6	0.5540	0.9834
230.0	393.70	0.01855	1.97991	1.99846	368.3	831.8	1200.1	0.5588	0.9748
240.0	397.39	0.01860	1.89909	1.91769	372.3	828.4	1200.6	0.5634	0.9665
250.0	400.97	0.01865	1.82452	1.84317	376.1	825.0	1201.1	0.5679	0.9585
260.0	404.44	0.01870	1.75548	1.77418	379.9	821.6	1201.5	0.5722	0.9508
270.0	407.80	0.01875	1.69137	1.71013	383.6	818.3	1201.9	0.5764	0.9433
280.0	411.07	0.01880	1.63169	1.65049	387.1	815.1	1202.3	0.5805	0.9361
290.0	414.25	0.01885	1.57597	1.59482	390.6	812.0	1202.6	0.5844	0.9291
300.0	417.35	0.01889	1.52384	1.54274	394.0	808.9	1202.9	0.5882	0.9223
350.0	431.73	0.01912	1.30642	1.32554	409.8	794.2	1204.0	0.6059	0.8909
400.0	444.60	0.01934	1.14162	1.16095	424.2	780.4	1204.6	0.6217	0.8630
450.0	456.28	0.01954	1.01224	1.03179	437.3	767.5	1204.8	0.6360	0.8378
500.0	467.01	0.01975	0.90787	0.92762	449.5	755.1	1204.7	0.6490	0.8148
550.0	476.94	0.01994	0.82183	0.84177	460.9	743.3	1204.3	0.6611	0.7936
600.0	486.20	0.02013	0.74962	0.76975	471.7	732.0	1203.7	0.6723	0.7738
650.0	494.89	0.02032	0.68811	0.70843	481.9	720.9	1202.8	0.6828	0.7552
700.0	503.08	0.02050	0.63505	0.65556	491.6	710.2	1201.8	0.6928	0.7377
750.0	510.84	0.02069	0.58880	0.60949	500.9	699.8	1200.7	0.7022	0.7210
800.0	518.21	0.02087	0.54809	0.56896	509.8	689.6	1199.4	0.7111	0.7051
850.0	525.24	0.02105	0.51197	0.53302	518.4	679.5	1198.0	0.7197	0.6899
900.0	531.95	0.02123	0.47968	0.50091	526.7	669.7	1196.4	0.7279	0.6753
950.0	538.39	0.02141	0.45064	0.47205	534.7	660.0	1194.7	0.7358	0.6612
1000.0	544.58	0.02159	0.42436	0.44596	542.6	650.4	1192.9	0.7434	0.6476
1050.0	550.53	0.02177	0.40047	0.42224	550.1	640.9	1191.0	0.7507	0.6344
1100.0	556.28	0.02195	0.37863	0.40058	557.5	631.5	1189.1	0.7578	0.6216
1150.0	561.82	0.02214	0.35859	0.38073	564.8	622.2	1187.0	0.7647	0.6091
1200.0	567.19	0.02232	0.34013	0.36245	571.9	613.0	1184.8	0.7714	0.5969
1250.0	572.38	0.02250	0.32306	0.34556	578.8	603.8	1182.6	0.7780	0.5850
1300.0	577.42	0.02269	0.30722	0.32991	585.6	594.6	1180.2	0.7843	0.5733
1350.0	582.32	0.02288	0.29250	0.31537	592.3	585.4	1177.8	0.7906	0.5620
1400.0	587.07	0.02307	0.27871	0.30178	598.8	576.5	1175.3	0.7966	0.5507
1450.0	591.70	0.02327	0.26584	0.28911	605.3	567.4	1172.8	0.8026	0.5397
1500.0	596.20	0.02346	0.25372	0.27719	611.7	558.4	1170.1	0.8085	0.5288
1550.0	600.59	0.02366	0.24235	0.26601	618.0	549.4	1167.4	0.8142	0.5182
1600.0	604.87	0.02387	0.23159	0.25545	624.2	540.3	1164.5	0.8199	0.5076
1650.0	609.05	0.02407	0.22143	0.24551	630.4	531.3	1161.6	0.8254	0.4971
1700.0	613.13	0.02428	0.21178	0.23607	636.5	522.2	1158.6	0.8309	0.4867
1750.0	617.12	0.02450	0.20263	0.22713	642.5	513.1	1155.6	0.8363	0.4765
1800.0	621.02	0.02472	0.19390	0.21861	648.5	503.8	1152.3	0.8417	0.4662
1850.0	624.83	0.02495	0.18558	0.21052	654.5	494.6	1149.0	0.8470	0.4561
1900.0	628.56	0.02517	0.17761	0.20278	660.4	485.2	1145.6	0.8522	0.4459
1950.0	632.22	0.02541	0.16999	0.19540	666.3	475.8	1142.0	0.8574	0.4358
2000.0	635.80	0.02565	0.16266	0.18831	672.1	466.2	1138.3	0.8625	0.4256
2100.0	642.76	0.02615	0.14885	0.17501	683.8	446.7	1130.5	0.8727	0.4053
2200.0	649.45	0.02669	0.13603	0.16272	695.5	426.7	1122.2	0.8828	0.3848
2300.0	655.89	0.02727	0.12406	0.15133	707.2	406.0	1113.2	0.8929	0.3640
2400.0	662.11	0.02790	0.11287	0.14076	719.0	384.8	1103.7	0.9031	0.3430
2500.0	668.11	0.02859	0.10209	0.13068	731.7	361.6	1093.3	0.9139	0.3206
2600.0	673.91	0.02938	0.09172	0.12110	744.5	337.6	1082.0	0.9247	0.2977
2700.0	679.53	0.03029	0.08165	0.11194	757.3	312.3	1069.7	0.9356	0.2741
2800.0	684.96	0.03134	0.07171	0.10305	770.7	285.1	1055.8	0.9468	0.2491
2900.0	690.22	0.03262	0.06158	0.09420	785.1	254.7	1039.8	0.9588	0.2215
3000.0	695.33	0.03428	0.05073	0.08500	801.8	218.4	1020.3	0.9728	0.1891
3100.0	700.28	0.03681	0.03771	0.07452	824.0	169.3	993.3	0.9914	0.1460
3200.0	705.08	0.04472	0.01191	0.05663	875.5	56.1	931.6	1.0351	0.0482
3208.2*	705.47	0.05078	0.00000	0.05078	906.0	0.0	906.0	1.0612	0.0000

*Critical pressure

14. 057 AA2.04 001

Given the following plant conditions:

- The plant is operating at 100% RTP.
- A loss of Instrument Bus 2 has occurred.

Which ONE (1) of the following completes the statement below?

Safeguards Train __(1)__ Sequencer is currently de-energized and __(2)__.

A. (1) "A"

(2) bistable Status Panel "A" will be de-energized

B. (1) "B"

(2) bistable Status Panel "A" will be de-energized

C✓ (1) "A"

(2) channel 2 bistables on Status Panel "A" will be illuminated with the exception of CV HI-HI Pressure

D. (1) "B"

(2) channel 2 bistables on Status Panel "A" will be illuminated with the exception of CV HI-HI Pressure

The correct answer is C.

A. Incorrect - First part of distractor is correct. Status Panel "A" is powered from IB-3 and will therefore remain energized.

B. Incorrect - Safeguard Train "A" is powered from IB-2. Status Panel "A" is powered from IB-3 and will therefore remain energized.

C. Correct.

D. Incorrect - Safeguard Train "A" is powered from IB-2. The second part of the distractor is correct.

Question 14
Tier/Group 1/1
K/A Importance Rating - RO 3.7 SRO 4.0

Ability to determine and interpret the following as they apply to the Loss of Vital AC Instrument Bus: ESF system panel alarm annunciators and channel status indicators

Reference(s) - Sim/Plant design, APP-002-B2, AOP-024, AOP-024BD
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-024-002
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 43.5 / 45.13
Comments -

CONTINUOUS USE

ATTACHMENT 2

EXTENDED LOSS OF INSTRUMENT BUS 2 (AND 7)

(Page 1 of 5)

NOTE

The following control functions will be lost until Instrument Bus 2 and 7 are restored:

LT-115, VCT Level
FRV B Automatic Control
FRV Bypass Valve C (FCV-499)
FCV-1424 (AFW PUMP A inoperable)
PZR Spray Valve PCV-455A (lights only)
FCV-114A, PW to Blender (AUTO Function)
Charging Pump Controller B, SC-152 (locks up)
ICCM - Channel I
Safeguards Train A Sequencer
RMS Rack 1, except R-32B (CR initiates Pressurization Mode)
PW & BA Flow Totalizers
S/G C PORV
FI-122A, Charging Flow
RPI RTGB Indication (lights only - ERFIS still functional)
Quench Valve Control (FCV-1596 AND FCV-1597 fail open)

1. Continue to operate FRV B in MAN.

2. Contact Operations Staff for availability of a dedicated FRV watch.

3. IF CHARGING PUMP B is in service, THEN perform the following:

   a. IF necessary, THEN, start CHARGING PUMP A OR C.

   b. Stop CHARGING PUMP B.

4. Verify CLOSED LCV-460A & B, LTDN LINE STOP.

5. Place PZR Level Selector Switch, LM-459, to 461 REPL 460 position.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

CONTINUOUS USE

ATTACHMENT 10

RESTORING NORMAL POWER TO INSTRUMENT BUS 2 (AND 7)

(Page 1 of 7)

NOTE

- This attachment assumes that Instrument Bus 2 is currently powered from MCC-8.
- WHEN the Instrument Bus is transferred, THEN entry to ITS LCO 3.8.9 will occur.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Check INVERTER A - IN SERVICE	Place INVERTER A in service using OP-601, DC Supply System section, Startup of inverter A.
2.	Check Either Of The Following: • Reactor Trip Breakers - OPEN OR • Reactor Power - GREATER THAN P-10	Complete one of the following prior to proceeding: • Perform a GP-006 Shutdown OR • Raise Reactor power above P-10
3.	Perform The Following:	
	a. Evaluate the affect of a loss of Instrument Bus 2 on illuminated bistables in channels I, III, and IV	ALL Ch. II bistables will be illuminated
	b. Check affects of illuminated bistables - WILL CAUSE TRANSIENT	b. Go To Step 4.
	c. Verify the bistables - CLEARED	c. WHEN bistables are cleared, THEN Go To Step 4.

CONTINUOUS USE

ATTACHMENT 3

EXTENDED LOSS OF INSTRUMENT BUS 3 (AND 8)

(Page 1 of 5)

NOTE

The following control functions/indications will be lost until Instrument Bus 3 and 8 are restored:

PT-446, Turbine 1st Stage Pressure
HFC-114, FCV-114A Manual Load Station (Auto Makeup Function)
FRV A, B, & C Automatic Control
FRV Bypass Valve A (FCV-479)
PCV-455B, Spray Valve (Indication only)
Safeguards Train B Sequencer
FCV-1425 (AFW PUMP B inoperable)
Charging Pump A Controller, SC-151 (locks up)
Charging Pump C Controller, SC-153 (locks up)
ICCM - Channel II
Steam Dump Steam Pressure Control
RMS Racks 2 & 3 and R-32B
S/G A PORV Control
TCV-1447 and TCV-1448 Exhaust Hood Spray Valves
(Indication and Manual Function lost)
TR-448, RCP Temperature Recorder
RCP "Yellow" alarms (fed from TR-448)
Bistable Status Panel A

DISTRACTOR

1. Verify Turbine First Stage Pressure selected to PT-447 position.

NOTE

In the event that the Plant experiences a trip due to difficulty in maintaining all S/Gs in manual level control, feed flow to the S/Gs will be accomplished via the AFW Pumps OR FRV Bypass Valves.

2. Continue to operate FRVs A, B, & C in MAN.

3. Contact Operations Staff for availability of a dedicated FRV watch.

4. Place RCS MAKEUP SYSTEM Control Switch to STOP.

INSTRUMENT BUS NO. 3

Location: Safeguards Room, East Wall

Normal Power: Inverter "B" / Alternate Power: MCC-8 (2GL)

SPARE		**Instrument Bus No.3 Power Supply (From INST BUS 3 PWR XFER SW)**	
1	SPARE	2	Hagan Rack 8 (CWD 417)
3	Hagan Rack 14 Isolator Rack 30, Channel 3	4	Hagan Rack 15 (CWD 457)
5	Hagan Rack 16 (CWD 418)	6	Hagan Rack 17 (CWD 421); LI-970 (CWD 495); LI-969 (CWD 494A)
7	Hagan Rack 18 (CWD 422)	8	RTGB "C" TB-UE 42 and 43 RTGB "A" TB-SM 41 and 42 (CWD's 434, 963 and 964); FR-498 rec (CWD 964)
9	AFW Pump "B" Flow Control Valve FCV-1425, FIC-1425 (CWD 658)	10	NIS Cabinet "C", CWD 446
11	Safeguards Rack 63 (CWD 420)	12	Safeguards Rack Status Lights (CWD 397)
13	FIC-635, (CWD-489)	14	FIC-638, FIC-657 (CWD-489)
15	Exhaust hood spray valves (CWD 761)	16	Turbine Supervisory Recorder, Net Generation Recorder, Turbine MSR Temperature Recorder (CWD 791, 792, 793)
17	SPARE	18	Load, Frequency control panel (CWD 722)
19	NIS Cabinet "C" (2 Pole Bkr) (CWD 446)	20	Safeguards sequencing relays Train "B"
21		22	BLANK
23	Power Panel No. 26 Alternate Supply	24	BLANK
25	Instrument Bus No. 8	26	SPARE (3 Pole Bkr)
27	(3-pole breaker)	28	
29		30	

15. 058 AA1.03 001

Given the following plant conditions:

- Plant was operating at 100% RTP.
- A loss of "A" DC Bus occurs.

Which ONE (1) of the following identifies the expected plant response due to the loss of "A" DC Bus?

PCV-1922A, IVSW Automatic Header Pressure Control Valve

	Safety Injection Actuation	PCV-1922A OPEN	4KV Buses 1 & 2 Fast-Bus Transfer	Exciter Field Bkr Auto Trips
A.	YES	YES	YES	YES
B.✓	YES	YES	NO	NO
C.	NO	YES	NO	YES
D.	NO	NO	NO	NO

The correct answer is B.

A: Incorrect - The first two distractors are correct. 4KV Buses 1 and 2 will not Fast-Bus Transfer due to a loss of control power. The Exciter Field Bkr will not open due to a loss of control power. Foldout "A" contains steps to dispatch personnel to open the exciter field breaker on a loss of "A" DC bus. The Exciter Field Bkr will trip on a loss of "B" DC Bus. The SI will actuate since Instrument Bus 1 is lost due to E-1 Bus being de-energized and Instrument Bus 2 is lost from the loss of "A" DC Bus.

B: Correct

C: Incorrect - Candidate may not remember that Instrument Bus 1 is lost due to the loss of E-1 resulting in the SI. Candidate may also think that there is not relationship between a loss of DC power with the Exciter Field breaker since a Generator Lockout will still occur from the 86BU.

D: Incorrect - See discussion in "C" above for SI Actuation. Candidate may think that PCV-1922A will stay closed since, in this distractor, a safety injection did not actuate.

Question 15
Tier/Group 1/1
K/A Importance Rating - RO 3.1 SRO 3.3

Ability to operate and / or monitor the following as they apply to the Loss of DC Power:
Vital and battery bus components

Reference(s) - Sim/Plant design, EPP-26/27, EPP-26/27BD
Proposed References to be provided to applicants during examination - None
Learning Objective - EPP-26-008
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.5 / 45.6
Comments -

INFORMATION USE

ATTACHMENT 1

MAJOR EFFECTS / LOAD LIST

(Page 1 of 4)

Major Effects:

Reactor	Will trip due to loss of power to 52/RTA undervoltage coil.
Turbine	Will trip via 20/ET from Rx Trip (20/AST has lost power).
Generator	Will receive lockout signal. 86BU opens OCB 52/8 & 52/9 and initiates an auto bus transfer for 4KV busses on UAT. Exciter Field Breaker will not open.
4KV Busses 3, 4, & 5	4KV Bus 4 will transfer to Bus 3. Thus, 4KV Busses 3, 4, and 5 and all downstream busses and equipment will remain energized (this includes breaker DC Control Power and protective relaying).
4KV Busses 1 & 2	If initially on SUT, these and all downstream busses and equipment will remain energized. If initially on UAT, will not auto-transfer due to loss of control power. 4KV Busses 1 & 2 and all downstream busses and equipment, will deenergize. However, their supply and load breakers will remain closed. In either case, will lose DC Control Power and protective relaying. Safety Switch 1 is available to restore DC Control power to 4KV Busses 1 & 2
480V Bus E-1	May be energized or deenergized, based on condition of 4KV Bus 1. In either case, it and all downstream busses will lose DC Control Power and protective relaying.
EDG A	Auto-starts due to loss of power to air start solenoids but will not field flash nor close its output breaker.
EDG B	If Instrument Bus 1 & 2 are deenergized, an SI signal is generated. The B EDG will auto start but will not load since Bus E-2 is already energized from the SUT.

INFORMATION USE

ATTACHMENT 1

MAJOR EFFECTS / LOAD LIST

(Page 3 of 4)

Major DC Loads Lost:

Aux Panel DC Fuse Panel: (continued)

Component	Function	Position	Ckt
CVC-244	VCT/Debor Demin Diversion	to RC Filter	30
CVC-303A	RCP Seal Return	Open	24
CVC-303C	RCP Seal Return	Open	25
CVC-310B	Normal Charging	Open	22
CVC-311	Aux Spray	Closed	23
SI-850A	Accum A Test	Closed	10
SI-850B	Loop 1 Inj Line Test	Closed	5
SI-850E	Accum C Test	Closed	6
SI-851A	Accum A Makeup	Closed	7
SI-852A	Accum A Drain	Closed	8
SI-853A	Accum A Vent	Closed	9
SI-855	N_2 to Accum	Closed	17
RC-567	Reactor Vessel Head Vent	Closed	52
RC-569	Reactor Vessel Head Vent	Closed	52
IVSW-1922A	Auto Header Isolation	Open	45
MS-V1-3A	MSIV SG "A"	Closed	1
MS-V1-3B	MSIV SG "B"	Open[1]	43
MS-V1-3C	MSIV SG "C"	Open[1]	44
FCV-478	A FW Reg Valve	Closed	47
FCV-488	B FW Reg Valve	Closed	47
FCV-498	C FW Reg Valve	Closed	47
FCV-479	A FW Reg Valve Bypass	Closed	46
FCV-489	B FW Reg Valve Bypass	Closed	46
FCV-499	C FW Reg Valve Bypass	Closed	46
Steam Dumps (see previous page)			40,41,42

[1] MSIVs for S/G "B" & "C" will remain as-is since DC Bus B is still energized.

Loss of "A" DC

DISCUSSION

This Basis Document provides the step justification for a plant specific EPP. There is no ERG background for this procedure and no Safety Significant Deviation identification number is assigned for the steps since there are no corresponding ERG instructions.

The purpose of this procedure is to provide directions for combating conditions that arise from a loss of DC Bus A. The procedure is intended to handle situations arising from conditions in which the EPPs are applicable (> 350°F). This procedure assumes that no other casualty is in progress. Adjustment of the steps may be necessary if other events are in progress. A loss of DC is not an analyzed event at RNP and is not considered a credible event since a passive failure would be required to cause this event.

If the Reactor Trip Breakers are closed, there will always be a Rx Trip from a loss of power to the 52/RTA UV coil. EDG A will always auto-start, (loss of power to air start solenoids), but without control power, it cannot flash its field or close its output breaker. Since DC Bus A supplies Inverter A, Instrument Bus 2 and 7 will always be lost. However, Loss of DC Bus A has vastly different consequences depending on the initial AC electrical lineup. Initially, if at power, following the reactor and turbine trip, 4 KV and 480V Buses will remain energized as the turbine coasts down. Bus voltage will decrease as the turbine speed decreases. DC Bus A supplies Control Power to Breakers on 4KV Busses 1 & 2, 480V Busses 1 & 2A, and 480V Emergency Bus E-1. (480V Bus 2B is normally supplied from 4KV Bus 1, so it will follow the effects of Bus 1. However, its DC Control Power is supplied by Bus B so it will not lose protective relaying)

- If these busses were initially on the Startup Transformer (SUT) they will remain energized. However, all Busses except for 480V Bus 2B will lose DC Control Power.
- If the busses were initially on the Unit Aux Transformer (UAT), the resultant Rx/Turbine/Generator trip will attempt an auto-transfer, but without DC Control Power, this will not occur. The UAT will be deenergized along with all the busses and components it was supplying. The Loss of E-1 results in a loss of Instrument Bus 1. Since Instrument Bus 2 was lost from the Loss of DC Bus A, all bistables in both of these channels will fail and initiate an SI. (This will be a one-train SI since half the plant AC power is lost and the A train Sequencer is failed)

If the Reactor Trip Breakers were closed but all busses were still on the SUT, a Reactor Trip without SI will occur. If the Unit was at power and busses were on UAT, a Reactor Trip with SI will occur. Either way the EOP network will be entered. This EPP will be entered via PATH-1 and EPP-7 or EPP-4. Certain actions necessary for a Loss of DC Bus A will be completed in Foldout A. These are actions that are performed to enable completion of certain steps in PATH-1 and steps needed to combat the loss of DC. These steps are:

- Alignment of makeup to the Charging Pump suction by bypassing LCV-115B (CVC-358 is opened). LCV-115B fails closed and since Letdown is isolated, a path of water must be aligned to the Charging Pumps.
- Instrument Bus 2 is transferred to MCC-8 in order to regain instrumentation to aid in diagnostics of PATH-1.
- The exciter field breaker is tripped locally to prevent further damage to the Generator and Exciter. As the Generator coasts down, the exciter will attempt to maintain voltage by increasing its output. Normal protection is not available because the control power to trip the Exciter Field Breaker is via DC Bus A.
- A EDG Fuel Racks are tripped to stop the engine. This is the fastest method of stopping the damage to the air start distributor. The EDG is running but can not be loaded because of the lack of control power to the Voltage Regulator.
- Instrument Air is isolated to the EDG to prevent start attempts and conserve air in the starting receiver.
- If MCC-5 is deenergized it is transferred to the DS Bus. If the loss of DC Bus A occurred from an at power condition MCC-5 will be lost. Transferring the Bus to the DS bus will regain Instrument Bus 1 and safety related loads, such as valve operators powered from MCC-5.

This procedure and EPP-27, for DC Bus "B" have been credited in the evaluation of INPO SOER 81-15, PARTIAL LOSS OF DC POWER, recommendation 2C. No specific steps or sections were identified in the evaluation.

INFORMATION USE

ATTACHMENT 1

MAJOR EFFECTS / LOAD LIST

(Page 1 of 4)

Major Effects:

Reactor	Will trip due to loss of power to 52/RTB undervoltage coil.
Turbine	Will trip via 20/AST from Rx Trip (20/ET has lost power).
Generator	Will receive lockout signal. However, 86P cannot open OCB 52/8 & 52/9 due to the loss of their control power. This causes a Breaker Failure scheme which trips OCB 52/3, 52/6, 52/7, 52/12, 52/14 and the downstream breakers on the Darlington SCPSA line. The Exciter Field Breaker will open.
4KV Busses 1 & 2	If initially on SUT, nothing will happen. If initially on UAT, the busses will auto-transfer due to the Rx Trip. In either case, 4KV busses 1 and 2 and all downstream busses and equipment will remain energized.
4KV Bus 3	Will remain energized on the SUT. 4KV Bus 3 and 480V Bus 3 will lose DC Control Power (including a loss of protective relaying).
4KV Busses 4 & 5	4KV Bus 4 will try to auto-transfer to Bus 3 but cannot due to the loss of DC Control Power. Thus, 4KV Busses 4 & 5 and all downstream busses and equipment will deenergize. 4KV Bus 4 and 480V Bus 4 will lose DC Control Power (including a loss of protective relaying). Control Power (and protective relaying) will remain for 4KV Bus 5 and 480V Bus 5.
Emergency Bus E-1	Will remain energized. SST 2F will lose cooling fans.
Emergency Bus E-2	Will remain energized on the SUT but will lose DC Control Power (including a loss of protective relaying). SST 2G will lose cooling fans.
DS Bus	Will remain energized with Control Power available.
EDG A	Remains available, if needed.
EDG B	Auto-starts due to loss of power to air start solenoids but will not field flash and output breaker will not close.

Loss of 'B' DC

DISCUSSION

This Basis Document provides the step justification for a plant specific EPP. There is no ERG background for this procedure and no Safety Significant Deviation identification number is assigned for the steps since there are no corresponding ERG instructions.

The purpose of this procedure is to provide directions for combating conditions that arise from a loss of DC Bus B. The procedure is intended to handle situations arising from conditions in which the EPPs are applicable (> 350°F). This procedure assumes that no other casualty is in progress. Adjustment of the steps may be necessary if other events are in progress. A loss of DC is not an analyzed event at RNP and is not considered a credible event since a passive failure would be required to cause this event.

If the Reactor Trip Breakers are closed, there will always be a Rx Trip from a loss of power to the 52/RTB UV coil. EDG B will always auto-start, (loss of power to air start solenoids), but without control power, it cannot flash its field or close its output breaker. Since DC Bus B supplies Inverter B, Instrument Bus 3 and 8 will be lost. DC Bus B supplies Control Power to 4KV Buses 3 & 4, 480V Buses 2B, 3, & 4, and 480V Emergency Bus E-2.

Plant Distribution and Switchyard Effects

- If 4KV Buses 1 & 2 were initially on the Startup Transformer (SUT), these busses will remain energized. If initially on the Unit Aux Transformer (UAT), the resultant Rx/Turbine/Generator trip will initiate an auto-transfer and the busses will continue to be energized.
- Since 4KV Bus 3 is initially on the SUT, it, and the busses it supplies will always remain energized. However, these busses will not initially have DC Control Power (This means that fault protection for these buses is inoperable)
- If 4KV Buses 4 & 5 were on Bus 3, these busses will also remain energized. 4KV Bus 4 will not initially have any DC Control Power, but 4KV Bus 5 will (its Control Power comes from DC Bus "C").
- If 4KV Buses 4 & 5 were initially on the UAT, the resultant Rx/Turbine/Generator trip will try to initiate an auto-transfer (4KV Bus 4 to Bus 3), but without Control Power, nothing will happen. The UAT will be deeneergized along with 4KV Bus 4 & 5 and 480V Bus 4 & 5.
- The loss of 4KV Bus 4 will affect this event most by taking away power to PP-47 which supplies the cooling fans to both Emergency Bus transformers, SST 2F and 2G (480V Bus 4 feeds MCC-12 which feeds PP-28 which feeds PP-47). Both transformers could experience overheating. There are several means of attacking this problem. Transformer 2G can be mitigated by load shedding Bus E-2. For Transformer 2F, EDG A is available and could be paralleled on to E-1 to reduce the total transformer load. The best solution in either case is to transfer 4KV Bus 4 DC Control Power to the emergency source which would allow 4KV Bus 4 to be transferred to 4KV Bus 3 and thus regain power to 480V Bus 4 and PP-47. This is accomplished in Attachment 2.
- A Generator Lockout comes from 86P, but the Generator Output Breakers 52/8 and 52/9 cannot open due to loss of Control Power. This causes a breaker failure scheme which isolates the failed breakers by opening all surrounding breakers (52/3, 52/6, 52/7, 52/12, 52/14, and downstream breakers on the Darlington SCPSA line).
- 480V Bus 4 uses DC Control Power from MCC-B-A fed from B Battery. This however will have little impact other than manual operation of the charging springs. 480V Bus 4 breakers are not remotely operated and fault protection is provided via internal power from CTs which feed the amptector device. The amptector provides power to the breaker trip actuator. Thus control power is not required to provide fault protection.
- 480V Bus 5 uses AC Control Power (stepped down from the incoming voltage). Therefore, it will always have control power if the 480V source is energized.
- Unlike a loss of DC Bus A, this event will trip the Exciter Field Breaker. Thus, downstream buses will immediately drop to 0 Volts instead of decaying during the coastdown.
- 480V Bus 2B is powered from 4KV Bus 1 so it will remain energized. However, its DC Control Power will be lost. The main effect of the DC loss is a loss of cooling water to the Station Air Compressor (CWD-589). The control power will be restored via Attachment 2.

If the Reactor Trip Breakers were closed but all buses were on the SUT, a Reactor Trip with no loss of AC Buses will occur. If the Unit was at power and buses were on UAT, a Reactor Trip with loss of 4KV Buses 4 & 5 will occur. Either way the EOP network will be entered.

Since an SI does not occur on a loss of DC Bus B, entry to the procedure will be via EPP-4, Reactor Trip. Certain actions will be completed while in EPP-4 via Foldout A. These actions are:

a. Transfer of Instrument Bus 3 to MCC-8.

b. Shutdown of Emergency Diesel B.

STEP SPECIFIC DESCRIPTION AND RNP DIFFERENCES

The following pages will provide the RNP step number and the STEP basis for each step where applicable. This is a Robinson specific EOP, therefore there is no corresponding ERG series of steps. This procedure covers an event that is not covered by the ERGs (Loss of DC). The entire procedure may be categorized as an SSD 10. The steps within this procedure will not interfere with performance of the EOPs since this procedure does not consider any other event in progress other than a loss of DC Bus "B". The loss of a DC Bus at RNP is considered "beyond design basis" and is not analyzed in the UFSAR.

RNP STEP	BASIS
1	STEP BASIS

This step provides transitional direction for the subsequent step. If the Loss of DC occurred from an at power condition, the main generator output Circuit Breakers, 52/8 and 52/9, will be closed and action will be necessary to trip them.

If the event started from a low power or shutdown condition the subsequent step will not be necessary.

2 STEP BASIS

On a loss of DC Bus B the North and South Generator Circuit Breakers, 52/8 and 52/9, will receive a lockout signal. Due to the loss of DC these breakers will not open. This in turn causes backup relaying to open other breakers to isolate the generator. In order to accomplish actions later in the procedure and to allow reclosing the backup Circuit Breakers these breakers must be opened.

There are no local controls that will open the breakers without control power. There is, however, a maintenance control (for testing) at each phase of the Circuit Breakers. This feature will trip the Circuit Breakers one phase at a time. Since this function was not intended to be performed by Site Personnel the Load Dispatcher will be notified to request assistance in opening the breakers.

3 STEP BASIS

This continuous action step is provided to initiate efforts to repair the faulted DC Bus. It is placed early in the procedure so that efforts can be made to contact Maintenance personnel.

The high level step provides direction to diagnose the cause and provides transitional guidance. There are three possible failure mechanisms that are the most likely causes:

- Fault on B Battery
- Fault on B Battery Bus
- Fault on MCC-6

The failure, or tripping, of the in-service Battery Charger, is not a likely cause of the loss of DC since warning would be provided via an annunciator with ample time for Operator action to transfer the Chargers.

N4 STEP BASIS

The note reminds the Operator that AFW Pump B will not be available due to a loss of Control Power.

4 STEP BASIS

This step assures the maintenance of the secondary heat sink by maintaining S/G level at the standard range used throughout the EOP Network. In this case AFW Pump A and the SDAFW pump are specified since AFW Pump B is lost.

16. 065 AA2.05 001

Given the following plant conditions:

- Plant is at 100% RTP.
- APP-002-E7,INST AIR COMP D TRIP, illuminates.
- APP-002-F7, INST AIR HDR LO PRESS, illuminates.
- Instrument Air header pressure is 83 psig and lowering.
- AOP-017, LOSS OF INSTRUMENT AIR, is entered, and the transition made to Section A, Modes 1 AND 2.
- "B" and "C" S/Gs Levels are at 49% and slowly lowering.

Which ONE (1) of the following completes the statement below?

The operating crew is required _____ while continuing in AOP-017.

A. cross-connect Station Air and Instrument Air to regain control of "B" and "C" FRVs

B. lower turbine load as necessary to maintain feed and steam flows matched

C. take MANUAL control of "B" and "C" FRVs

D. ✓ trip the reactor and go to PATH-1

The correct answer is D.

A. Incorrect - AOP-017 does not direct cross-connecting station air and instrument air until instrument air pressure has dropped less than 80 psig. Pressure is currently 83 psig.

B. Incorrect - Although lowering turbine load may assist in matching steam flow and feed flow this is not a mitigation strategy specified in AOP-017. The correct strategy is specified in AOP-010.

C. Incorrect - This would be a correct action if a loss of instrument air was not in progress. In the conditions given the lowering air pressure must be assumed to cause the FRVs to drift and taking manual control would not be an effective strategy.

D. Correct - Step of AOP-017, Attachment A, asks the operator to check any S/G level control "Adversely affected by loss of IA." This would be answered "YES." The next step would have the operator trip the reactor and go to PATH-1 and continue in AOP-017.

Question 16
Tier/Group 1/1
K/A Importance Rating - RO 3.4 SRO 4.1

Ability to determine and interpret the following as they apply to the Loss of Instrument Air: When to commence plant shutdown if instrument air pressure is decreasing

Reference(s) - Sim/Plant design, PATH-1, AOP-017
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-017-004
Question Source - BANK (Last used for HLC-06 Replacement NRC Exam.)
Question Cognitive Level - F
10 CFR Part 55 Content - 43.5 / 45.13
Comments -

CONTINUOUS USE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL
VOLUME 3
PART 5
ABNORMAL OPERATING PROCEDURE

AOP-017

LOSS OF INSTRUMENT AIR

REVISION 40

Purpose and Entry Conditions

(Page 1 of 1)

1. PURPOSE

   This procedure provides instructions in the event a loss of Instrument Air occurs.

2. ENTRY CONDITIONS

   a. Instrument Air Header pressure less than 85 psig.

   b. Instrument Air System pressure lowering uncontrollably.

- END -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Check Plant Status - MODE 1 OR MODE 2	Go To Step 4.
* 2.	Check IA Header Pressure - LESS THAN 60 PSIG No	IF IA pressure lowers to less than 60 psig, THEN Go To Step 3. Go To Step 4.
3.	Perform The Following: a. Trip the Reactor b. Go To PATH-1 OR EOP-E-0, Reactor Trip or Safety Injection, while continuing with this procedure	
4.	Make PA Announcement For Procedure Entry	
5.	Verify Instrument Air Compressor D - RUNNING	
6.	Verify The Primary Air Compressor - RUNNING	
* 7.	Check IA Header Pressure - LESS THAN 80 PSIG No	IF IA pressure lowers to less than 80 psig, THEN observe NOTE prior to Steps 8 and 9 and perform Steps 8 and 9. Observe the NOTE Prior To Step 10 and Go To Step 10.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

IA-3821 is located on IA Dryer D.

Distractor

8. Dispatch Operator(s) To Perform The Following:

a. Verify Station Air Compressor Available For Service As Follows:

- Verify SA-1, STATION AIR TO RECEIVER - OPEN

  AND

- Verify Station Air Compressor Function Switch - ON

RNO: a. Go To Step 8.d.

b. Verify the following SA TO IA CROSS CONNECT BYPASS FILTER ISOLATION Valves - OPEN:

- SA-220
- SA-221

RNO: b. Open SA-5, STATION AIR TO INST AIR CROSS CONNECT.

c. Verify the STATION AIR COMP - RUNNING

d. Verify IA-18, AIR DRYER "A" & "B" BYPASS - OPEN

e. Verify the following Compressors - RUNNING

- INST AIR COMP A
- INST AIR COMP B

f. Check FCV-1740, AIR DRYER HIGH DP FLOW CONTROL Valve - OPEN

RNO: f. Open IA-3665, AIR DRYER "A" & "B" BYPASS.

g. Open IA-3821, INSTRUMENT AIR DRYER "D" BYPASS

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

- IA-662, IA BACK-UP CV QCV-10374 ISOLATION Valve is located on the Northeast side of Lube Oil Reservoir Tank.
- A ladder will be needed to close C-47, CST CONDENSER SUPPLY Valve, which is located approximately 9 ft above the ground on the CST.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
9.	Dispatch An Operator To Perform The Following:	
	a. Verify Condensate Polisher Air Compressor - RUNNING	a. Stop any Condensate Polisher regeneration in progress. Go To Step 9.c.
	b. Close IA-662, IA BACK-UP CV QCV-10374 ISOLATION	
	c. Isolate CST to the Condenser by verifying the following - CLOSED: • C-44A, LCV-1417A INLET AND • C-45, LCV-1417A BYPASS ISOL	c. Close C-47, CONDENSATE STORAGE TANK CONDENSER SUPPLY.
	d. Shutdown the MWT System using OP-915-1, Demineralized and Primary Water, System Shutdown	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

- SA-70 is a normally closed valve. It is NOT intended to dispatch an Operator to check the position of SA-70 in the subsequent step unless the position of the valve is in question.
- SA-70 is located in the overhead between Main Feed Pump "A" and the SG DRAIN/WLU PUMPs.
- A ladder will be required to access SA-70.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
10.	Determine Need To Isolate Instrument Air From Station Air As Follows:	
	a. Check Instrument Air cross-connected with Station air via SA-70, PRIMARY AIR COMP RECEIVER TO STATION AIR HEADER NO	a. Go To Step 11.
	b. Dispatch an operator to close SA-70	
11.	Check Loss Of IA - DUE TO TRIPPED AIR COMPRESSOR No	Dispatch operator(s) to locate AND isolate the leak as close to the break as possible.
12.	Make A PA Announcement For Plant Personnel To Stop Using IA For Breathing Air Until Further Notice	
*13.	Check Plant Status - BEING ADVERSELY AFFECTED DUE TO REDUCTION IN IA PRESSURE YES	IF plant is being adversely affected due to reduction in IA pressure, THEN Go To Step 14. Observe the CAUTION prior to Step 15 and Go To Step 15.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
14.	Determine Plant Operating Mode As Follows:	
	a. Check Plant status - SHUTDOWN NO	a. Go To Section A, Modes 1 AND 2.
	b. Check RHR status - ALIGNED FOR CORE COOLING	b. Go To Section B, Hot Shutdown (Without RHR In Service).
	c. Go To Section C, RHR Aligned For Core Cooling	

****

CAUTION

IF an Instrument Air Compressor has NOT come to a complete stop when transferring from automatic to manual, THEN the compressor may trip.

****

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
*15.	Check Start Cycles Of Instrument Air Compressors "A" AND "B" - LESS THAN 10 PER HOUR	WHEN the affected Air Compressor is NOT rotating, THEN place the compressor in the manual mode.
*16.	Determine If IA Capacity Has Been Restored As Follows:	
	a. Check IA Header pressure: • GREATER THAN 85 PSIG AND • STABLE OR RISING	a. WHEN IA pressure is greater than 85 psig, THEN Go To Step 17. Go To Step 1.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION A

Modes 1 AND 2

(Page 1 of 7)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
* 1.	Determine If IA Capacity Has Been Restored As Follows:	
	a. Check IA Header pressure: • GREATER THAN 85 PSIG NO AND • STABLE OR RISING	a. IF IA capacity is restored, THEN Go To Step 1.b. Go To Step 2.
	b. Go To Attachment 4, Restoration From Loss Of Instrument Air	
* 2	Check Any S/G Level Control - ADVERSELY AFFECTED BY LOSS OF IA YES	IF any S/G level control is affected, THEN Go To Step 3. Observe NOTE prior to Step 4 and Go To Step 4.
3.	Perform The Following: a. Trip the Reactor b. Go To PATH-1 OR EOP-E-0, Reactor Trip or Safety Injection, while continuing with this procedure c. Go To Section B, Hot Shutdown (Without RHR In Service)	

NOTE

Use of the RWST for RCS Makeup will add negative reactivity.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
* 4.	Check VCT Level - LESS THAN 12.5 INCHES	IF VCT level lowers to less than 12.5 inches, THEN Go To Step 5. Go To Step 7.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

Distractor

NOTE

Steps 1 is an immediate action step.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Check Feedwater Regulating Valves - OPERATING PROPERLY (MANUAL OR AUTO): • FCV-478, FRV "A" • FCV-488, FRV "B" • FCV-498, FRV "C" No	Perform the following: a. Verify FRV for affected S/G(s) in manual control. b. Attempt to stabilize S/G level using FRV and/or FRV Bypass Valves by matching steam flow with feed flow. c. Stop any load change in progress. d. IF unable to control S/G level, THEN trip the Reactor AND Go To PATH-1 OR EOP-E-0, REACTOR TRIP or SAFETY INJECTION. e. Go To Step 37.
* 2.	Check Reactor Trip Setpoint - BEING APPROACHED	IF a Reactor Trip Setpoint is approached, THEN trip the Reactor and Go To PATH-1 OR EOP-E-0, REACTOR TRIP or SAFETY INJECTION. Go To Step 4.
3.	Trip The Reactor And Go To Path-1 OR EOP-E-0, REACTOR TRIP or SAFETY INJECTION.	
4.	Make PA Announcement For Procedure Entry	

17. W/E 05 EK3.1 001

Given the following plant conditions:

- A loss of BOTH Main Feedwater Pumps (MFP) has resulted in a manual reactor trip.
- All 3 AFW Pumps are disabled.
- The crew is performing actions of FRP-H.1, Response to Loss of Secondary Heat Sink.
- Wide Range S/G levels are at 25% and lowering.
- Attempts to start either MFP have failed.
- PZR Level is at 12%.

Which ONE (1) of the following completes the statement below?

IAW FRP-H.1, RCS pressure will be reduced by opening __(1)__ to allow the __(2)__.

A.✓ (1) one PZR PORV

(2) Hi Steam Line DP and PZR Pressure SI signals to be blocked prior to performing actions to establish Condensate flow

B. (1) CVC-311, Aux. Spray

(2) Hi Steam Line DP and PZR Pressure SI signals to be blocked prior to performing actions to establish Condensate flow

C. (1) one PZR PORV

(2) safety injection flow to inject into the RCS

D. (1) CVC-311, Aux. Spray

(2) safety injection flow to inject into the RCS

The correct answer is A.

A. Correct.

B. Incorrect - One PZR PORV will be used to reduce RCS pressure since letdown has been secured based on PZR level. If letdown was in service then Auxiliary Spray would be the correct answer. One S/G will have to be depressurized to less than 600 psig to enable a condensate pump to flow forward into the S/G. The SI signals will be blocked to preclude having to reset the FW Isolation signals.

C. Incorrect - The first part of distractor is correct. The second part of the distractor is the basis for depressurizing the RCS when RCS Bleed and Feed is required. In this event Bleed and Feed criteria have not been met since S/G levels are at 25% Wide Range. The criteria for initiating Bleed and Feed is at least two S/G Wide Range levels less than 10% [19%].

D. Incorrect -One PZR PORV will be used to reduce RCS pressure since letdown has been secured based on PZR level. If letdown was in service then Auxiliary Spray would be the correct answer. The second part of the distractor is the basis for depressurizing the RCS when RCS Bleed and Feed is required. In this event Bleed and Feed criteria have not been met since S/G levels are at 25% Wide Range. The criteria for initiating Bleed and Feed is at least two S/G Wide Range levels less than 10% [19%].

Question 17
Tier/Group 1/1
K/A Importance Rating - RO 3.4 SRO 3.8

Knowledge of the reasons for the following responses as they apply to the (Loss of Secondary Heat Sink): Facility operating characteristics during transient conditions, including coolant chemistry and the effects of temperature, pressure, and reactivity changes and operating limitations and reasons for these operating characteristics.

Reference(s) - Sim/Plant design, FRP-H.1, FRP-H.1BD
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-H.1-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 41.10 / 45.6 / 45.13
Comments -

CONTINUOUS USE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL

VOLUME 3

PART 4

FUNCTION RESTORATION PROCEDURE

FRP-H.1

RESPONSE TO LOSS OF SECONDARY HEAT SINK

REVISION 24

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

****

CAUTION

Feed flow is not re-established to any faulted S/G if an intact S/G is available.

****

1.	Check Total Feed Flow - LESS THAN 300 GPM DUE TO OPERATOR ACTION	Go To Step 3.
2.	Reset SPDS And Return To Procedure And Step In Effect	
3.	Determine If Secondary Heat Sink Is Required As Follows:	
	a. Check RCS pressure - GREATER THAN ANY NON-FAULTED S/G PRESSURE	a. Reset SPDS and Go To PATH-1, Entry Point C.
	b. Check RCS temperature - GREATER THAN 350°F [310°F]	b. Perform the following: 1) Place RHR System in service using Supplement I. 2) <u>WHEN</u> adequate cooling with RHR is established, <u>THEN</u> reset SPDS and return to procedure and step in effect.
* 4.	Check Any Two S/G Wide Range Levels - LESS THAN 10% [19%]	<u>IF</u> any two S/G Wide Range Levels lower to less than 10% [19%], <u>THEN</u> Go To Step 5. Go To Step 6.
5.	Perform The Following: a. Stop all RCPs b. Observe <u>CAUTION</u> prior to Step 31 and Go To Step 31	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
6.	Check CST level - GREATER THAN 10%	Align SW backup to the AFW Pumps using OP-402, Auxiliary Feedwater System, while continuing with this procedure. IF the CST is low due to catastrophic failure AND is inaccessable, THEN align SW backup to the MDAFW Pumps using Attachment 2, SW Backup To MDAFW Pumps. Go To Step 14.
7.	Verify All S/G Blowdown AND Sample Isolation Valves - CLOSED	
8.	Check AFW Lines - INTACT	Isolate break. IF the break is isolated, THEN Go To Step 9. IF the break can NOT be isolated, THEN Go To Step 14.

d

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
9.	Try To Establish Motor Driven AFW Flow To At Least One S/G As Follows:	
	a. Check AFW Pump Breakers - TRIPPED	a. Go To Step 9.c.
	b. Attempt to reclose any tripped breakers as follows:	
	1) Position the MDAFW Pump Control Switch to the STOP position	
	2) Reset SI	
	3) Position the MDAFW Pump Control Switch to the START position	
	4) Check MDAFW Pump - RUNNING	4) IF the tripped breaker will NOT reclose, THEN contact I&C to investigate. Go To Step 10.
	c. Verify AFW HDR DISCH Valves - OPEN: • V2-16A • V2-16B • V2-16C	
	d. Check AFW flow to S/Gs - GREATER THAN 300 GPM	d. Go To Step 10.
	e. Reset SPDS and return to procedure and step in effect	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
10.	Attempt To Start SDAFW Pump As Follows:	
	a. Verify STEAM DRIVEN AFW PUMP STM SHUTOFF Valves - OPEN • V1-8A • V1-8B • V1-8C	a. IF the steam supply valves can NOT be opened, THEN Go To Step 11.
	b. Verify STEAM DRIVEN AFW PUMP DISCH Valves - OPEN • V2-14A • V2-14B • V2-14C	
	c. Check AFW flow to S/Gs - GREATER THAN 300 GPM	c. Go To Step 11.
	d. Reset SPDS and return to procedure and step in effect	
11.	Locally Investigate AND Attempt To Restore AFW Flow As Follows:	
	a. Verify AFW Pump suction supply is available	
	b. Position the MDAFW Pump LOCAL/REMOTE Switch to LOCAL	
	c. Attempt to start a MDAFW Pump as follows:	
	1) Depress the MDAFW Pump local STOP Pushbutton	
	2) Depress the MDAFW Pump local START Pushbutton	
	3) Check MDAFW Pump - STARTED	3) Place the LOCAL/REMOTE Switch to REMOTE.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
*12.	Check AFW Flow To S/Gs - GREATER THAN 300 GPM	IF feed flow to at least one S/G verified, THEN perform the following: a. Maintain flow to restore narrow range level to greater than 8% [18%]. b. WHEN narrow range level is greater than 8% [18%], THEN reset SPDS AND return to procedure and step in effect. Go To Step 14.
13.	Reset SPDS And Return To Procedure And Step In Effect	
14.	Stop All RCPs	
15.	Check Condensate System - IN SERVICE	Place the Condensate System in service as follows: a. IF the Condensate System is NOT available, THEN Go To Step 30. b. Open QCV-10426, COND POL SEC BYP. c. Close V5-3, COND PUMP DISCH. d. Momentarily place V5-3 to OPEN. e. Start one Condensate Pump. f. WHEN feedwater pressure is greater than 300 psig, THEN verify V5-3 full open. g. Open HCV-1459, LP HEATERS BYP. IF at least one Condensate Pump can NOT be started, THEN Go To Step 30.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

The subsequent step will defeat all FW Isolation signals which is necessary to allow starting of a Main Feedwater Pump. Manual Operator action will be required to initiate a FW Isolation.

16. Place ALL The FEEDWATER ISOLATION Key Switches In The OVRD/RESET Position

- STM GEN A
- STM GEN B
- STM GEN C

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

Local operation of the FRV and B/P valves below is via reverse acting handwheels.

17.	Attempt To Establish Feedwater Flow As Follows:	
	a. Verify the FW HDR SECTION Valves - CLOSED • V2-6A • V2-6B • V2-6C	
	b. Start one Main FW Pump	b. Go To Step 20.
	c. Open the FRV Bypass Valves: • FCV-479 • FCV-489 • FCV-499	c. Locally open the FRV Bypass Valve using the Manual Handwheel. (Requires small Locked Valve Key.)
	d. Check FW Flow - ESTABLISHED	d. Go To Step 20.
18.	Check S/G Levels As Follows:	
	a. Level In At Least One S/G - GREATER THAN 8% [18%]	a. Go To Step 19.
	b. Reset SPDS And Return To Procedure And Step In Effect	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
19.	Determine If Feedwater Flow Is Adequate:	
	a. Check the following: • Core Exit T/C Temperature - LOWERING <u>OR</u> • S/G Wide Range Level - RISING IN AT LEAST ONE S/G	a. Go To Step 20.
	b. Maintain FW flow to restore S/G Level to greater than 8% [18%]	
	c. Reset SPDS And Return To Procedure And Step In Effect	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

Supplement K is available for optimizing Auxiliary Spray below.

20. Depressurize The RCS As Follows:

a. Check letdown - IN SERVICE

No

a. IF a PZR PORV is available, THEN Go To Step 20.e.

IF a PZR PORV is NOT available, THEN Go To Step 20.b.

Distractor

b. Open CVC-311, AUX SPRAY

c. WHEN RCS pressure is less than 1950 psig, THEN close CVC-311

d. Observe the CAUTION prior to step 21 and Go To Step 21

e. Open one PZR PORV to depressurize the RCS to less than 1950 psig.

f. WHEN pressure is less than 1950 psig, THEN close the PORV.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

****

CAUTION

Following block of automatic SI initiation, manual SI initiation may be required if conditions degrade.

****

*21. Block SAFETY INJECTION As Follows:

a. Momentarily Place the PZR PRESS/HI STM LINE DP Switch to the BLOCK position

b. Check Tavg - LESS THAN 543°F

RNO: b. WHEN Tavg is less than 543°F, THEN perform Step 21.c.

Observe the CAUTION prior to Step 22 and Go To Step 22.

c. Momentarily Place the T-AVG Switch to the BLOCK position

22. Identify S/G With Lowest Level To Select For Depresssurization

23. Verify Closed MSIVs For Remaining S/Gs With Higher Levels

20-27 6 WOG BASIS

PURPOSE: To direct the operator in establishing condensate flow as an alternative (or supplement) to AFW and main FW flow

BASIS:

The condensate system is the next source of water readily available to the operator for use in reestablishing the secondary heat sink.

In order to depressurize at least one SG to less than the shutoff head pressure of the condensate system pumps, the RCS must be depressurized below (A.06) psig to allow blocking of the low steamline pressure SI and low PRZR pressure SI signals. If these signals were allowed to actuate, feedline and steamline isolation actuation signals may have to be reset. Feedline isolation may still occur on a reactor trip signal coincident with the low Tavg signal.

Auxiliary spray is used to depressurize the RCS, if letdown is in service, since it provides a maximum cooling to the primary system while allowing no loss of primary water inventory. Normal spray is not available since RCPs are stopped (Step 3). If letdown is not in service, PRZR PORVs are used to avoid thermal stresses to the auxiliary spray nozzles. However, if the PRZR PORVs cannot be used, auxiliary spray must be used.

Depressurization of the SG(s) is accomplished through the condenser steam dump, PORV, or other means if required. Footnote (O.09) defines the steam generator pressure requirement that will allow the condensate pump to provide adequate feedwater flow for decay heat removal. Minimum condensate flow for condensate pump protection, which is provided by a recirculation line flow control valve, is typically much greater than the flow required to remove decay heat. Reducing SG pressure to the condensate pump discharge header pressure for recirculation would permit the condensate pumps to inject into the SG with adequate feed flow for decay heat removal.

The optimum number of SGs to depressurize to less than O.09 psig, in the case of the reference plant, is one because certain benefits are realized by depressurizing only one SG. The likelihood of reaching the criteria for initiation of RCS bleed-and-feed is reduced because only a single SG is steamed. Additionally, the accompanying reduction in pressurizer level and RCS subcooling is less severe, which in turn reduces the likelihood that manual SI actuation will be required based on degraded plant conditions. Thus, before the SG is depressurized it should be isolated from the other SGs.

KNOWLEDGE:

At least one SG should be depressurized to a pressure that allows the condensate pump to deliver flow at least equal to that of which is used for decay heat removal. Providing condensate pump flow equal to the minimum flow used for recirculation, satisfies the flow requirement.

18. W/E 12 EK3.3 001

Given the following plant conditions:

- A Reactor Trip and Safety Injection have occurred from 100% RTP.
- EPP-16, Uncontrolled Depressurization of All Steam Generators, is being performed.
- All steam generator (S/G) pressures are lowering uncontrollably.

Which ONE (1) of the following completes the statement below regarding the **preferred** method for controlling feedwater flow in accordance with EPP-16?

The basis for lowering flow to 80 to 90 gpm to all S/Gs is to __(1)__ and the **preferred** method of controlling AFW flow is to __(2)__.

A. (1) minimize RCS repressurization rate

(2) dispatch an operator to manually throttle the V2-16s

B. (1) maintain S/G components in "wet" condition

(2) dispatch an operator to manually throttle the V2-16s

C. (1) minimize RCS repressurization rate

(2) throttle the MDAFW Flow Controllers FIC-1424 and FIC-1425

D✓ (1) maintain S/G components in "wet" condition

(2) throttle the MDAFW Flow Controllers FIC-1424 and FIC-1425

The correct answer is D.

A. Incorrect. With a fault in one or two S/Gs the operators are directed in Foldout A to dump steam from the intact S/G to control RCS repressurization once the faulted S/Gs have dried out. Candidate may think that controlling the AFW flow to the S/Gs will have the same desired effect. Dispatching an operator to manually throttle the V2-16s is the RNO method for controlling flow. Typically this method is necessary due to the varying pressures in the S/G's. However, control of feedwater is preferred to remain in the control room.

B. Incorrect. The first part of the distractor is correct. Dispatching an operator to manually throttle the V2-16s is the RNO method for controlling flow. Typically this method is necessary due to the varying pressures in the S/G's. However, control of feedwater is preferred to remain in the control room.

C. Incorrect. With a fault in one or two S/Gs the operators are directed in Foldout A to dump steam from the intact S/G to control RCS repressurization once the faulted S/Gs have dried out. Candidate may think that controlling the AFW flow to the S/Gs will have the same desired effect. The second part of the distractor is correct.

D. Correct.

Question 18
Tier/Group 1/1
K/A Importance Rating - RO 3.5 SRO 3.7

Knowledge of the reasons for the following responses as they apply to the (Uncontrolled Depressurization of all Steam Generators): Manipulation of controls required to obtain desired operating results during abnormal, and emergency situations.

Reference(s) - Sim/Plant design, EPP-16, EPP-16BD
Proposed References to be provided to applicants during examination - None
Learning Objective - EPP-16-003
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 41.10 / 45.6 / 45.13
Comments -

CONTINUOUS USE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL

VOLUME 3

PART 4

END PATH PROCEDURE

EPP-16

UNCONTROLLED DEPRESSURIZATION OF ALL STEAM GENERATORS

REVISION 18

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Open Foldout D	
2.	Perform The Following: a. Reset SPDS b. Initiate monitoring of Critical Safety Function Status Trees	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

****

CAUTION

Maintain one steam supply to the SDAFW available if the SDAFW Pump is the only available source of feed flow.

****

3. Isolate All S/Gs As Follows:

   a. Verify FW REG AND FW REG BYPASS Valves - CLOSED

   b. Verify FW HDR SECTION Valves - CLOSED

      - V2-6A
      - V2-6B
      - V2-6C

   c. Verify STEAM SHUTOFFS Valves - CLOSED

      - V1-8A
      - V1-8B
      - V1-8C

   d. Verify MSIVs AND MSIV BYP Valves - CLOSED

   e. Verify STEAM LINE PORVs - CLOSED

      - RV-1
      - RV-2
      - RV-3

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
4.	Locally Open The Breakers For The Following Valves: • V1-8A, SDAFW PUMP STEAM ISOLATION (MCC-5, CMPT-16F) • V1-8B, SDAFW PUMP STEAM ISOLATION (MCC-6, CMPT-16M) • V1-8C, SDAFW PUMP STEAM ISOLATION (MCC-6 CMPT-18M)	
5.	Check The Following S/G Blowdown Isolation <u>AND</u> Sample Valves - CLOSED:	
	a. FCV-1930 A & B <u>AND</u> FCV-1933 A & B	a. Locally remove power to Radiation Monitor R-19A by placing switch located at bottom right hand corner inside monitor cabinet to OFF.
	b. FCV-1931 A & B <u>AND</u> FCV-1934 A & B	b. Locally remove power to Radiation Monitor R-19B by placing switch located at bottom right hand corner inside monitor cabinet to OFF.
	c. FCV-1932 A & B <u>AND</u> FCV-1935 A & B	c. Locally remove power to Radiation Monitor R-19C by placing switch located at bottom right hand corner inside monitor cabinet to OFF.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
6.	Locally Verify The Following Valves - CLOSED a. BYPASS DRN & WARM-UP LINE TO AFW PUMP: • MS-20 • MS-29 • MS-38 b. STEAM LINE BEFORE SEAT DRAIN ROOT ISOL: • MS-19 • MS-28 • MS-37 c. STEAM LINE AFTER SEAT DRAIN ROOT ISOL: • MS-21 • MS-30 • MS-39	
7.	Check Cooldown Rate In RCS Cold Legs - GREATER THAN 100°F/HR IN LAST 60 MINUTE	Go To Step 11.
8.	Check MDAFW Pump Status - AT LEAST ONE AVAILABLE	Go To Step 10.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
9.	Control Feed Flow To Minimize RCS Cooldown As Follows: a. Throttle feed flow to between 80 gpm and 90 gpm to each S/G using MDAFW FLOW CONTROLLER: • FIC-1424, AFW PUMP A DISCH FLOW OR • FIC-1425, AFW PUMP B DISCH FLOW Preferred	Distractor a. Establish between 80 gpm and 90 gpm feed flow to each S/G as follows: 1) Open the breakers for MDAFW HEADER DISCHARGE Valves: • V2-16A (MCC-9, COMPT-2ML) • V2-16C (MCC-9, COMPT-3J) • V2-16A (MCC-10, COMPT-4C) • V2-16B (MCC-10, COMPT-4F) 2) Locally throttle AFW HDR DISCH Valves to establish 80 gpm to 90 gpm to each S/G: • AFW-V2-16A - S/G "A" • AFW-V2-16B - S/G "B" • AFW-V2-16C - S/G "C" 3) Go To Step 11.
	b. Go To Step 11	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
10.	Control Feed Flow To Minimize RCS Cooldown As Follows:	
	a. Throttle feed flow to between 80 gpm and 90 gpm to each S/G using FIC-6416, SDAFW FLOW CONTROLLER	a. Establish between 80 gpm and 90 gpm feed flow to each S/G as follows: 1) Open the breakers to SDAFW PUMP TO S/G: • V2-14A (MCC-10, CMPT-3C) • V2-14B (MCC-9, COMPT-1C) • V2-14C (MCC-10, COMPT-4M) 2) Locally throttle SDAFW PUMP FW DISCH TO SG to establish 80 gpm to 90 gpm to each S/G: • AFW-V2-14A - S/G "A" • AFW-V2-14B - S/G "B" • AFW-V2-14C - S/G "C"
11.	Maintain A Minimum Of 80 GPM AFW Flow To Each S/G With Level Less Than 8% [18%]	
12.	Check S/G Levels - ALL LESS THAN 50%	Control feed flow to maintain level less than 50% in all S/Gs.
13.	Request Periodic RCS Boron Samples	
14.	Check RCS Hot Leg Temperatures - STABLE <u>OR</u> DECREASING	Control feed flow <u>OR</u> steam dump to stabilize RCS Hot Leg temperatures.

RNP STEP	WOG STEP	BASIS/DIFFERENCES

7   2

WOG BASIS

PURPOSE: To control feed flow to minimize the effects of the cooldown due to the secondary depressurization and to subsequently control the transient.

BASIS:

Depending upon the size of the effective break areas for the steam generators, the cooldown rate experienced after reactor trip could exceed 100°F/hr. A reduction of feed flow to the steam generators has three primary effects:

1. To minimize any additional cooldown resulting from the addition of feedwater,
2. To prevent steam generator tube dryout by maintaining a minimum feed flow to the steam generators and,
3. To minimize the water inventory in the steam generators that eventually is the source of additional steam flow to containment or the environment.

The minimum feed flow of (S.04) gpm represents the value in plant specific units corresponding to 25 gpm. The 25 gpm value is representative of a minimum measurable feed flow to a steam generator. Plant specific values may depend upon flow instrumentation and the sensitivity of the controls on the feed flow.

As steam flow rate drops, the feed flow will eventually increase the steam generator inventory. Feed flow is controlled to maintain steam generator narrow range level less than 50% to prevent overfeeding the steam generators.

In addition, as SG pressure and steam flow rate drop, RCS hot leg temperatures will stabilize and start increasing. The operator controls feed flow or dumps steam to stabilize the RCS hot leg temperatures. This allows the safety injection flow to establish conditions for SI termination and minimizes thermal stresses that may be generated.

RNP DIFFERENCES/REASONS

Step 7 of the RNP procedure represents step step 2.a of the ERG. The RNP step has been split inot multiple steps in order to eliminate the actions contained in the ERG Caution at step 2 and to provide for other Human Factors concerns associated with the ERG step.

SSD DETERMINATION

This is an SSD per criterion 11.

8, 9, 10, & 11   C2

WOG BASIS

PURPOSE: To alert the operator to maintain a minimum feed flow to minimize any subsequent thermal shock to SG components

BASIS:

If feed flow to a SG is isolated and the SG is allowed to dry out, subsequent reinitiation of feed flow to the SG could create significant thermal stress conditions on SG components. Maintaining a minimum verifiable feed flow to the SG allows the components to remain in a "wet" condition, thereby minimizing any thermal shock effects if feed flow is increased.

RNP DIFFERENCES/REASONS

The RNP procedure places the caution or note in an action step to prevent actions within cautions and noted as required by the writer's guide. The RNP steps for throttling have been split since the throttle valves are different for the SDAFW Pumps and the MDAFW Pumps.

19. 005 AK2.02 001

Given the following plant conditions:

- The plant is operating at 50% RTP with OST-011, Rod Cluster Control Exercise & Rod Position Indication, being performed.
- When Control Bank "D" rods are returned to 164 steps it is noted that one rod is 17 steps below the rest of the bank.
- AOP-001, Malfunction of Reactor Control System, is implemented by the crew.
- The Shift Manager has directed that the rod be realigned IAW AOP-001.

Which ONE (1) of the following completes the basic method used to realign the rod listed below?

Open the Control Bank "D" lift coil disconnect switch(es) for __(1)__.
Realign the rod using __(2)__ position of the rod bank selector switch.
Close all lift coil disconnect switches.

A.✓ (1) all but the misaligned rod

(2) CB D

B. (1) all but the misaligned rod

(2) M (MANUAL)

C. (1) the misaligned rod

(2) CB D

D. (1) the misaligned rod

(2) M (MANUAL)

The correct answer is A.

A. Correct.

B. Incorrect - The first part of the answer is correct. AOP-001 specifies that the rods will be moved by selecting the specific bank on the Rod Bank Selector switch. Since this is Control Bank D, leaving the Rod Bank Selector switch in Manual would not be a problem based on rod sequencing but is not authorized by the procedure.

C. Incorrect - The process for recovery is to withdraw the affected rod to align with the other rods in the bank. If only the misaligned rod lift coil disconnect switch was opened then all the unaffected rods would have to be inserted. This would create a much larger and undesired reactivity effect. The second part of the distractor is correct.

D. Incorrect - The process for recovery is to withdraw the affected rod to align with the other rods in the bank. If only the misaligned rod lift coil disconnect switch was opened then all the unaffected rods would have to be inserted. This would create a much larger and undesired reactivity effect. AOP-001 specifies that the rods will be moved by selecting the specific bank on the Rod Bank Selector switch. Since this is Control Bank D, leaving the Rod Bank Selector switch in Manual would not be a problem based on rod sequencing but is not authorized by the procedure.

Question 19
Tier/Group 1/2
K/A Importance Rating - RO 2.5 SRO 2.6

Knowledge of the interrelations between the Inoperable / Stuck Control Rod and the following: Breakers, relays, disconnects, and control room switches

Reference(s) - Sim/Plant design, AOP-001, AOP-001BD
Proposed References to be provided to applicants during examination - None
Learning Objective -AOP-001-004
Question Source - BANK
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7
Comments -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 1 of 35)

1.	Check Current Plant Status - MODE 1	Observe the NOTE prior to Step 49 and Go To Step 49.
2.	Verify ROD BANK SELECTOR Switch Position - M (Manual)	
3.	Check Tavg - WITHIN -1.5 TO +1.5°F OF TREF	Adjust Turbine load using Attachment 1, Turbine Load Adjustment, OR RCS boron concentration using OP-301, Chemical and Volume Control System (CVCS), RCS Boration Quick Checklist, OR RCS Dilution Quick Checklist, to maintain Tavg to within -1.5 to +1.5°F of Tref prior to continuing.
4.	Stop Any Evolutions That Change Reactor Power Except As Called For By This procedure • Turbine load changes • Boron concentration changes	
5.	Check APP-005-E2, ROD CONT SYSTEM URGENT FAILURE - ILLUMINATED No →	Perform one of the following: • IF an entire bank of rods will NOT move, THEN Go To Step 64. OR • IF individual rod(s) indicate misalignment OR will NOT move, THEN Go To Step 18.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 8 of 35)

*16.	Perform Appropriate Alignments As Follows:	
	a. Check Reactor Engineering finding - ROD ALIGNMENT NECESSARY	a. Perform the following: 1) WHEN the urgent failure condition is corrected, THEN depress ROD ALARM RESET button on RTGB AND verify APP-005-E2 clears. 2) Go To Section D, Individual Rod Position Indication Failure.
	b. Check Reactor Engineering finding - IRPI ADJUSTMENT NECESSARY	b. Go To Step 17.
	c. Perform Section D, Individual Rod Position Indication Failure, prior to continuing with this section of the procedure	
17.	Determine If Urgent Failure Alarm Should Be Reset As Follows:	
	a. Check urgent failure condition - CORRECTED	a. WHEN the urgent failure condition is corrected, THEN Go To Step 17.b.
	b. Check APP-005-E2, ROD CONT SYSTEM URGENT FAILURE - EXTINGUISHED	b. Depress the ROD ALARM RESET Pushbutton on the RTGB AND verify APP-005-E2 clears.
	c. Go To Step 27	
18.	Contact Personnel To Assist In The Recovery: • I&C Maintenance • Engineering	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 9 of 35)

NOTE

- TECH SPEC limits for bank positions greater than OR equal to 200 steps are 15 inches (24 steps) alignment with associated Group Step Counter position.
- TECH SPEC limits for bank positions less than 200 steps are 7.5 inches alignment with average IRPI position of associated Bank.
- Use IRPI and/or Incore Flux Map for determination of Control Rod misalignment.
- ERFIS display GD ROD LOG may be used for additional information.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
19	Check IRPI Rod Misalignment - GREATER THAN TECH SPEC LIMIT	Observe the CAUTION prior to Step 23 and Go To Step 23.
20	Check Number Of Rods Indicating Misalignment - GREATER THAN ONE	Observe the NOTE prior to Step 22 and Go To Step 22.
21.	Perform The Following:	
	a. Check SDM - Refer to FMP-012, Manual Determination of Shutdown Margin Boron Concentration for proper SDM.	a. Initiate boration to restore SDM within 1 hour.
	b. Within 6 hours Place the unit in Mode 3 using GP-006-2, Rapid Plant Shutdown From Power Operation To Hot Shutdown.	
	c. Go To Step 61	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 10 of 35)

NOTE

This Continuous Action step is designed to assure compliance with ITS LCO 3.1.4 if the rod can NOT be realigned within 1 hour.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
*22.	Check Rod Realignment Status - COMPLETE	IF the rod realignment has NOT been completed within 1 hour of discovery, THEN perform the following: a. Verify SDM is within the limits specified in the COLR within 1 hour in accordance with FMP-012, Manual Determination of Shutdown Margin Boron Concentration. b. Reduce Thermal Power to less than or equal to 70% within 2 hours. c. Verify SDM is within the limits provided in the COLR every 12 hours in accordance with FMP-012, Manual Determination of Shutdown Margin Boron Concentration. d. Notify Reactor Engineering to perform ITS SR 3.2.1.1 AND SR 3.2.2.1 within 72 hours. e. IF the rod can NOT be realigned. THEN within 5 days, complete a Safety Analysis for continued operation with the misaligned rod.

(CONTINUED NEXT PAGE)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

22. (CONTINUED)

f. IF the requirements of items a through e can NOT be achieved, THEN be in Mode 3 within 6 hours using GP-006-2, Rapid Plant Shutdown from Power Operation to Hot Shutdown.

****

CAUTION

Movement of Control Rods except as directed by subsequent steps to realign a rod could cause further misalignment.

****

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
*23.	Check For Power Reduction - REQUIRED	IF a power reduction becomes necessary, THEN perform Step 24. Observe the NOTE prior ~~to~~ Step 25 and Go To Step 25.
24.	Perform The Following: • Borate to reduce Reactor power using OP-301, Chemical and Volume Control System (CVCS), RCS Boration Quick Checklist. • Adjust Turbine load to maintain Tavg to within -1.5 to +1.5°F of Tref using Attachment 1, Turbine Load Adjustment.	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 12 of 35)

NOTE

- The Reactor Engineer's findings will determine if rods are to be aligned OR if an IRPI adjustment is necessary.
- ERFIS display GD ROD LOG may be used for additional information.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
25.	Confirm Indications Of Misaligned Rod(s) As Follows:	
	a. Request Reactor Engineering evaluate indications to determine extent of rod misalignment	
	b. Check Reactor Engineering determination - COMPLETED	b. WHEN the Reactor Engineering determination is complete, THEN Go To Step 26.
26.	Perform Appropriate Alignments As Follows:	
	a. Check Reactor Engineering finding - ROD MISALIGNED/STUCK	a. Go To Section D, Individual Rod Position Indication Failure.
	b. Check Reactor Engineering finding - IRPI ADJUSTMENT NECESSARY	b. Go To Step 27.
	c. Perform Section D, Individual Rod Position Indication Failure, prior to continuing with this section of the procedure	
27.	Check Identified Equipment Failure(s) Causing Rod Misalignment - CORRECTED Y	WHEN I&C personnel have completed repairs, THEN observe NOTE prior to 28 AND Go To Step 28.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

NOTE

The rate of rod withdrawal/insertion referred to below is in relation to the duration of time over which the rod should be recovered; NOT rod speed.

28. Contact Reactor Engineering To Obtain The Following:

a. Power level at which recovery is to be performed

Power Level % ________________

b. Rate at which rod should be withdrawn/inserted

Rod Rate Withdrawal/Insertion ________

c. Record affected rod position

Number of steps ________________

29. Notify Manager - Operations Or His Designee Of The Following:

a. Current plant conditions

b. Power level required for rod alignment

c. Approval for rod alignment is required prior to continuing

d. Check rod alignment - APPROVED — RNO: d. Go To Step 61.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 14 of 35)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
30.	Make Preparations For Rod Alignment As Follows:	
	a. Monitor the highest indicating Power Range NIS Channel	
	b. Check power reduction - REQUIRED	b. Go To Step 30.d
	c. Adjust Reactor power level as follows: • Borate to reduce Reactor power using OP-301, Chemical and Volume Control System (CVCS), RCS Boration Quick Checklist • Adjust Turbine load using Attachment 1, Turbine Load Adjustment, OR steam dumping rate to maintain Tavg to within -1.5 to +1.5°F of Tref	
	d. Record the following in the CO Log Book: • Time that rod misalignment was observed • Power level at which rod will be recovered • Rate of rod withdrawal/insertion to be used • Core location of misaligned rod	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

31. Record the Group Step Counter Reading For The Group Associated With The Misaligned Rod

______________________ Steps

NOTE

The P-A Converter is located in the Computer Room in RACK RPI #2 - ROD POSITION DETECTOR & BISTABLE ASSEMBLIES. Key #16 is required to unlock the cabinet door.

32. Determine If The P-A Converter Reading Needs To Be Recorded As Follows:

a. Check misaligned rod location - LOCATED IN CONTROL BANK — a. Go To Step 33.

b. Place the DISPLAY Selector Switch in the affected bank position.

c. Record the P-A Converter reading for the affected Control Bank

______________________ Steps

d. Place the DISPLAY Selector Switch in the OFF position

33. Check misaligned rod position - HIGHER THAN REMAINDER OF BANK — Go To Step 39.

No

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
38.	Determine If Group Step Counters Are Properly Sequenced As Follows:	
	a. Check Group 1 AND Group 2 Group Step Counter readings for the affected bank - EQUAL	a. Perform one of the following: • IF the misaligned rod was in Group 1, THEN Go To Step 38.c. OR • IF the misaligned rod was in Group 2, THEN Go To Step 44.
	b. Check misaligned rod location - WAS IN GROUP 2	b. Go To Step 44.
	c. Insert the rod one step	
	d. Withdraw the rod one step	
	e. Go To Step 44	
39.	Reset The Group Step Counter For The Affected Rod Group To The Value Recorded In Step 28.c	

NOTE

Key #13 is required to open the Lift Coil Disconnect Panel Door.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
40.	Place Lift Coil Disconnect Switches For All Rods In The Affected Bank, EXCEPT The Misaligned Rod, In The OFF Position	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 19 of 35)

~~41~~ Adjust Tavg To Within -1.5 TO +1.5°F Tref During Rod Alignment As Follows:

- Adjust Turbine load using Attachment 1, Turbine Load Adjustment

  OR

- Adjust boron concentration using OP-301, Chemical and Volume Control System (CVCS), RCS Boration Quick Checklist, OR RCS Dilution Quick Checklist

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 20 of 35)

NOTE

APP-005-E2, ROD CONT SYSTEM URGENT FAILURE, will illuminate when the rod is moved due to all Lift Coil Disconnect Switches being off in the unaffected group.

42. Align The Affected Rod As Follows:

a. IF traversing the ROD BANK SELECTOR Switch through the AUTO position is required in the next step, THEN Depress AND hold the AUTO ROD DEFEAT Pushbutton

b. Select the affected bank with the ROD BANK SELECTOR Switch

c. IF the AUTO ROD DEFEAT Pushbutton is depressed, THEN release the AUTO ROD DEFEAT Pushbutton

d. Withdraw the rod at the rate specified in Step 28.b to the Group Step Counter position recorded in Step 31

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 21 of 35)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
43.	Establish Proper Rod Group Sequencing As Follows:	
	a. Check Group 1 AND Group 2 Group Step Counter readings for the affected bank - EQUAL	a. Perform one of the following: • IF the misaligned rod was in Group 2, THEN Go To Step 43.c. OR • IF the misaligned rod was in Group 1, Go To Step 44.
	b. Check misaligned rod location - WAS IN GROUP 1	b. Go To Step 44.
	c. Withdraw the rod one step	
	d. Insert the rod one step	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

SECTION B

IMMOVABLE/MISALIGNED RODS

(Page 22 of 35)

NOTE

Key #13 is required to open the Lift Coil Disconnect Panel Door.

44. Return The Rod Control System To Normal As Follows:

    a. Place the Lift Coil Disconnect Switches for the affected bank in the ON position

    b. IF traversing the ROD BANK SELECTOR Switch through the AUTO position is required in the next step, THEN Depress AND hold the AUTO ROD DEFEAT Pushbutton

    c. Place ROD BANK SELECTOR Switch in M (Manual)

    d. IF the AUTO ROD DEFEAT Pushbutton is depressed, THEN release the AUTO ROD DEFEAT Pushbutton

    e. Depress ROD ALARM RESET Pushbutton on RTGB

    f. Verify APP-005-E2 clears

20. 028 AA2.04 001

Given the following plant conditions:

- Plant is at 100% RTP.
- "C" Charging Pump is in Auto and "B" Charging Pump is in Manual.
- Pressurizer level transmitter LT-459 is selected for control when the reference leg for LT-459 develops a small leak.

Which ONE (1) of the following identifies the instrument and plant response?

	LI-459 PZR LVL Indication	LI-460 PZR LVL Indication	"C" Charging Pump Speed Controller Output
A.	Lowers	Rises	Rises
B.✓	Rises	Lowers	Lowers
C.	Lowers	Lowers	Rises
D.	Rises	Rises	Lowers

The correct answer is B.

A. Incorrect - The reference leg leak will cause LI-459 to fail high. The indication would lower if the leak was on the variable line of the D/P cell.

B. Correct

C. Incorrect - The reference leg leak will cause LI-459 to fail high. The indication would lower if the leak was on the variable line of the D/P cell. Candidate may think that LT-459 and LT-460 share a common reference line as does LT-461 and LT-462 (cold cal. instrument).

D. Incorrect - The candidate may think that LT-459 and LT-460 have a common reference line. These transmitters have independent reference lines. LI-460 will lower due to the charging pump speed lowering.

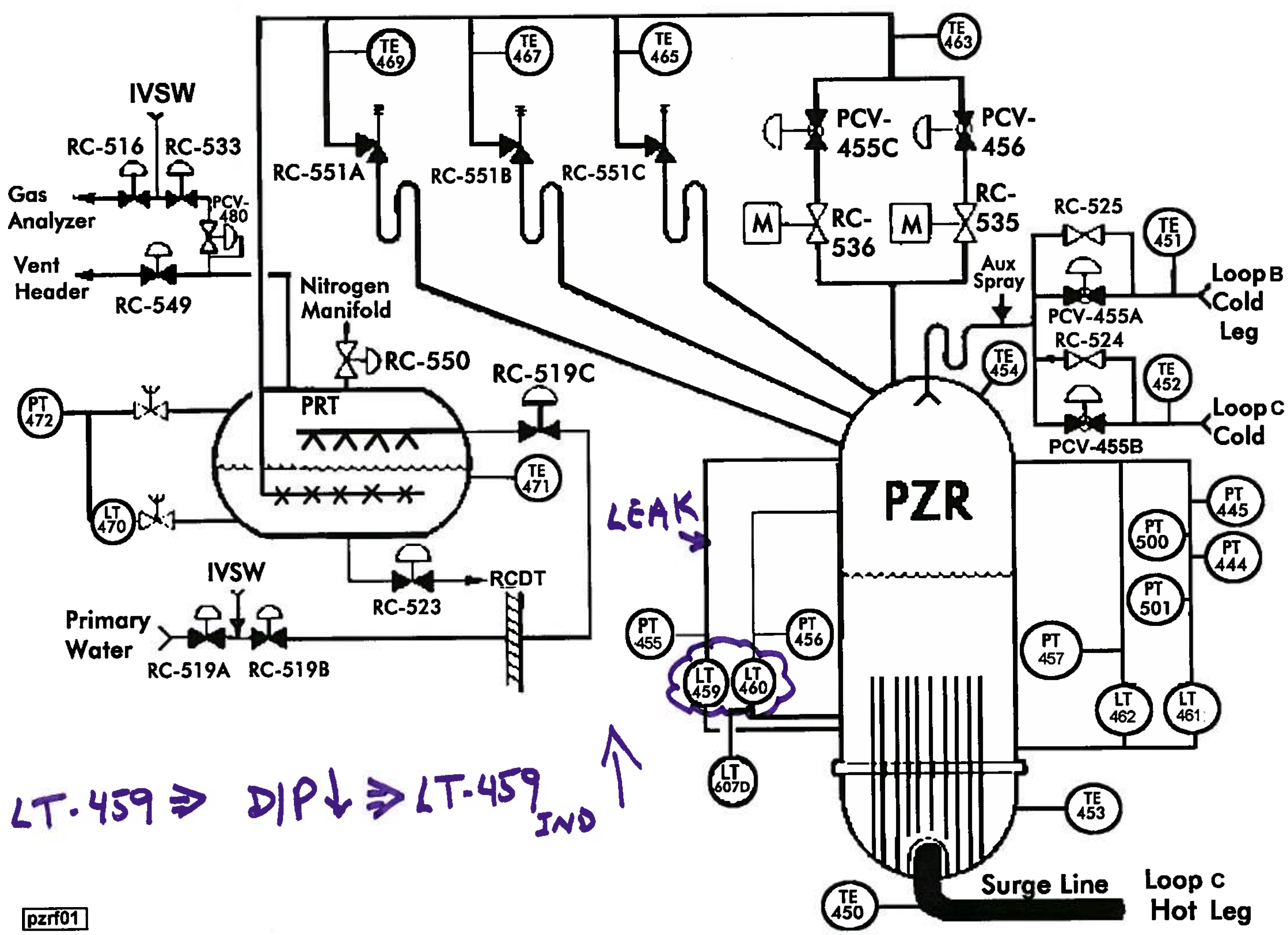
Question 20
Tier/Group 1/2
K/A Importance Rating - RO 2.6 SRO 3.1

Ability to determine and interpret the following as they apply to the Pressurizer Level Control Malfunctions: Ammeters and running indicators for CVCS charging pumps

Reference(s) - Sim/Plant design, System Description, GFES
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-025-004
Question Source - BANK (Modified from a question used on 2007 NRC Exam. Used VCT level in 2007 vice CCP Speed Controller Output.)
Question Cognitive Level - H
10 CFR Part 55 Content - 43.5 / 45.13
Comments - Discussion with P. Capehart on 6/15/11: RNP does not have ammeter indicators for CVCS charging pumps. It was agreed that any indications of CVCS charging pumps (speed indication, red/green lights, Flowrate, etc.) could be utilized to meet this K/A.

SYSTEM SIMPLIFIED DIAGRAM

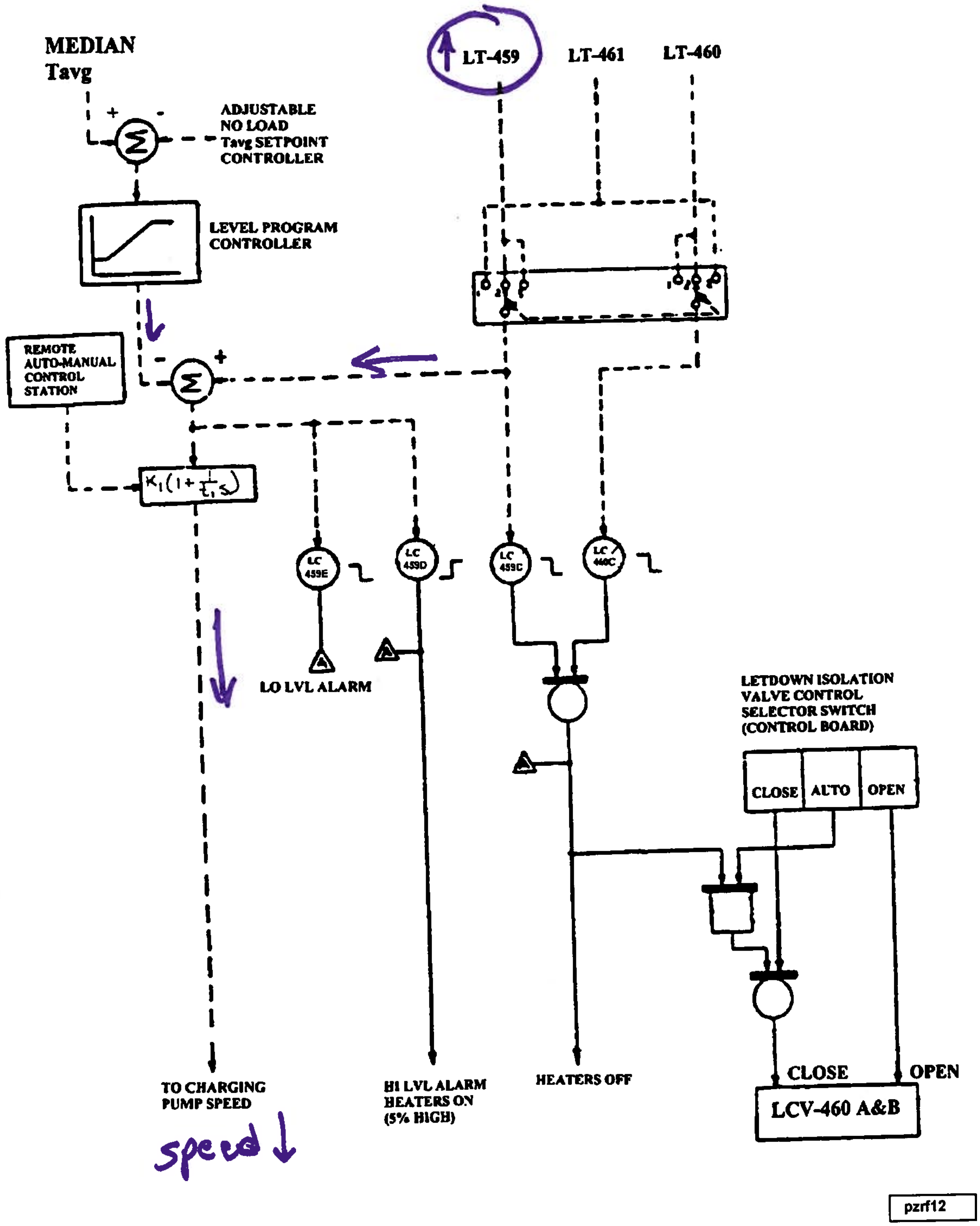
PZR-FIGURE-1



INFORMATION USE ONLY

LEVEL CONTROLLER

PZR-FIGURE-10



INFORMATION USE ONLY

21. 032 AA2.09 001

I&C has just completed a surveillance on the high voltage power supply to the Source Range nuclear instruments. The surveillance determined the as-found voltage was 1400 VDC, instead of the normal 1600 VDC.

Which ONE (1) of the following identifies the effect the lower voltage has on SR N-31 and N-32 instrument response?

N-31 and N-32 will indicate __(1)__ than normal due to a reduction in voltage to the __(2)__.

A. (1) higher

(2) pulse height discriminator allowing more ionization events to pass

B. (1) higher

(2) detector resulting in more ion pairs being detected

C. (1) lower

(2) pulse height discriminator allowing fewer ionization events to pass

D.✓ (1) lower

(2) detector resulting in fewer ion pairs being detected

The correct answer is D.

A: Incorrect - Pulse height discriminator circuit has no relation to the High Voltage applied to the detector.

B: Incorrect - Indicated power will lower. The reduction of 200 VDC is significant.

C: Incorrect - Pulse height discriminator circuit has no relation to the High Voltage applied to the detector.

D: Correct - The high voltage set at 1600 VDC in the Proportional Region of the detector curve, such that a significant reduction in applied voltage will result in a reduced count rate.

Question 21
Tier/Group 1/2
K/A Importance Rating - RO 2.5 SRO 2.9

Ability to determine and interpret the following as they apply to the Loss of Source Range Nuclear Instrumentation: Effect of improper HV setting

Reference(s) - Sim/Plant design, LP-703, System Description, GFES
Proposed References to be provided to applicants during examination - None
Learning Objective - GFES Sensors and Detectors
Question Source - BANK (Last used for HLC-08. Format of question revised.)
Question Cognitive Level - H
10 CFR Part 55 Content - 43.5 / 45.13
Comments -

3.0 COMPONENT DESCRIPTION

3.1 Detectors

A gas filled detector consists of an outer can, an inner electrode and the fill gas. An electrical potential is applied between the outer can and the electrode. When neutrons or gamma rays pass through the fill gas, ionization occurs resulting in ion-pairs being formed. The positive ion will be attracted to the negative potential (cathode) and the electrons will travel to the positive potential (anode). Adjusting the applied voltage will affect the acceleration of the ions and thus the number of ion-pairs formed.

The number of ion-pairs collected is a function of applied voltage and can be plotted to yield a six region general characteristic curve for gas filled detectors (see Figure 7).

Only Regions I, II, and III will be discussed here because these are the only types used in the NIS.

Region I is the Recombination Region which has the following general characteristics:

- Not all ion-pairs formed are collected
- Increasing the applied voltage results in an increase in the number of ion-pairs collected
- The number of ion-pairs formed is dependent upon the type of radiation (i.e. Neutron and Gamma caused ionization will be different)

The IR inner chamber operates in this region, allowing large changes in compensation with small changes in voltage (0-110V)

Region II is the Ionization Region which has the following general characteristics:

- All ion-pairs formed are collected
- Increasing the applied voltage results in no increase in the number of ion-pairs collected
- The number of ion-pairs formed is dependent upon the type of radiation (i.e. Neutron and Gamma caused ionization will be different)

The IR outer chamber, PR, and Channels N51/N52 detectors operate in this region.

SRNI

Region III is the Proportional Region which has the following general characteristics:

- Applied voltage is sufficiently high to cause secondary ionizations (called Gas Amplification)
- Output is proportional to the ionizing event
- The Gas Amplification ranges from a factor of 1 to a factor of 10^4

The SR Detectors operate in this range.

The Nuclear Instrumentation System detectors are the gas filled type. The SR detectors use BF_3 as a fill gas, the Intermediate and PR Detectors use N_2 as fill gas. The fission chambers are also gas filled.

When boron is used to detect neutrons by indirect ionization the following interactions occur:

$${}_0n^1 + {}_5B^{10} \rightarrow {}_3Li^7 + {}_2He^4 + 5e$$

The ${}_2He^4$ particle is also called an alpha particle. The Li^{+3} and He^{+2} ions induce ionization of gas atoms. The neutrons detected by excore detectors are leakage neutrons

The Nuclear Instrumentation System employs eight radial detector locations containing a total of sixteen detectors (two Proportional Counters, two Compensated Ionization Chambers, four dual-detector Uncompensated Ionization Chamber assemblies, and two dual-detector fission chambers) installed around the Reactor in the Primary shield (see Figure 1).

3.1.1 SR Detectors

BF_3 Proportional Counters (see Figure 8) have a nominal thermal neutron sensitivity of ten counts per neutron per square centimeter-second. Nominal applied voltage is 1600 Vdc with a maximum of 1900Vdc.

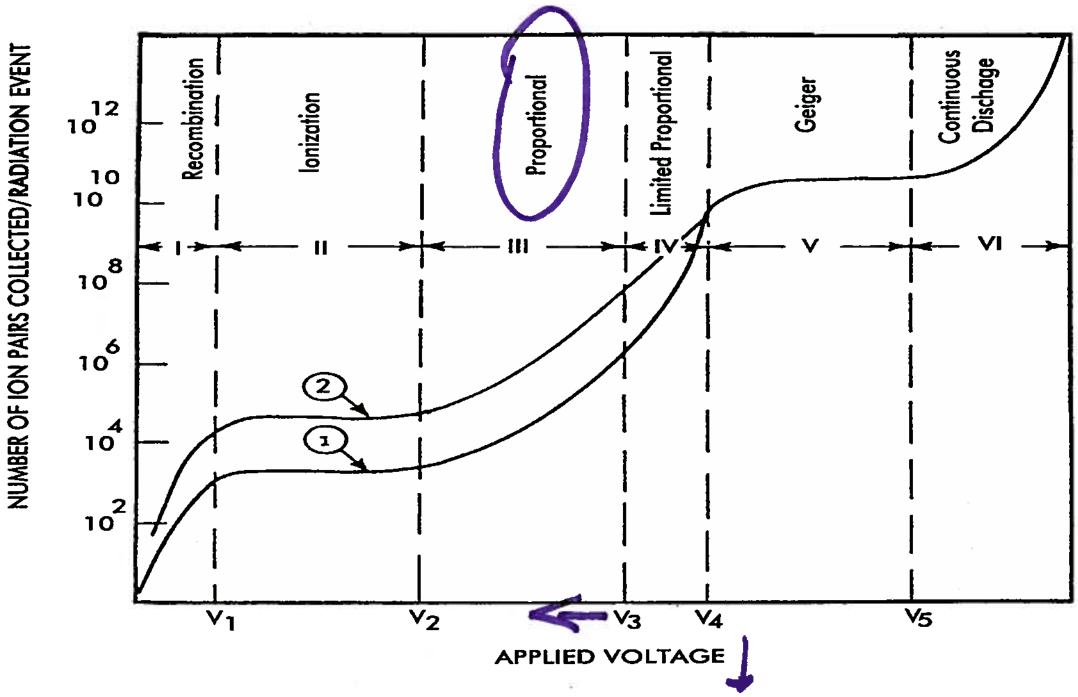
These counters provide pulse signals to the SR Channels. These detectors are installed on opposite sides of the core at an elevation approximating the quarter core height. High density polyethylene is used as a moderator and insulator inside the housing assembly.

The SR detectors are designed such that gas pressure and volume minimize the magnitude of pulse signals caused by gamma radiation. The incident neutrons interact with the boron in the BF_3 gas producing large pulses. The pulse amplitude created by the neutron is about 6 times larger than that created by the gamma. The gamma radiation does not interact with the boron to produce a large pulse. The output of these detectors is then fed to a discriminator circuit which will not pass the smaller gamma produced pulses, but will pass the larger pulses produced by neutron ionization.

3.1.2 IR Detectors

Compensated Ionization Chambers (see Figure 9) serve as neutron sensors for the IR Channels, and are located above, in the same instrument wells and detector assemblies, as the SR Detectors. These detectors have a nominal thermal neutron sensitivity of 4×10^{-14} amperes per neutron per square centimeter-second. Gamma sensitivity is less than 3 x

TYPICAL NUMBER OF ION PAIRS COLLECTED PER RADIATION EVENT VERSUS VOLTAGE APPLIED ON A GAS-FILLED DETECTOR
NI-FIGURE-7



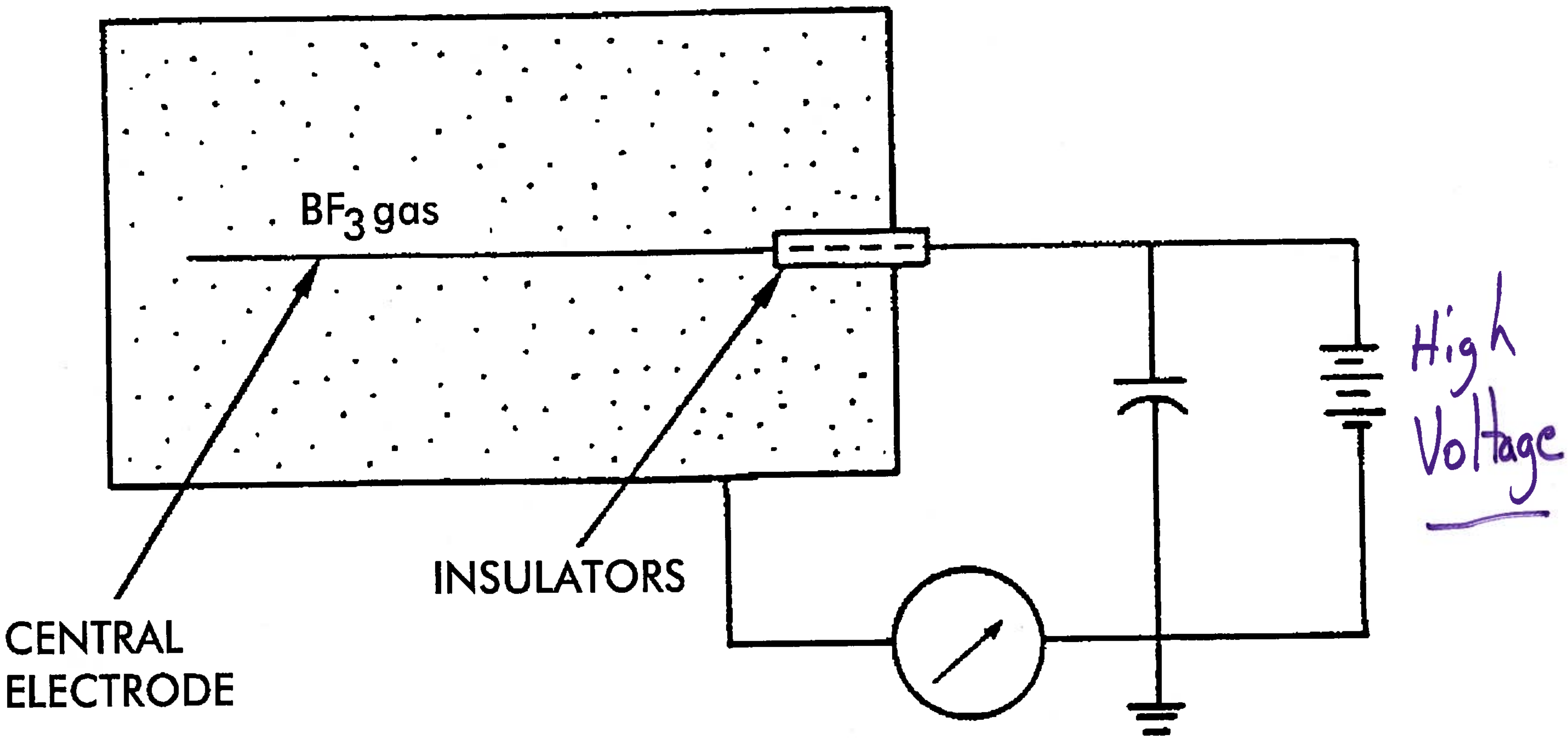
Curve 1: Radiation event of lower specific ionization.

Curve 2: Radiation event of higher specific ionization.

nif07

SCHEMATIC DIAGRAM OF BF3 DETECTOR
NI-FIGURE-8

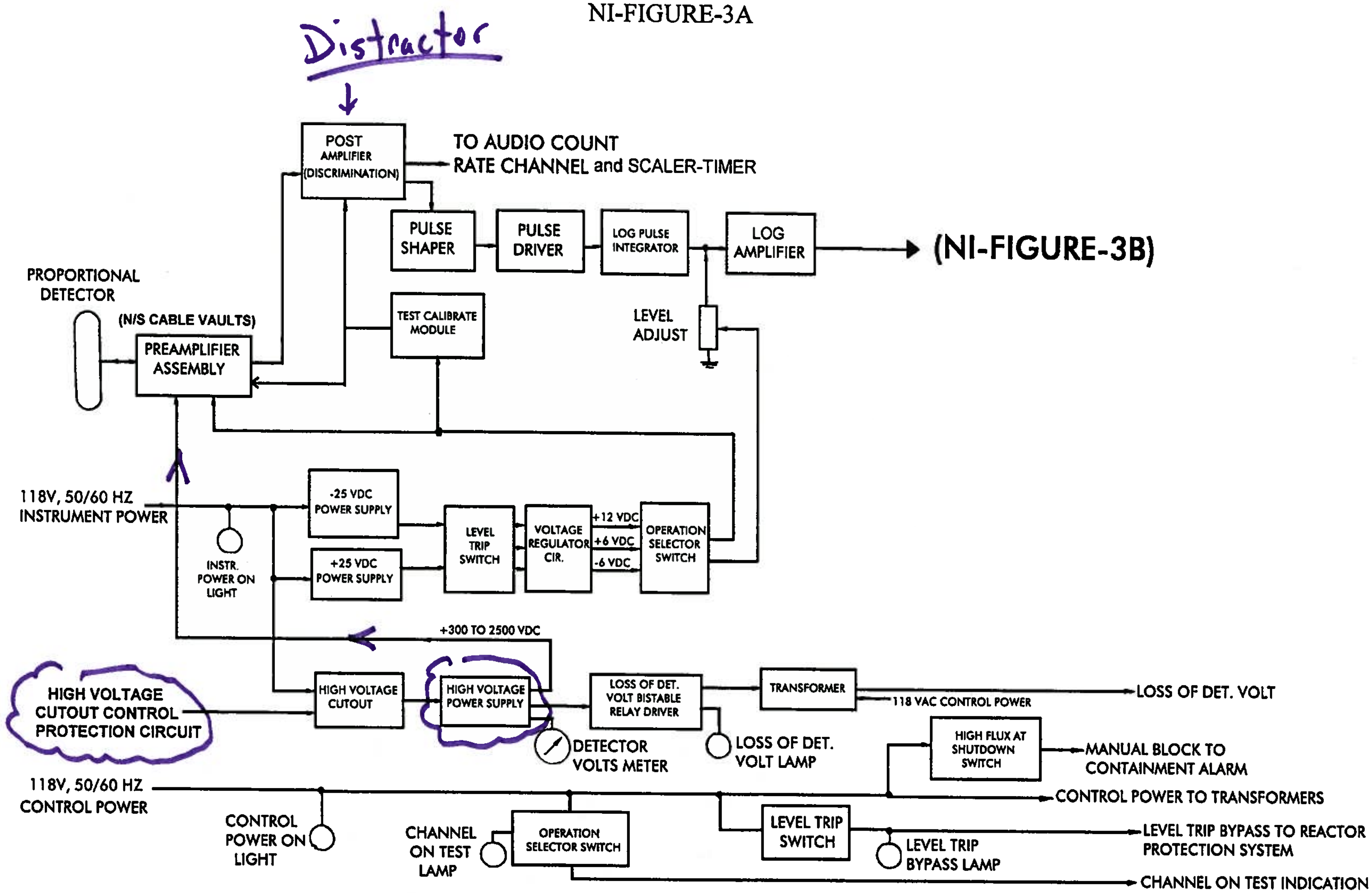
SRNI



nif08

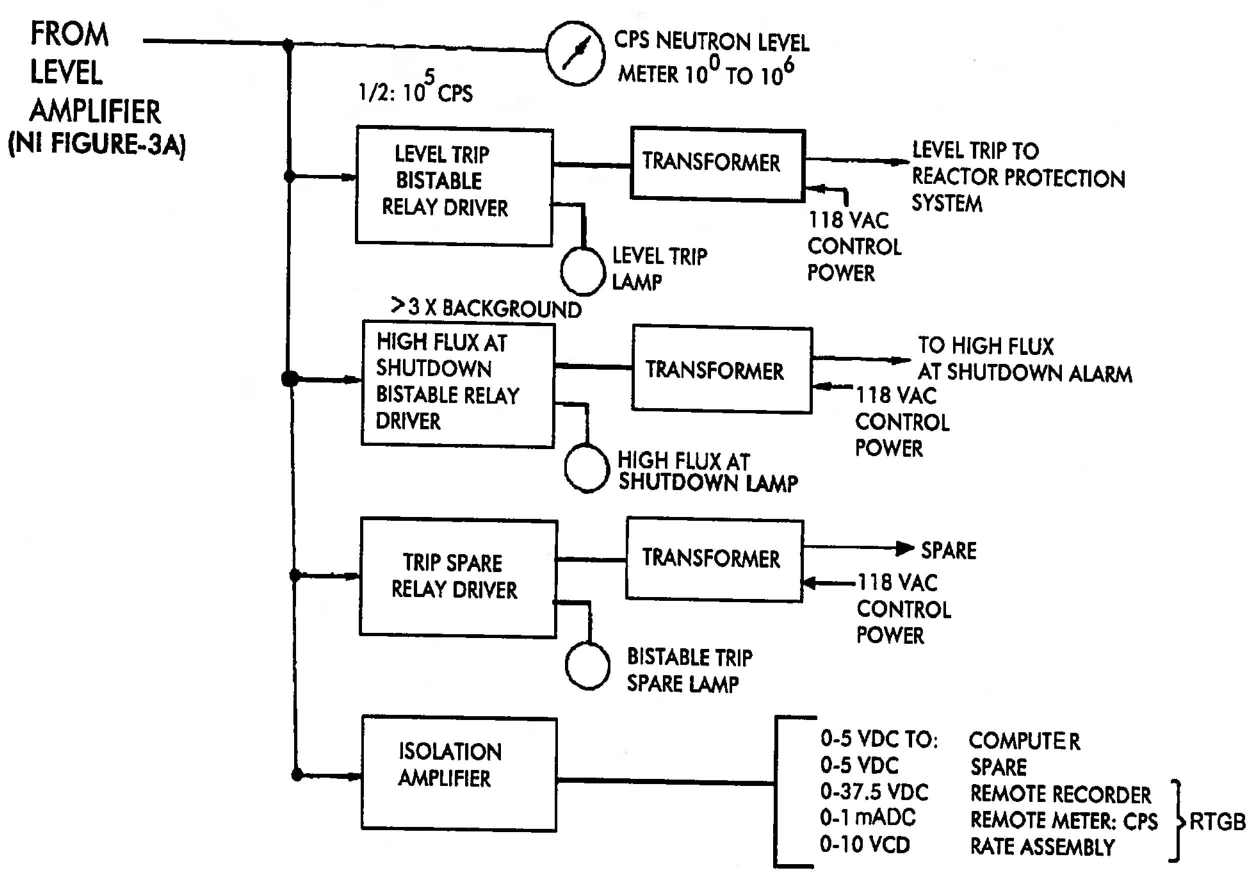
SOURCE RANGE BLOCK DIAGRAM

NI-FIGURE-3A



NIF03A

SOURCE RANGE BLOCK DIAGRAM
NI-FIGURE-3B

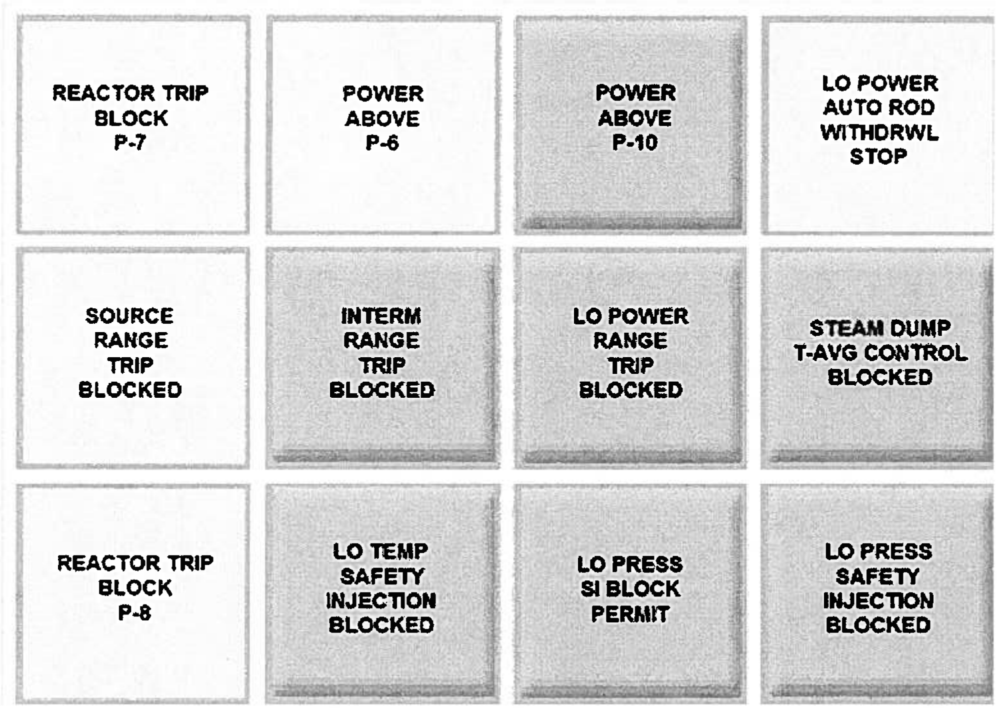


NIF03B

22. 033 AG2.2.44 001

Given the following plant conditions:

- The plant is at 8% RTP with the Turbine at 1800 RPM, unloaded.
- The following is the current status of plant permissives:



(lightly shaded blocks are illuminated, darker blocks are extinguished)

- An operator assisting I&C with N-35 maintenance removes the N-35 control power fuses.

Which ONE (1) of the following identifies the Reactor Protection System response for the N-35 IR Level Trip Bypass switch positions shown below?

	NORMAL	BYPASS
A.	No Reactor Trip	No Reactor Trip
B.	Reactor Trip	No Reactor Trip
C.	No Reactor Trip	Reactor Trip
D✓	Reactor Trip	Reactor Trip

The correct answer is D.

A. Incorrect - Removing the control power fuse will trip the RPS bistable for the associated IR instrument. Placing the IR Level Trip Switch in Bypass will block an IR trip signal, but only if the channel has control power. Based on the current power level and status of the Intermediate Range Trip Blocked status light, the IR High Trip has not been blocked.

B. Incorrect - Removing the control power fuse will trip the RPS bistable for the associated IR instrument. Placing the IR Level Trip Switch in Bypass will block an IR trip signal, but only if the channel has control power. Based on the current power level and status of the Intermediate Range Trip Blocked status light, the IR High Trip has not been blocked.

C. Incorrect - Removing the control power fuse will trip the RPS bistable for the associated IR instrument. Placing the IR Level Trip Switch in Bypass will block an IR trip signal, but only if the channel has control power. Based on the current power level and status of the Intermediate Range Trip Blocked status light, the IR High Trip has not been blocked.

D. Correct.

Question 22
Tier/Group 1/2
K/A Importance Rating - RO 4.2 SRO 4.4

Loss of Intermediate Range Nuclear Instrumentation: Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions.

Reference(s) - Sim/Plant design, System Description, OWP-011 (NI-7)
Proposed References to be provided to applicants during examination - None
Learning Objective - NIS SD-010-010
Question Source - BANK (Not used on an NRC Exam from 2004 to present.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 43.5 / 45.12
Comments -

NI-35, Intermediate Range

1. This revision has been verified to be the latest revision available.

   ______________ (Print) ______________ ______
   Name Signature Date

2. System: NI Work Request No:______________

3. Component: NI-35, Intermediate Range

4. Scope of Work:

   Perform maintenance on Nuclear Instrument NI-35.

5. Testing required on redundant equipment prior to rendering component inoperable:

   N/A

6. Precaution:

   1) Refer to ITS Table 3.3.1-1 for Intermediate Range applicability and operability requirements.

   2) Removal of control power fuses below P-10, or above P-10 with the Intermediate Range High Power Trip **NOT** blocked, will cause a reactor trip signal.

   3) This OWP has been screened in accordance with PLP-037 criteria and determined to be a Case Three activity.

7. Valve/Breaker/Switch lineup has been completed.

   ______________/______
   Signature Date

8. Clearance Issued (If applicable) Clearance No:______________

9. I&C Maintenance lineup complete.

   N/A / N/A
   Signature Date

10. Clearance removed and Valve/Breaker/ Switch lineup restored to normal.

    ______________/______
    Signature Date

11. Intermediate Range NI-35 has been declared operable.

    ______________/______
    Signature Date

4.8.2 IR

- POWER ABOVE P-6 (**10^{-10} amps**)
- INTERM RANGE TRIP BLOCKED
- NIS TRIP BYPASS NI 35 (36)

4.8.3 PR

- POWER ABOVE P-10 (**10%**)
- LO POWER RANGE TRIP BLOCKED
- REACTOR TRIP BLOCK P-7
- REACTOR TRIP BLOCK P-8
- NIS TRIP BYPASS NI 41 (42,43,44)

5.0 CONTROLS AND PROTECTION

5.1 SR Controls

- Level trip switch - two positions

  NORMAL - Enables the trip function of the channel

  BYPASS - Used to bypass reactor trip function of a source range channel during channel testing and/or in case of channel failure

- Operation selector switch - eight positions

  NORMAL - Non-testing position

  60 cps - Control voltages to test-calibrate module for 60 pulse per second output to drawer signal processing circuitry

  10^3 cps, 10^5 cps, 10^6 cps positions vary the control voltage to provide proper indication

  10 cps PRE-AMP - Control voltage to preamplifier for 10 pulses per second preamplifier test

10.24K cps PRE-AMP - Control voltage to preamplifier for 10.24K pulses per second preamplifier test

Level adjust - Control voltage to level adjust potentiometer for variable test voltage to drawer level amplifier

- Level adjust potentiometer - provides variable portion of a -6Vdc control voltage as an input to drawer level amplifier

***NOTE**: This test signal should only add to the actual output coming from the detector. If the pot is rotated rapidly to decrease the signal it may momentarily reduce the total output signal to less than the actual detector output signal.* (CR 98-02373)

- High flux at shutdown switch - two positions

NORMAL - Allows high flux output from source range to RTGB annunciator and CV horn

BLOCK - Used to block high flux at shutdown annunciator and containment evacuation horn

5.2 IR Controls

- Level trip switch - Same as SR above
- Operation selector switch - Same as SR above
- Test mode switch - two positions

FIXED - Enables the test calibrate module to provide the current level selection by the Operation Selector switch

VARIABLE - The variable potentiometer is switched into the test calibrate module circuitry to provide current variations above the selected level

5.3 PR Drawer A Controls

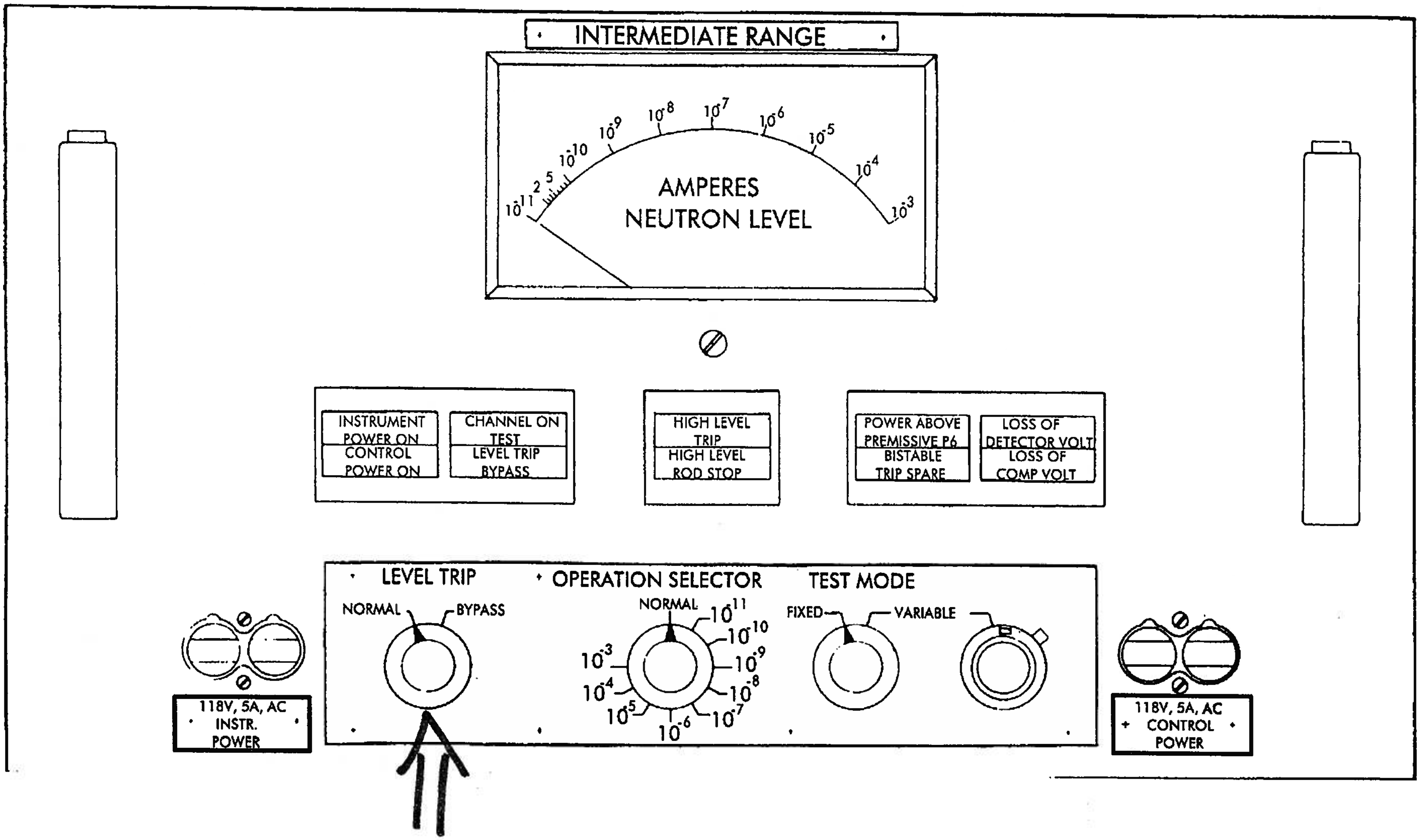
- Dropped Rod Mode switch

RESET - The bistable latching circuit is interrupted and the circuit resets normally

NORMAL - The dropped rod rod stop bistable circuit is inhibited from resetting after the circuit is tripped.

FRONT PANEL OF INTERMEDIATE RANGE DRAWER

NI-FIGURE-14



nif14

transmit four rate signals to the respective control room startup-rate meters. The indicators for SR channels N-31 and N-32 are NI-31D and NI-32D, respectively. A test module is provided which can inject a test signal into any one of the rate circuits and can be monitored on a test meter mounted on the front panel of this drawer. Two power supplies are provided to assure rate indication from at least one Source and IR channel pair.

3.4 IR Channels (N-35 and N-36)
(See Figures 4 and 14)

IR output information is tabulated in Section 2.4.2. Each IR channel receives a direct current signal from a compensated ion chamber and supplies positive high voltage and compensating (negative) high voltage to its respective detector. The compensating high voltage is used to cancel the effects of gamma radiation on the signal current being delivered to the IR channel. Both high voltage supplies are adjustable through controls located inside the channel drawer. The detector signal is received by the IR logarithmic amplifier. This modular unit, comprised of several operational amplifiers and associated discrete solid state components, produces an analog voltage output signal which is proportional to the logarithm of the input current. This signal is used for local indication and it is monitored by the isolation amplifier and the various bistable relay-driver modules within the IR drawer. A 10^{-11} ampere signal is continuously inserted and serves as a reference during gamma compensation. Local indication is provided by a meter mounted on the front panel of the drawer which has a logarithmic scale calibration of 10^{-11} to 10^{-3} amperes. The isolation amplifier is the same solid state module that is used in the SR; it supplies the same five outputs for the Intermediate Ranges. Six bistable relay-driver units are used in the IR Drawer to provide the following functions:

- Monitor the positive high voltage
- Monitor the compensating high voltage
- Provide the Permissive P-6
- Provide rod-stop (blocks automatic and manual rod withdrawal)
- Provide reactor trip
- Serve as a spare

The IR permissive P-6 bistables and the relays from each channel are combined in the Reactor Protection System into one of two matrices to provide the permissive function and control board annunciation of permissive availability.

Permissive P-6 permits simultaneous manual blocking of the SR trips and removal of the SR detector high voltage. Once SR blocking has been performed, the operator may, through administrative action, defeat permissive P-6 and reactivate the SR high voltage and trip functions if required. This defeat is accomplished by the coincident operation of two control board mounted, momentary contact switches. This provision, however, is only operational below permissive P-10, which is supplied by the PR channels. Above P-

10, the P-6 defeat circuit is automatically bypassed and permissive P-6 is maintained which, in effect, maintains SR cutoff. The level bistable relay-driver unit which provides the IR rod stop function also drives two relays in the Reactor Protection System. Again, one of two matrices formed by the relays from the two IR channels supplies the rod stop function and RTGB annunciation (APP-005-A2). Blocking of the outputs of these matrices is administratively performed when nuclear power is above permissive P-10 and can only be accomplished by deliberate operator activation of two RTGB mounted switches. See NI-Figure-30 for this trip logic.

The IR reactor trip function is provided by a similar circuit arrangement, the only difference being the trip point of the bistable unit. The same RTGB switches which control blocking of the rod stop matrices also provide blocking action for the reactor trip matrices. These blocks are manually inserted when the PR instrumentation indicates proper operation through activation of the P-10 permissive function. On decreasing power, however, the more restrictive IR trip functions are automatically reinserted in the protective system when 3 of 4 PRs are < P-10. While these trips are blocked, there will be continuous illumination on the RTGB of INTERMEDIATE RANGE TRIP BLOCKED. The high voltage failure monitors provide both local and remote annunciation upon failure of the respective high voltage supplies. A common annunciator IR DET LOSS OF VOLT (APP-005-C2) is provided for the positive high voltage while separate annunciators N-35(36) LOSS OF COMP VOLT (APP-005-B2 and D2) are provided for the compensating voltages on the RTGB.

Administrative testing of each IR channel is provided by a built-in test-calibrate module which injects a test signal at the input to the log amplifier. The signal is controlled by a multiposition switch on the front of each IR drawer. A fixed ampere signal is available in decade increments from 10^{-11} through 10^{-3} as well as a variable signal.

As in SR testing, the OPERATION SELECTOR switch must be operated in coincidence with a trip bypass on the IR drawer. An interlock between these switches prevents injection of a test signal until the trip bypass is in operation. Removal of the trip bypass also removes the test signal.

3.5 IR Auxiliary Equipment

The remote meter indication is in the form of an analog signal (0-1mA) proportional to the log of the ion chamber current. The isolation amplifier in each channel supplies this output to a separate meter (NI-35B, NI-36B). Meter calibration is 10^{-11} to 10^{-3} amperes.

The NR-45 recorder has been described above for the SR. A 0-50mVdc signal from the isolation amplifier is supplied to the recorder and is proportional to the ion chamber current range of 10^{-11} to 10^{-3} amperes. Both IR channels indicate and record continuously on NR-45.

The comparator and rate drawer receives four input signals (0-10Vdc), one from each of

23. 060 AK1.02 001

Given the following plant conditions:

- A leak on the Waste Gas Vent Header has occurred in the Auxiliary Building.
- IAW AOP-009, Accidental Gas Release From a WGDT, the HP has been directed to obtain air samples of the affected area.
- The HP reports that the Auxiliary Building has exceeded the limits for being declared an Airborne Radioactivity Area.

Which ONE(1) of the following completes the statements below?

The Auxiliary Building is in excess of the Derived Air Concentrations specified in Appendix B of 10CFR20 in that the concentration of a given radionuclide in air which, if breathed by a worker for a working year of 2000 hours under conditions of light work results in an intake of __(1)__ Annual Limit on Intake (ALI).

The ALI is established to ensure that inhalation by a worker in a year will not exceed a committed dose equivalent (whole body) of __(2)__ rem.

A. (1) 0.6

(2) 50

B.✓ (1) 1

(2) 5

C. (1) 0.6

(2) 5

D. (1) 1

(2) 50

The correct answer is B.

A. Incorrect - Another criteria for an airborne radioactivity area if concentrations are such that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the Annual Limit on Intake or 12 DAC-hours. 50 rem is the limit to any individual organ or tissue.

B. Correct - 1 ALI is the derived air concentration for a reference man working in an area for 2000 hours breathing the limit of a specific radionuclide. The second part of the distractor is correct.

C. Incorrect - See discussion in "A" above for the first distractor. The second distractor is correct.

D. Incorrect - 1 ALI is the derived air concentration for a reference man working in an area for 2000 hours breathing the limit of a specific radionuclide. 50 rem is the limit to any individual organ or tissue.

Question 23
Tier/Group 1/2
K/A Importance Rating - RO 2.5 SRO 3.1

Knowledge of the operational implications of the following concepts as they apply to Accidental Gaseous Radwaste Release: Biological effects on humans of the various types of radiation, exposure levels that are acceptable for personnel in a nuclear reactor power plant; the units used for radiation intensity measurements and for radiation exposure levels

Reference(s) - Sim/Plant design, HPP-105, DOS-NGGC-0004, 10CFR20
Proposed References to be provided to applicants during examination - None
Learning Objective - MCD-12, PLANT ACCESS TRAINING
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.8 / 41.10 / 45.3
Comments -

Originally the question had the following in the stem.

Airborne radioactivity area if concentrations are such that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of __(1)__ percent of the Annual Limit on Intake.

*The choices were 1 a*nd 0.6, with 0.6 being the correct answer. All validators choice 1 as the answer.

DEFINITIONS/ABBREVIATIONS

DEFINITIONS

Airborne Radioactive Material: Radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

Airborne Radioactivity Area: A room, enclosure, or area in which airborne radioactive materials exist in concentrations:

-In excess of the Derived Air Concentrations specified in Appendix B of 10CFR20

-To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the Annual Limit on Intake or 12 DAC-hours.

ALARA - (As Low As is Reasonably Achievable): Making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical, taking into account the state of technology and economics of improvements in relation to the benefits.

Annual Limit on Intake: The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rem or a committed dose equivalent of 50 rem to any individual organ or tissue.

Breathing Zone: The air space an individual is expected to breathe from during the typical performance of a task.

Corrected DAC Fraction: DAC Fraction divided by Protection Factor

Derived Air Concentration: The concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2000 hours under condition of light work results in an intake of one ALI. DAC values are given in 10 CFR 20 Table 1, Column 3, of Appendix B.

High Xenon Area: An area in which the Xe-133 air concentration equals or exceeds 1 DAC (1 E-04 μCi/cc).

Low Volume Air Samplers: Air Samplers that pull approximately 2 cfm.

Protection Factor: A measure of the degree of protection afforded by a respirator, defined as the ratio of the concentration of airborne radioactive material outside the respiratory protective equipment to that inside the equipment (usually inside the facepiece) under conditions of use. It is applied to the ambient airborne concentration to estimate the concentrations inhaled by the wearer.

Total Effective Dose Equivalent: The sum of the deep-dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures total).

High Tritium Area: An area in which the Tritium (H_3) air concentration equals or exceeds 4 E-06 μCi/cc.

24. 067 AA1.06 001

Given the following plant conditions:

- The plant is operating at 100% RTP.
- The following fire alarms (color of text) have been received on the Fire Alarm Computer.

  - A43 ZN-20 Fire Alm. TRN-A E1/E2 Room (RED)
  - A51 ZN-20 Fire Alm. TRN-A E1/E2 Rm. Halon Actuated (RED)
  - A55 ZN-NO Fire Alm. TRN-A FDAP A1 Master Fire Alm. (RED)
  - B04 ZN-20 Fire Alm. TRN-B E1/E2 Room (RED)
  - B06 ZN-20 Fire Alm. TRN-B E1/E2 Rm. Halon Actuated (RED)
  - B09 ZN-NO Fire Alm. TRN-B FDAP B1 Master Fire Alm. (RED)

Which ONE(1) of the following completes the statement below IAW AOP-041, Response to Fire Event?

The Control Room Operator is responsible for dispatching the fire brigade, starting the motor driven fire pump, placing the......

A.✓ PCV-456 and PCV-455C Power Isolation Switches to the ISOLATED position and securing Auxiliary Building Ventilation.

B. EDG and E1/E2 Breaker's Appendix R Isolation switches to NORMAL and securing Auxiliary Building Ventilation.

C. PCV-456 and PCV-455C Power Isolation Switches to the ISOLATED position, securing Auxiliary Building Ventilation and placing Control Room Ventilation in Pressurization Mode.

D. EDG and E1/E2 Breaker's Appendix R Isolation switches to NORMAL, securing Auxiliary Building Ventilation and placing Control Room Ventilation in Pressurization Mode.

The correct answer is A.

A. Correct.

B. Incorrect - The action to place the Diesel Gen. and E1/E2 Breaker's Appendix R Isolation switches to NORMAL is only applicable in AOP-004 when the control room must be evacuated. These are recently added switches that maintains normally open switch contacts to isolate fire-induced cable damage in the event of a postulated fire in the EDG rooms. Since the fire is in E1/E2 the candidate may think that they should be operated.

C. Incorrect - The first two actions are correct. The action to place control room ventilation in pressurization mode is incorrect. The candidate may think that this is prudent due to the proximity of the fire to the control room. This action is not directed in AOP-041.

D. Incorrect. See discussions in distractors B and C.

Question 24
Tier/Group 1/2
K/A Importance Rating - RO 3.5 SRO 3.7

Ability to operate and / or monitor the following as they apply to the Plant Fire on Site:
Fire alarm

Reference(s) - Sim/Plant design, AOP-041, APP-44, AOP-004
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-041-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.5 / 45.6
Comments -

CONTINUOUS USE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL
VOLUME 3
PART 5
ABNORMAL OPERATING PROCEDURE

AOP-041

RESPONSE TO FIRE EVENT

REVISION 4

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Notify SM To Evaluate EALs.	
2.	Notify The SM To Have The Emergency Communicator Report To The Control Room.	
3.	Check Fire Location - INSIDE The Fire Brigade Response Area (Refer To Attachment 6, "Fire Brigade Response Area")	Observe the Note prior to Step 48 and then Go To Step 48.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

If additional information is available to the Control Room to warrant NOT sounding the fire alarm, then the Shift Manager may elect to exit this procedure.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
4.	Alert The Fire Brigade As Follows:	IF the PA system is unavailable OR plant alarms are malfunctioning, THEN contact the Fire Brigade via portable radios, cell phones or beepers.
	a. Place the VLC Switch in the EMERGENCY position.	
	b. Sound the FIRE ALARM for 15 seconds.	
	c. Perform the following site wide announcement over the Plant PA:	

"Attention Fire Brigade Personnel. Attention Fire Brigade Personnel. A fire has been confirmed at ______________________________; First Responders report to the Fire Brigade Incident Commander. Non-fire brigade personnel stay clear of the fire area."

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
	d. Sound the FIRE ALARM again for 15 seconds.	
	e. Repeat the above message.	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

Steps 5 and 6 are time critical and shall be performed within 10 minutes.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
5.	Fire CONFIRMED In One Of The Following Areas: • South Cable Vault (Fire Zone 10) • Unit 2 Cable Spread Room (Fire Zone 19) • Emergency Switchgear Room (Fire Zone 20) • Control Room (Fire Zone 22)	Go To Step 7
6.	Place The Following Valves To The ISOLATED Position: • PCV-456 POWER ISOLATION SWITCH • PCV-455C POWER ISOLATION SWITCH	
7.	Check Tavg - GREATER THAN 200 DEGREES F	Go To Step 10

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

- Attachment 3 provides guidance for alarms during Containment Building SIT (Structural Integrity Test) or ILRT (Integrated Leak Rate Test).
- For single train fire alarms while Containment Integrity is required and/or confirmed fires in the CV, as a minimum, a team of two Fire Brigade personnel will enter containment to investigate and report the conditions. This team should consist of a Fire Protection Auxiliary Operator and a Radiation Control Technician.
- Reference to AP-031 if additional guidance is needed concerning Emergency Entry into An LHRA or VHRA.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
8.	Check The Fire Location Is In One Or More Of The Following Areas: • Control Room • Auxiliary Building • CV • SW Intake • Turbine Building	Go To Step 10
9.	Go To DSP-001 While Continuing With This Procedure.	
*10.	Check EOP Network OR Multiple AOPs - IN EFFECT. NO →	IF the EOP Network OR multiple AOPs are entered, THEN perform Step 11. Go to Step 12
11.	Notify The FBIC To Direct The Performance Of The Remainder Of This Procedure.	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
12.	Check Fire Area - CONTROLLED BY SECURITY.	Go To Step 14
13.	Request Security Perform An Accountability Check Of The Area <u>AND</u> Report Any Personnel Present In The Fire Vicinity.	
14.	Establish Communication Between The FBIC Or Fire Brigade Team And The Control Room And Provide Any Requested Support.	
15.	Check Report From Fire Brigade At Scene - VICTIM(S) REPORTED.	Go To Step 17

<u>NOTE</u>

- If a Security event is in progress, then the Security Supervisor may not be available to assist with outside communications or notifications.
- Security can be contacted at extension 1272, 1273, or 1581.

16.	<u>IF</u> this procedure is being controlled by the Control Room, <u>THEN</u> Call 911 For Additional Medical Assistance If Needed.	Notify Security Supervisor To Call 911 For Additional Medical Assistance If Needed.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

- The Motor Driven Fire Pump should start with water flow/Fire Suppression System actuation.
- The Engine Driven Fire Pump will automatically start if the Motor Driven Fire Pump can NOT maintain system pressure.

17. Verify The Motor Driven Fire Pump Is RUNNING.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
*18	Check Any Of The Following Conditions - EXIST:	Go To Step 20

- Offsite Fire Department assistance is requested by the Fire Brigade Incident Commander or SM/CRS.

- Fire is located on the Main, Auxiliary, or Start-Up Transformers.

- The fire can not be extinguished using portable fire extinguishers AND fire located in any of the following:

Administration Building	O&M Building
Outage Management Building	Main Warehouse
Areas with limited access such as the Unit 1 Coal Handling Tunnel	EOF/TSC Building
Any other large building	

- A fire lasting greater than 10 minutes from the time that fire fighting commenced AND is NOT under the control of the Site Fire Brigade.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

- If a Security event is in progress, then the Security Supervisor may not be available to assist with outside communications or notifications.
- Security can be contacted at extension 1272, 1273, or 1581.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
19.	IF this procedure is being controlled by the Control Room, THEN Perform Attachment 1, Request Offsite Fire Department Assistance.	Notify Security Supervisor to Perform Attachment 1, Request Offsite Fire Department Assistance.
20.	Check Either Of The Following Conditions - EXIST Y • Fire CONFIRMED in Reactor Auxiliary Building OR • Need to limit spread of fire/smoke	Go To Step 23
21.	Verify The Associated Ventilation Equipment Is Shutdown By Either Using The Equipment's Control Switch OR By Opening The Supply Breaker (Refer To Attachment 5).	
22.	Notify The FBIC Of Any Changes To Ventilation.	
*23.	Evaluate The Need To Evacuate Plant Personnel. (Use Local Or Site Evacuation As Needed.)	

INFORMATION USE

Attachment 5

VENTILATION EQUIPMENT CONTROL SWITCHES AND SUPPLY BREAKERS

(Page 1 of 1)

FIRE LOCATION	FANS	POWER SUPPLY BREAKER	SWITCH LOCATION
REACTOR AUXILIARY BUILDING: 1ST, 2ND LEVELS	HVA-2	MCC-5	RTGB
	HVE-2A	MCC-5	RTGB
	HVE-2B	MCC-6	RTGB
	HVE-5A	MCC-5	RTGB
	HVE-5B	MCC-6	RTGB
	HVE-7	MCC-2	NOTE 1
	HVS-1	MCC-5	NOTE 1
IF fire is in the Diesel Generator Room, THEN the Diesel Room fans will also be verified STOPPED.	DIESEL ROOM "A"		
	HVS-6	MCC-5	RTGB
	HVE-18	MCC-5	RTGB
	DIESEL ROOM "B"		
	HVS-5	MCC-6	RTGB
	HVE-17	MCC-6	RTGB
SPENT FUEL PIT, SPENT FUEL PIT HEAT EXCHANGER ROOM, NEW FUEL STORAGE, SPENT FUEL PIT PUMP AREA, FAN ROOM "A"	HVS-4 HVE-15 HVE-15A	POWER PANEL 22 POWER PANEL 22 POWER PANEL 22 (located in Hot Machine Shop)	Switches located in Fan Room on Diesel Generator Muffler Deck
HOT MACHINE SHOP, CVCS HUT ROOM, CASK PREP AREA, GAS DECAY TANK ROOM, FAN ROOM "B"	HVS-2 HVE-14	POWER PANEL 22 POWER PANEL 22 (located in Hot Machine Shop)	Switch located in Fan Room over Hot Machine Shop

NOTE 1: These fans start and stop when HVE-2A or HVE-2B is operated.

CONTINUOUSUSE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL
VOLUME 3
PART 5
ABNORMAL OPERATING PROCEDURE

AOP-004

CONTROL ROOM INACCESSIBILITY

REVISION 19

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
	NOTE The EOP Network does NOT apply while in this procedure.	
1.	Verify Reactor Trip As Follows: • REACTOR TRIP MAIN AND BYPASS BREAKERS - OPEN	Manually trip the Reactor.
2.	Verify Turbine Trip As Follows: • All TURBINE STOP VALVES - CLOSED OR • All GOVERNOR VALVES - CLOSED	Manually trip the Turbine by simultaneously depressing the THINK and TURBINE TRIP Pushbutton.
3.	Verify MSIVs AND MSIV BYPASSES - CLOSED	
4.	Place VLC Switch In The EMERG Position	
5.	At The RTGB, Verify LCV-115B, EMERG MU TO CHG SUCTION - OPEN	IF LCV-115B will NOT open, THEN Go To Step 7.
6.	At The RTGB, Verify LCV-115C, VCT OUTLET - CLOSED	IF LCV-115C will NOT close, THEN close LCV-115B, EMERG MU TO CHG SUCTION.
7.	Verify The Following Valves - CLOSED • CVC-200A, LTDN ORIFICE • CVC-200B, LTDN ORIFICE • CVC-200C, LTDN ORIFICE	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
8.	Place The Following Switches In The NORMAL Position • EMERG DG A BUS E1 BKR 52/17B APP R ISOLATION • 480VBUS E1 BKR 52/18B APP R ISOLATION • EMERG DG B BUS E2 BKR 52/27B APP R ISOLATION • 480VBUS E2 BKR 52/28B APP R ISOLATION	DISTRACTOR
9.	Check Control Room Operators Security Key - ON THEIR PERSON	Obtain backup Security Key from DSP/AOP key box
10.	Evacuate The Control Room AND Report To The Old Fire Equipment Building	
11.	Direct Security To Prevent Non-Fire Brigade Plant Personnel From Entering The Control Room Unless Permission Is Granted By The SM	

NOTE

A PA is located near the Hydrogen Seal Oil Unit.

12. Announce The Following On The PA System:
    - Entry into AOP-004.
    - The Control Room Has Been Evacuated.
    - Stay clear of the Control Room Area.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
*13.	Check Either Of The Following Conditions - EXISTS • Fire confirmed on the RTGB OR • Control of the plant can NOT be maintained due to fire damage	IF at any time during the performance of this procedure a fire is confirmed on the RTGB OR Control of the plant can NOT be maintained due to fire damage, THEN Go To DSP-002, Hot Shutdown Using The Dedicated/Alternate Shutdown Systems. Observe the NOTE prior to Step 15 and Go To Step 15.
14.	Go To DSP-002, Hot Shutdown Using The Dedicated/Alternate Shutdown Systems	

NOTE

When sufficient licensed personnel are available, the CRS will perform Attachment 4, Hot Shutdown Checklist, and allow the SM to focus on SEC duties.

15.	The SM/CRS Shall Obtain Attachment 4, Hot Shutdown Checklist, AND Complete It During Performance Of Attachments 1 Through 3	

25. 076 AK2.01 001

Given the following plant conditions:

- Plant is currently at 100% RTP preparing for a shutdown due to high RCS Activity levels.
- A RCS leak of 10 gpm has been identified inside Containment.

Which ONE(1) of the following identifies which process radiation monitors will indicate an elevated reading?

R-11: Containment Air Particulate
R-12: Containment Air Gas
R-14C: Plant Stack Gas (Low range)

	R-11	R-12	R-14C
A.	Yes	Yes	Yes
B.✓	Yes	Yes	No
C.	No	Yes	Yes
D.	Yes	No	No

The correct answer is B.

A. Incorrect - R-14C is aligned to the stack. The CV is currently being sampled by R-11 and R-12. R-14C would indicate a rise in reading if leakage was into the Auxiliary Building.

B. Correct

C. Incorrect - The candidate would select this if only the Gas detectors responded to high activity RCS leakage and leakage was being released to the Auxiliary Building.

D. Incorrect - The candidate would select this if only the CV particulate detector responded to high activity RCS leakage.

Question 25
Tier/Group 1/2
K/A Importance Rating - RO 2.6 SRO 3.0

Knowledge of the interrelations between the High Reactor Coolant Activity and the following: Process radiation monitors

Reference(s) - Sim/Plant design, System Description, AOP-005, OP-920
Proposed References to be provided to applicants during examination - None
Learning Objective - RMS006
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7
Comments -

PROCESS MONITORS

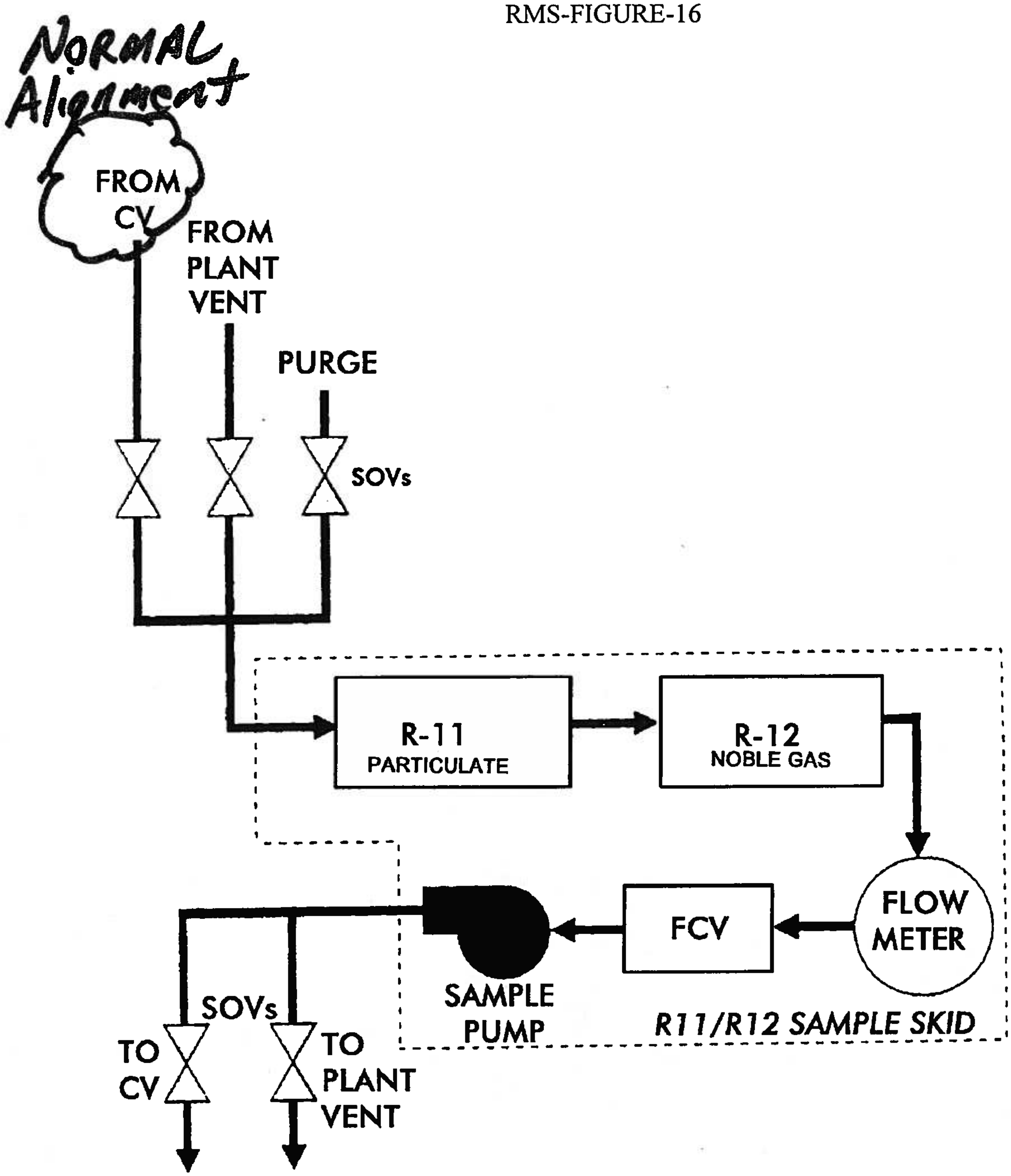
RMS-FIGURE-3

CHANNEL	MONITORS
R-11	AIR PARTICULATE MONITOR - CONTAINMENT AIR AND PLANT VENT
R-12	RADIOACTIVE GAS MONITOR- CONTAINMENT AIR AND PLANT VENT
R-14C	NOBLE GAS - PLANT VENT
R-14D, E	MID & HIGH RANGE - NOBLE GAS
R-15	CONDENSER AIR EJECTOR GAS MONITOR
R-16	RADIOACTIVE LIQUID MONITOR - CONTAINMENT HVH UNITS FAN AND MOTOR COOLING WATER
R-17	RADIOACTIVE LIQUID MONITOR - COMPONENT COOLING WATER
R-18	RADIOACTIVE LIQUID MONITOR - LIQUID WASTE DISPOSAL SYSTEM EFFLUENTS
R-19A, B, C	RADIOACTIVE LIQUID MONITOR - STEAM GENERATOR SECONDARY SIDE LIQUID

INFORMATION USE ONLY

R-11/R-12 SKID FLOW PATH

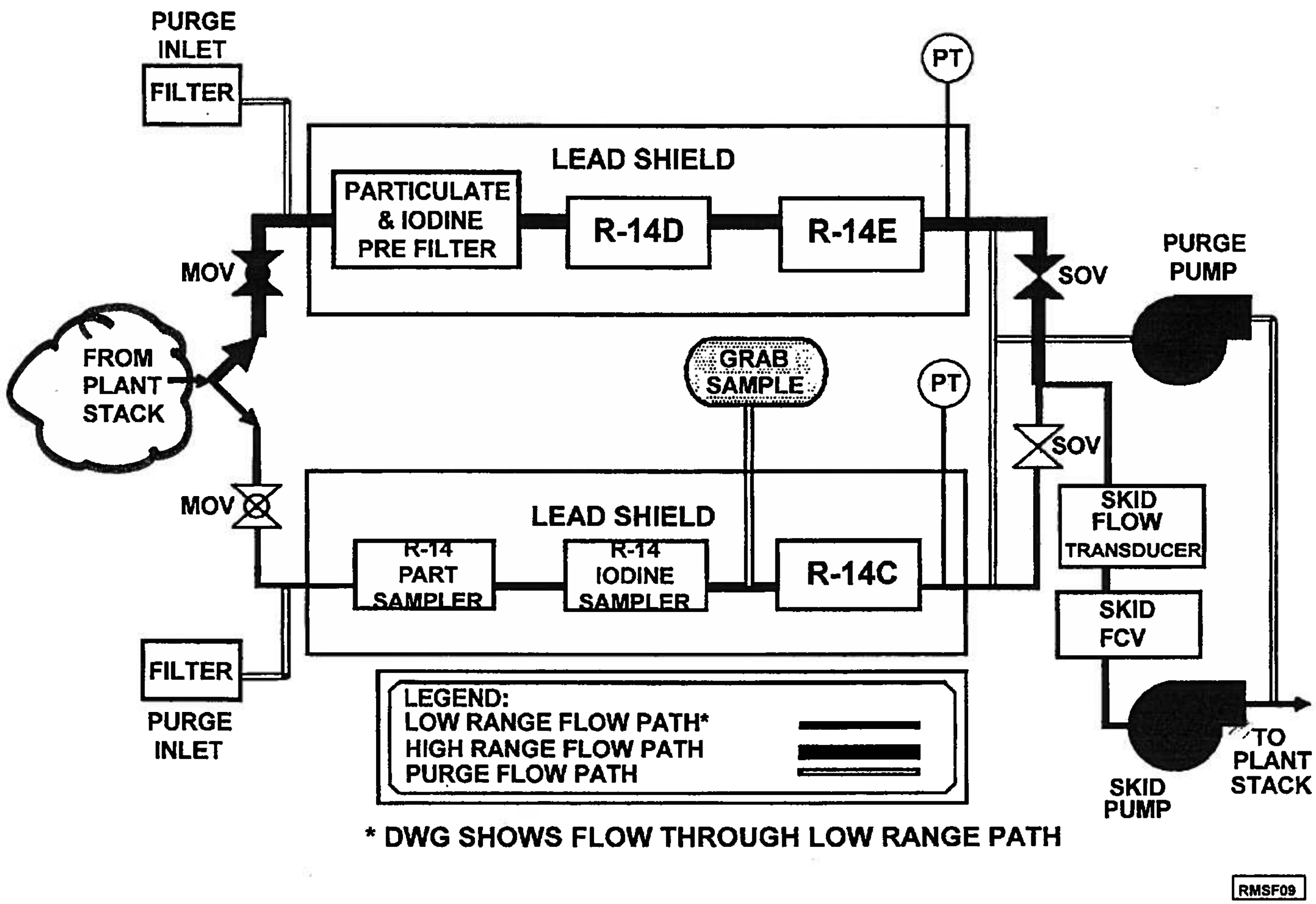
RMS-FIGURE-16



INFORMATION USE ONLY

R-14 SKID FLOW PATHS

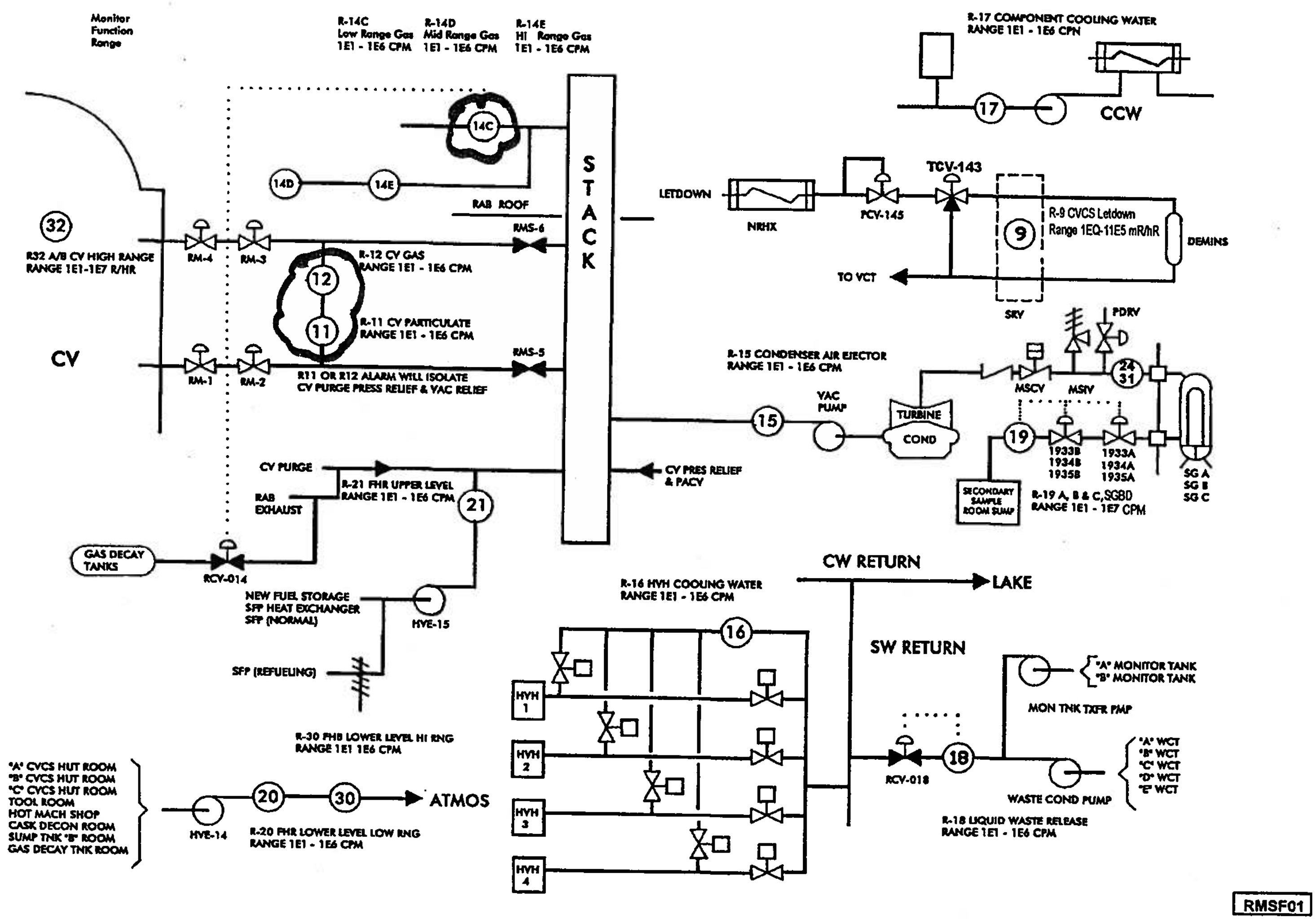
RMS-FIGURE-9



INFORMATION USE ONLY

SIMPLIFIED SYSTEM FLOW DIAGRAM

RMS-FIGURE-1



INFORMATION USE ONLY

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

ATTACHMENT 12

PROCESS MONITOR R-11/R-12 - CV AIR & PLANT VENT

(Page 1 of 3)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Check R-11/R-12 Selector Switch - SELECTED TO CV	Contact E&C AND RC to perform the following, as appropriate: • Collect gas samples to determine source of alarm. • Survey Auxiliary Building and Fuel Handling Building for source of activity. • Perform background radiation check at Radiation Monitors R-11 and R-12. Go To the main body, Step 1.b. of this procedure.
2.	Check RCS Temperature - GREATER THAN 200°F	IF a Fuel Handling Accident is in progress, THEN Go To AOP-013, Fuel Handling Accident. IF a Loss of RHR is in progress, THEN Go To AOP-020, Loss Of Residual Heat Removal (shutdown Cooling). IF neither event is in progress, THEN continue efforts to determine the cause of the alarm AND Go To main body, Step 1.b. of this procedure.
3.	Check Channel R-11/R-12 LOW FLOW Alarm - ILLUMINATED	Go To Step 5
4.	Verify R-11/R-12 Vacuum Pump - STOPPED	
5.	Check EOP Network Procedures - IMPLEMENTED	Go To Step 7.
6.	Return to Procedure And Step In Effect	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

ATTACHMENT 12

PROCESS MONITOR R-11/R-12 - CV AIR & PLANT VENT

(Page 2 of 3)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
7.	Check Personnel - IN CV	Go To Step 13.
8.	Place VLC Switch To EMERG Position	
9.	Depress And Hold CV EVACUATION HORN Pushbutton For 15 SECONDS	
10.	Announce The Following Over Plant PA System: "ATTENTION ALL PERSONNEL. ATTENTION ALL PERSONNEL. A HIGH RADIATION ALARM HAS BEEN RECEIVED ON CV VENT PROCESS MONITOR, R-11 (R-12). ALL NON-ESSENTIAL PERSONNEL EVACUATE CV UNTIL FURTHER NOTICE"	
11.	Repeat CV Evacuation Announcement Over PA System	
12.	Place VLC Switch To NORM Position	
13.	Check CONTAINMENT VENTILATION ISOLATION Valves - CLOSED	Perform the following: a. Depress H.V. OFF on R-11 <u>OR</u> R-12 to initiate Containment Ventilation Isolation. b. <u>IF</u> any CONTAINMENT VENTILATION ISOLATION Valve fails to close, <u>THEN</u> locally verify penetration is isolated from outside CV.
14.	Place The Following CV IODINE REMOVAL FAN Control Switches To PREPURGE Position: • HVE-3 • HVE-4	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

ATTACHMENT 12

PROCESS MONITOR R-11/R-12 - CV AIR & PLANT VENT

(Page 3 of 3)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
15.	Request RC To Perform A Background Radiation Check At Radiation Monitors R-11 AND R-12	
16.	Determine If Primary System Leakage Is Occurring, As Follows: • Check RCS Level - UNEXPLAINED LOWERING LEVEL OR • RCS Leak - LOCALLY IDENTIFIED OR • VCT Auto Makeups - EXCESSIVE OR • Charging Pump Speed - RISING	Go To the main body, Step 1.b, of this procedure.
17.	Go To AOP-16, Excessive Primary Plant Leakage, While Continuing With This Procedure	
18.	Refer to Technical Specification 3.3.6 and ODCM Table 3.10-1, Radioactive Gases	
19.	Go To The Main Body, Step 1.b, Of This Procedure	

- END -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

ATTACHMENT 13

PROCESS MONITOR R-14 - PLANT EFFLUENT

(Page 1 of 2)

NOTE

When PLANT EFFLUENT NOBLE GAS LOW RANGE RI-14C reaches a predetermined high level, the monitor will default to 1M CPM and valid readings will only be displayed on RI-14D and RI-14E.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Check Waste Gas Decay Tank Release - IN PROGRESS	Go To Step 6.
2.	At The Waste Disposal Panel Verify RCV-014, WASTE GAS DECAY TANK RELEASE ISOLATION Valve - CLOSED	
3.	Do Not Restart Release Until Cause Of High Radiation Alarm Is Determined And Corrective Actions Are Complete	
4.	Request E&C <u>AND</u> RC To Perform The Following, As Applicable: • Resample Waste Gas Decay Tank aligned for release • Perform background radiation survey for Radiation Monitor R-14	
5.	Go To Step 10	
6.	Start One Of The Following AUX BLDG CHARCOAL EXH FANs: • HVE-5A • HVE-5B	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

ATTACHMENT 13

PROCESS MONITOR R-14 - PLANT EFFLUENT

(Page 2 of 2)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
7.	At The Waste Disposal Panel, Check All Waste Gas Decay Tank Pressure Indications - ANY UNEXPLAINED OR UNCONTROLLED LOWERING	Go To Step 10.
8.	Go To AOP-009, Accidental Gas Release From A WGDT, While Continuing With This Procedure	
9.	Go To The Main Body, Step 1.b, Of This Procedure	
10.	Request E&C AND RC Perform The Following, As Applicable: • Collect gas samples to determine source of alarm • Survey Auxiliary Building and Fuel Handling Building for source of activity • Perform background radiation survey for Radiation Monitor R-14	
11.	Refer to ODCM Table 3.10-1, Radioactive Gases.	
12.	Go To The Main Body, Step 1.b, Of This Procedure	

- END -

26. W/E 08 EG2.4.2 001

Given the following plant conditions:

- Plant was operating at 100% RTP when a steam line break occurs in the CV.
- All RCS Cold leg temperatures are right of Pressure - Temperature Limit "A".
- RCS pressure is 600 psig.

Which ONE(1) of the following completes the statement below?

To meet the entry conditions of FRP-P.1, Response to Imminent Pressurized Thermal Shock, RCS Cold Leg Temperature must have dropped **greater** than __(1)__ in the last 60 minutes and RCS Cold Leg Temperature must be less than __(2)__.

A. (1) 100°F

(2) 320°F

B.✓ (1) 100°F

(2) 290°F

C. (1) 50°F

(2) 320°F

D. (1) 50°F

(2) 290°F

The correct answer is B.

A. Incorrect - The first part of the distractor is correct. The second part is the entry condition value for FRP-P.2.

B. Correct.

C. Incorrect - 50°F/hr is a common cooldown limit that is used in the EOP network. This rate is used in FRP-P.1 once the one hour soak is completed. The second part is the entry condition value for FRP-P.2.

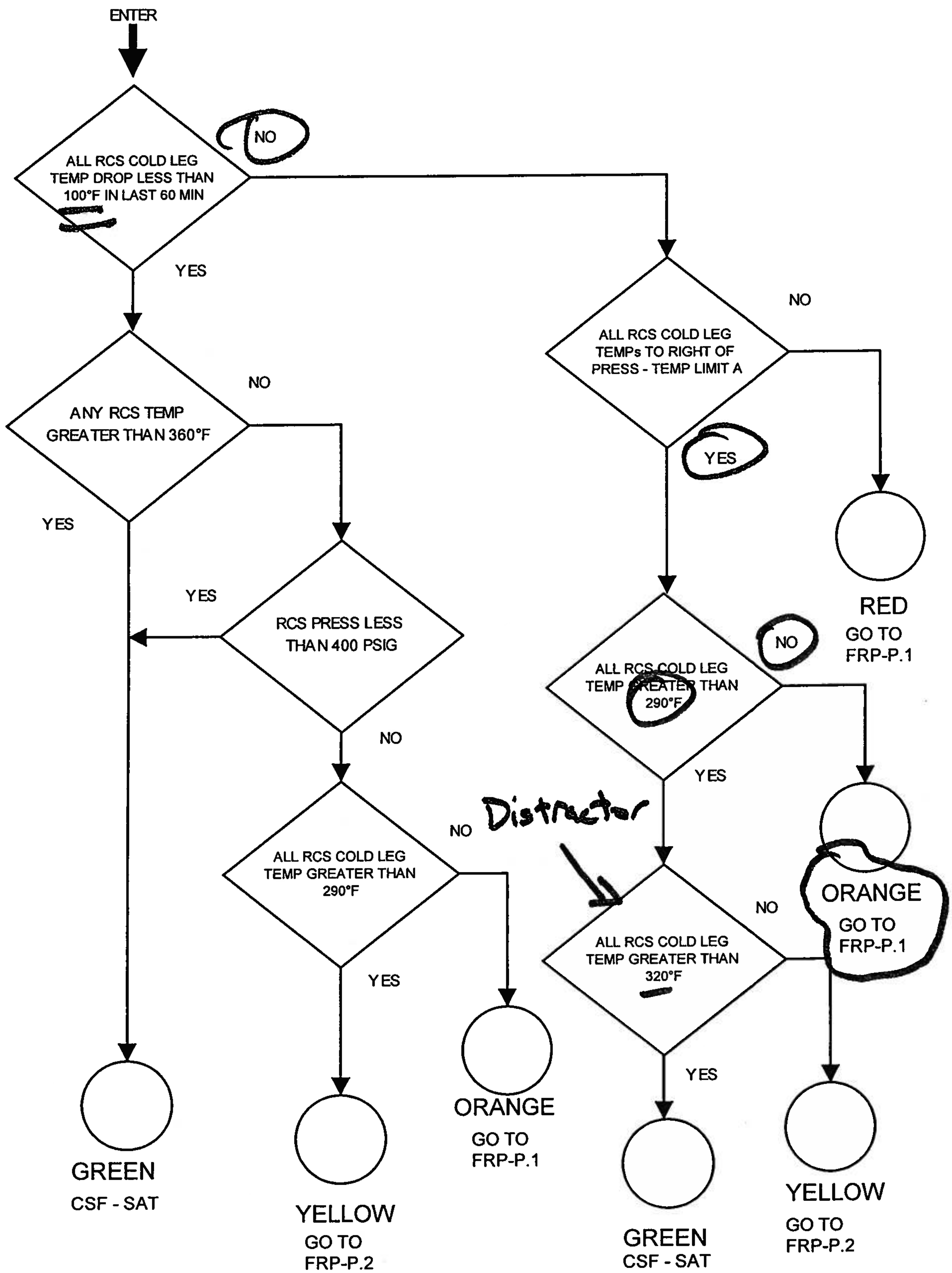
D. Incorrect- 50°F/hr is a common cooldown limit that is used in the EOP network. This rate is used in FRP-P.1 once the one hour soak is completed. The second part of the distractor is correct.

Question 26
Tier/Group 1/2
K/A Importance Rating - RO 4.5 SRO 4.6

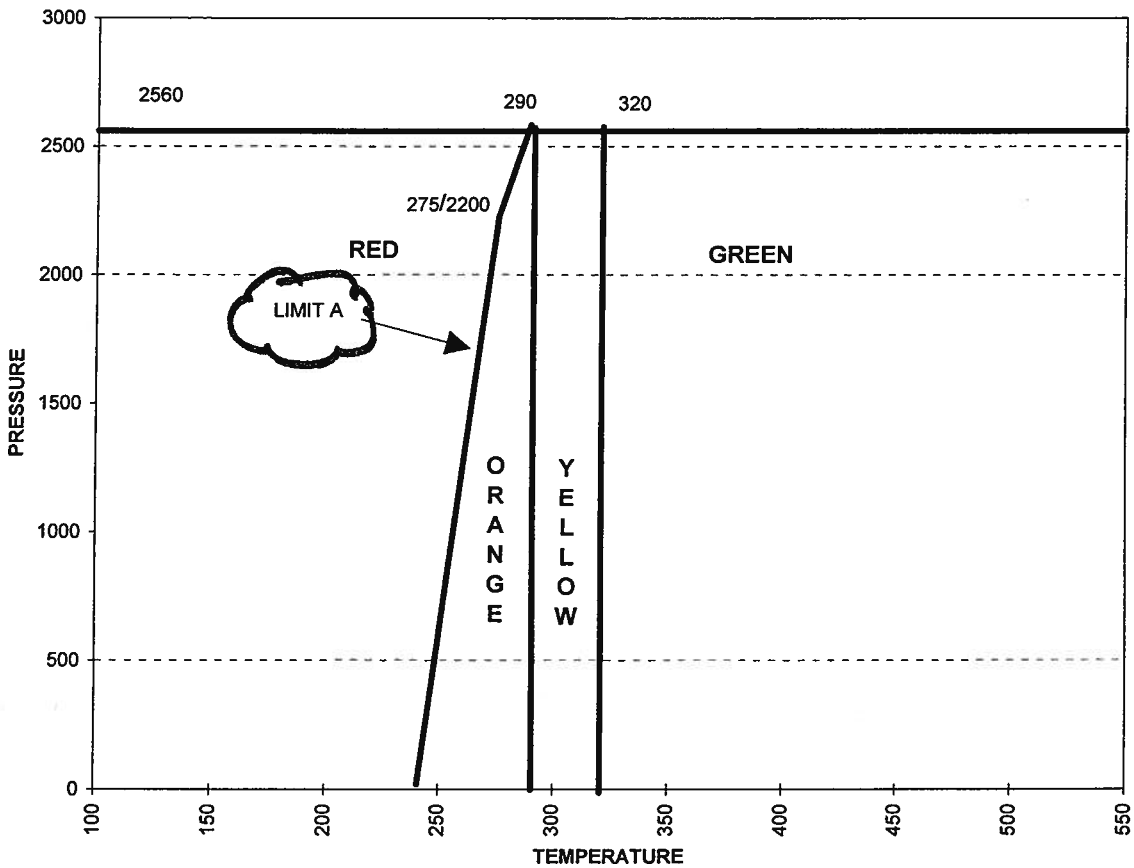
Pressurized Thermal Shock: Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions.

Reference(s) - Sim/Plant design, CSFST, FRP-P.1
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-P.1-003
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7 / 45.7 / 45.8
Comments -

CSF-4, RCS INTEGRITY



INTEGRITY CSF-4a



STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
46.	Observe The Following Restrictions: a. Maintain RCS pressure and Cold Leg temperature within the limits of Attachment 1, Post Soak Cooldown Limit Curve, during <u>ALL</u> subsequent actions b. Maintain cooldown rate in RCS Cold Legs less than 50°F/hr in any 60 minute period	Distractor
47.	Reset SPDS <u>AND</u> Return To Procedure And Step In Effect	

- END -

27. W/E 10 EK3.1 001

Given the following plant conditions:

- The reactor has tripped due to a loss of off-site power.
- A RCS cooldown to Mode 5 must be performed.
- A Natural Circulation cooldown is in progress in accordance with EPP-5, Natural Circulation Cooldown.
- BOTH CRDM Cooling Fans, HVH-5A and 5B, are running.
- TSC has determined that the RCS cooldown rate must exceed the EPP-5 limit.

Which ONE (1) of the following completes the statement below?

Following procedure transition, the RCS cooldown rate is limited to __(1)__ in order to __(2)__.

A.✓ (1) 100°F/hr

(2) remain within the Technical Specification limits

B. (1) 50°F/hr

(2) remain within the Technical Specification limits

C. (1) 100°F/hr

(2) prevent formation of voids in the Reactor Vessel upper head region

D. (1) 50°F/hr

(2) prevent formation of voids in the Reactor Vessel upper head region

The correct answer is A.

A. Correct.

B. Incorrect - The 50°F/hr cooldown limit is greater than 25°F/hr but the limit in EPP-6 and ITS is 100°F/hr. The 50°F/hr cooldown limit is used in other EOP procedures.

C. Incorrect - Cooldown rate of 25°F/hr is allowed in EPP-5 with both HVH-5A and B operating. When this rate is exceeded, transition to EPP-6 is required. ITS cooldown rate limit of 100°F/hr is correct. The purpose of EPP-6 is to continue plant cooldown and depressurization to cold shutdown under conditions that allow for the potential formation of a void in the upper head region.

D. Incorrect - Cooldown rate of 25°F/hr is allowed in EPP-5 with both HVH-5A and B operating. When this rate is exceeded, transition to EPP-6 is required. The 50°F/hr cooldown limit is used in other EOP procedures. The purpose of EPP-6 is to continue plant cooldown and depressurization to cold shutdown under conditions that allow for the potential formation of a void in the upper head region.

Question 27
Tier/Group 1/2
K/A Importance Rating - RO 3.4 SRO 3.7

Knowledge of the reasons for the following responses as they apply to the (Natural Circulation with Steam Void in Vessel with/without RVLIS): Facility operating characteristics during transient conditions, including coolant chemistry and the effects of temperature, pressure, and reactivity changes and operating limitations and reasons for these operating characteristics.

Reference(s) - Sim/Plant design, EPP-5/6, EPP-5/6BD
Proposed References to be provided to applicants during examination - None
Learning Objective - EPP-6-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 41.10 / 45.6 / 45.13
Comments -

CONTINUOUS USE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL

VOLUME 3

PART 4

END PATH PROCEDURE

EPP-5

NATURAL CIRCULATION COOLDOWN

REVISION 15

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
20.	Maintain The Following RCS Conditions: • RCS pressure - APPROXIMATELY 1950 PSIG • PZR level - BETWEEN 30% AND 40% • Cooldown rate in RCS cold legs - LESS THAN 25°F IN THE LAST 60 MINUTE • RCS temperature and pressure - WITHIN LIMITS OF CURVE 3.4, REACTOR COOLANT SYSTEM PRESSURE - TEMPERATURE LIMITATIONS FOR COOLDOWN	
21.	Monitor RCS Cooldown: • Check Core exit T/Cs - LOWERING • Check RCS hot leg temperatures - LOWERING • Check RCS subcooling - RISING	Raise steam dump from intact S/Gs.
*22.	Check Cooldown Rate Required - GREATER THAN LIMITS	IF the cooldown rates must be raised to greater than those allowed in this procedure, THEN Go To EPP-6, Natural Circulation Cooldown With Steam Void In Vessel. Observe NOTE prior to Step 24 and Go To Step 24.
23.	Go To EPP-6, Natural Circulation Cooldown With Steam Void In Vessel	

CONTINUOUS USE

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END PATH PROCEDURE

EPP-6

NATURAL CIRCULATION COOLDOWN WITH STEAM VOID IN VESSEL

REVISION 12

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

Supplement K is available for optimizing Auxiliary Spray below.

13.	Continue RCS Cooldown And Depressurization As Follows:	
	a. Maintain cooldown rate in RCS cold legs less than 100°F in the last 60 minute	
	b. Maintain RCS temperature and pressure within limits of curve 3.4, Reactor Coolant System pressure - temperature limitations for cooldown	
	c. Maintain RCS subcooling greater than 55°F	c. Stop depressurization AND establish subcooling.
	d. Check steam dump to Condenser - AVAILABLE	d. Dump steam using STEAM LINE PORVs. Go To Step 13.f.
	e. Dump steam to Condenser	
	f. Control feed flow to maintain S/G levels - BETWEEN 39% AND 50%	
	g. Control depressurization using auxiliary spray as follows: 1) Establish letdown using OP-301, Chemical and Volume Control System (CVCS) 2) Use CVC-311, AUX PZR SPRAY	g. Use one PZR PORV.

CONTINUOUS USE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

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END PATH PROCEDURE

EPP-6

NATURAL CIRCULATION COOLDOWN WITH STEAM VOID IN VESSEL

REVISION 12

At no time is it appropriate to make a transition to FR-I.3, RESPONSE TO VOIDS IN REACTOR VESSEL, and perform a head venting operation. This is contrary to the intent of guideline ES-0.3 where a vessel void is allowed to exist under controlled conditions while the plant is cooled down and depressurized to cold shutdown. If guideline FR-I.3 was used to vent the vessel head at this time, the steam void would not be eliminated. As pressure lowers (from venting), more water will flash to steam in the head region, which replaces the steam that was vented. The void size will remain essentially constant and the net result will be a loss of system inventory. Therefore, guideline FR-I.3 should not be used when cooling down and depressurizing the system with guideline ES-0.3.

It should be noted that although guideline ES-0.3 is the approved guidance for natural circulation cooldown/depressurization with a vessel void, guideline ES-0.2 presents the preferred mode of operation (i.e., no void formation) and should be used whenever possible.

3. RECOVERY/RESTORATION TECHNIQUE

The objective of the recovery/restoration technique incorporated into guideline ES-0.3 is to first recognize that an upper head void will form and then prepare for and monitor this void growth during the cooldown and depressurization of the RCS.

The following subsections provide a summary of the major categories of operator actions and the key utility decision points for guideline ES-0.3, NATURAL CIRCULATION COOLDOWN WITH STEAM VOID IN VESSEL (WITH RVLIS).

3.1 High Level Action Summary

A high level summary of the actions performed in ES-0.3 is given in the form of major action categories. These are discussed below in more detail.

MAJOR ACTION CATEGORIES IN ES-0.3

- o Try to Start an RCP
- o Cool Down and Depressurize RCS While Controlling Void Growth
- o Lock Out SI System
- o Place RHR System in Service
- o Cool Down to Cold Shutdown

o Try to Start an RCP

The operator initially prepares for a natural circulation cooldown and depressurization in ES-0.2. Before continuing the cooldown/depressurization instructed by ES-0.3, an attempt is made to start an RCP, since it is preferred to cool down the RCS under forced circulation. If this attempt is successful, the operator is instructed to transfer to the appropriate plant procedure for cooldown under forced circulation. If proper conditions for starting an RCP can be established during the course of this guideline, the operator is instructed to repeat the step for starting an RCP.

o Cool Down and Depressurize RCS While Controlling Void Growth

Before cooling down and depressurizing the RCS, a pressurizer level is established to accommodate void growth. During the cooldown/depressurization phase, a cooldown rate of less than 100°F/HR is maintained, together with a minimum RCS subcooling. RCS temperature and pressure should also be maintained within Technical Specification cooldown limits. To monitor void growth and maintain pressure control, RVLIS and pressurizer level instrumentation are checked for proper values.

RNP STEP	WOG STEP	BASIS/DIFFERENCES
13	3	WOG BASIS

PURPOSE: To continue the RCS cooldown and begin depressurization

BASIS:

This guideline is intended to provide a faster cooldown/depressurization than that outlined in ES-0.2. For this reason a maximum cooldown rate of 100°F/hr is allowed, along with a minimal subcooling requirement (i.e., instrument errors plus 20°F to ensure subcooling in hot legs). At the same time, however, the primary system pressure and temperature should be maintained within the Technical Specification limits. Deviation from the required cooldown rate could lead to excessive heat removal rates during the RCS cooldown. Since the intent of this guideline is to perform a controlled RCS cooldown and stay within Technical Specification limits, the requirement to maintain RCS temperature and pressure within these limits is explicitly emphasized in this step. Though this is not a pressurized thermal shock concern, emphasis is needed on maintaining RCS temperature and pressure within certain limits.

The utility should be aware that a faster natural circulation cooldown/depressurization, which allows upper head void growth, poses an additional concern. A high temperature differential may exist between the vessel proper and the vessel head that could cause differential contraction between the vessel head and vessel body at the flange, thereby stressing the studs beyond the allowable code limits.

A review of this potential thermal stress safety concern indicated that the best-estimate maximum differential temperature that could occur is 250°F, with 300°F being an enveloping maximum differential temperature. Westinghouse performed work for a number of near term operating license plants to address the safety grade cold shutdown requirements of draft Regulatory Guide 1.139, Guidance for Residual Heat Removal. The Diablo Canyon Natural Circulation Cooldown Pretest report included a review of the thermal stress concern in the reactor vessel during the natural circulation cooldown. Since the best-estimate maximum differential temperatures exceeded those analyzed for Diablo Canyon, the analysis results were extrapolated to determine the affect of the raised differential temperature. This extrapolation indicated that although thermal stresses will be raised for the greater differential temperatures, total stress in the reactor vessel closure studs is well within the allowable limits.

Based on this evaluation, it is concluded that a safety concern does not exist in implementing the guidance contained in the WOG natural circulation cooldown guidelines. Consequently, a plant specific evaluation of the natural circulation cooldown thermal stress concern is not needed prior to implementing the ERGs.

Although not required prior to guideline implementation, utilities may still desire to analyze this concern to better quantify the consequences in terms of potential margin reduction. Plant-specific evaluation/analysis of the reactor vessel thermal stress concern requires an assessment of actual cooldown rates of the fluid in the reactor vessel upper head and actual reactor vessel metal temperature during a natural circulation cooldown utilizing the recovery strategies in the ERGs. This information can then be utilized in a finite element stress analysis of the reactor vessel flange area.

RNP DIFFERENCES/REASONS

Added instructions for steam dump operations and S/G level control.

SSD DETERMINATION

This is an SSD per criterion 10.

Reduction in Core Decay Heat Generation:

As cooldown progresses, the secondary pressure (and temperature) lowers. This causes the cold leg temperature to lower with steam temperature. The hot leg temperature also lowers after a time lag that is established based on the primary system delta T.

To slow or terminate the cooldown, the steam dump valves are used to reduce the steam release, thus stabilizing and possibly increasing secondary pressure (and temperature) slightly. When the cooldown is slowed or terminated, the heat being removed from the primary system lowers to an equilibrium (constant temperature) level. The reduction in heat removal will result in a reduction in primary system delta T, the cold leg temperature will stabilize and possibly rise slightly and the hot leg temperature will lower slightly.

This short term response of system temperatures to the initiation and termination of plant cooldown must be accounted for by the operator in performing cooldown steps to better control system temperature at the desired values. Since the operator is instructed to stop the cooldown in the step that follows this note, the purpose of this note is to address the short term response of RCS hot leg temperature when cooldown is stopped. It reminds the operator to expect hot leg temperature to lower further after the cooldown is stopped. The operator should stop the cooldown with sufficient temperature margin that the expected reduction does not exceed the temperature limit in the step.

In the long term, the primary system delta T will gradually lower as core decay heat generation gradually lowers. As the primary system delta T gradually lowers, the cold leg temperature will gradually rise and the hot leg temperature will gradually lower. This long term response of system temperatures to the reduction in decay heat generation should be accounted for by the operator in performing steps that maintain system temperatures to better control system temperature at the desired values. Since this is a long term response consideration, it is not specifically addressed in the note. With respect to the long term effect of decreasing core decay heat generation rates on the behavior of system temperatures, the ERGs rely on operator knowledge and training to properly perform steps that initiate and terminate cooldown and maintain system temperatures.

KNOWLEDGE:

- Expected T_{HOT} reduction (short term response) after cooldown is stopped due to a reduction in loop delta Ts. See BASIS section above.
- Expected T_{HOT} reduction (long term response) due to a reduction in core decay heat generation rates. See BASIS section above.

RNP DIFFERENCES/REASONS

There are essentially no differences.

SSD DETERMINATION

This is not an SSD.

37 5 WOG BASIS

PURPOSE: To continue the step-wise cooldown

BASIS:

At 1600 psig a reduction in primary temperature to 450°F is just short of reaching the limiting Technical Specification cooldown curve (see Figure 1). Here it is important that the operator consider the preceding NOTE so as not to violate the Technical Specification cooldown curve when stopping the cooldown at the specified temperature.

The cooldown is now accomplished at the maximum rate of 100°F/hr, pressure is held constant at 1600 psig, and inventory is added to make up for system shrink. As explained in Step 3, RCS temperature and pressure should be maintained within limits of the Technical Specification cooldown curve and the limits imposed by this guideline. It is still unlikely that void formation will start or continue under these conditions as indicated in Figure 1.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
46.	Observe The Following Restrictions: a. Maintain RCS pressure and Cold Leg temperature within the limits of Attachment 1, Post Soak Cooldown Limit Curve, during <u>ALL</u> subsequent actions b. Maintain cooldown rate in RCS Cold Legs less than 50°F/hr in any 60 minute period	DISTRACTOR
47.	Reset SPDS <u>AND</u> Return To Procedure And Step In Effect	

- END -

28. 003 A1.07 001

Given the following plant conditions:

- Plant cooldown is in progress IAW GP-007, Plant Shutdown from Hot Shutdown to Cold Shutdown.
- RCS temperature is 250°F.
- RCS pressure is 375 psig.
- VCT pressure is 25 psig
- "A" and "C" RCP seal leakoff flows indicate 0.7 gpm.
- Seal injection flows are normal.

At time 1600, a loss of pressure control occurs and pressure begins dropping at a rate of 10 psig/min.

- Maximum RCP Seal Leakoff Temperature is 145°F.
- Maximum RCP Pump Bearing Temperature is 132°F.

Which ONE (1) of the following completes the statement below?

Assuming a linear rate of pressure reduction, at time __(1)__ the crew is required to __(2)__.

A. (1) 1605

(2) secure RCPs

B. (1) 1605

(2) open CVC-307, PRI SEAL BYP ISO

C.✓ (1) 1615

(2) secure RCPs

D. (1) 1615

(2) open CVC-307, PRI SEAL BYP ISO

The correct answer is C.

A. Incorrect. The time of 1605 will put pressure at 325 psig, which the minimum pressure for starting a RCP, however, the RCP can continue to run as long as 210 psid is maintained on No. 1 Seal. At time 1605 the No.1 Seal D/P would be 300 psid.

B. Incorrect. CVC-307 does not have to be opened unless RCP seal leakoff temperatures or RCP Pump Bearing temperatures are approaching their alarm setpoints. The given temperatures are normal for the given plant conditions. This is a recent change to the RCP Operating Procedure.

C. Correct. At time 1615 the D/P on the No.1 seals will be less than 210 psid and the RCPs need to be secured. At time 1615 RCS pressure will be 225 psig, which equates to a D/P of 200 psid across the No. 1 Seal.

D. Incorrect. CVC-307 does not have to be opened unless RCP seal leakoff temperatures or RCP Pump Bearing temperatures are approaching their alarm setpoints. The given temperatures are normal for the given plant conditions. This is a recent change to the RCP Operating Procedure.

Question 28
Tier/Group 2/1
K/A Importance Rating - RO 3.4 SRO 3.4

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the RCPS controls including: RCS temperature and pressure

Reference(s) - Sim/Plant design, OP-101, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective -RCS 004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 45.5
Comments -

5.2.1 (Continued)

8. Injection Water inlet temperature to an RCP should **NOT** exceed 130°F.

9. A differential pressure of greater than 210 psid should be maintained across No. 1 seal. This condition should be met if the RCS pressure is at least 325 psig, however, RCP operation may continue if RCS pressure drops below 325 psig after pump start as long as No. 1 seal dp of 210 psid is maintained. If decrease of No. 1 seal dp to below 210 psid is expected, the RCP should be tripped as soon as practical to minimize coast down time with less than 210 psid.

10. The No. 1 Seal Bypass Valve is used when RCS pressure is less than 1000 psig, to prevent the RCP pump bearing temperature **OR** the No. 1 Seal Leakoff temperature from reaching alarm levels. Prior to opening CVC-307, PRI SEAL BYPASS isolation, the following conditions shall all be satisfied:

    a. RCS pressure is between 100 and 1000 psig.

    b. All No. 1 Seal Leakoff valves (CVC-303A, B, C) are open.

    c. Any No. 1 Seal Leakoff flow rate is less than 1 gpm.

    d. Seal injection flow rate to each RCP is greater than 8 gpm.

11. Any change greater than 10°F on No. 1 and No. 2 seal leak-off for unknown reasons should be investigated.

12. Only one RCP is to be started at any one time.

13. A Reactor Coolant Pump should **NOT** be operated continuously until the RCS has been thoroughly vented.

14. If Component Cooling Water flow to the RCP motor is lost, the RCP shall be stopped before either the upper or lower bearing temperature has increased to 200°F IAW AOP-014. (CR 95-02015 and ESR 95-01075)

8.1.1.2 (Continued)

	RCP "A"	RCP "B"	RCP "C"
d. **VERIFY** Thermal Barrier labyrinth seal differential pressure is greater than or equal to 5 inches water column. (REF: ACR 93-438)	___	___	___

CAUTION

CVC-307, PRI SEAL BYP ISO, located in the No. 1 seal bypass line should remain closed unless the Reactor Coolant Pump Bearing Temperature OR the No. 1 Seal Leakoff Temperature approaches the alarm level. The bypass valve should then be opened ONLY IF the conditions in Step 8.1.1.2.e are met. (Ref. 2.4)

The following step is a CONTINUOUS ACTION STEP that applies any time an RCP is in operation (running) **AND** the listed conditions are met.

INIT

e. **IF** any RCP Seal Leakoff Temperature approaches 165°F **OR** any RCP Pump Bearing Temperature approaches 170°F, **THEN PERFORM** the following:

1) **VERIFY** the following conditions exist:

- RCS pressure is between 100 psig **AND** 1000 psig ____
- All No. 1 Seal Leakoff Valves are open ____
- Any No. 1 Seal Leakoff flow rate is less than 1 gpm ____
- Seal Injection flow rate to each RCP is greater than 8 gpm ____

Distracter

2) **OPEN** CVC-307, PRI SEAL BYP ISO. ____

3) **DOCUMENT** the RCP conditions that required operation of CVC-307 in the Control Room Log (AutoLog). ____

29. 004 K5.30 001

Given the following plant conditions:

- The RCS is on RHR and solid.
- RCS pressure is 350 psig.
- RCS temperature has risen 2°F in the last minute, and then stabilized.
- HIC-142, PURIFICATION FLOW, controller setting is at 40% demand.

Which ONE (1) of the following completes the statement below?

Letdown pressure __(1)__ , PCV-145 throttles __(2)__ to restore letdown pressure to its original value.

A. (1) rises

(2) shut

B.✓ (1) rises

(2) open

C. (1) lowers

(2) shut

D. (1) lowers

(2) open

The correct answer is B.

A Incorrect - Letdown pressure will rise and PCV-145 does throttle to respond to the pressure change and returns pressure to its original value. Incorrect since PCV-145 opens.

B Correct.

C Incorrect - RCS pressure will change and PCV-145 does throttle to respond to the pressure change and returns pressure to its original value. Incorrect since pressure initially rises, PCV-145 opens.

D Incorrect - PCV-145 does throttle to respond to the pressure change and returns letdown pressure to its original value. However, letdown pressure will initially rise.

Question 29
Tier/Group 2/1
K/A Importance Rating - RO 3.8 SRO 4.2

Knowledge of the operational implications of the following concepts as they apply to the CVCS: Relationship between temperature and pressure in CVCS components during solid plant operation

Reference(s) - Sim/Plant design, System description, GP-007
Proposed References to be provided to applicants during examination - None
Learning Objective - CVCS 004
Question Source - BANK (Last used for the 2004 NRC Exam. Question format modified.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 45.7
Comments -

ATTACHMENT 10.3
Page 1 of 4

RHR AND CVCS OPERATION WITH SOLID RCS CONDITIONS

In general, solid plant pressure control may be viewed as a mass/energy balance between the primary system (RCS and RHR) and the CVCS system.

In order to analyze long term actions we must treat the conditions as a mass inventory balance. First we must state what conditions we know.

1. For steady state conditions the mass out must equal the mass in (Assuming constant RCS temperature).

   m letdown = m charging

2. PCV-145 is set to maintain letdown pressure (~375 psig).

3. Charging flow is constant and controlled by speed of the pump.

4. Letdown flow is dependent on the total head loss in the line and the Delta-P between Primary and VCT.

   a. Total Head Loss = Component Head Loss + Piping Head Loss

      HCV-142 + Piping Head Loss
      PCV-145 + Piping Head Loss
      R.C. Filter + Piping Head Loss
      Demineralizers + Piping Head Loss

   b. Flow Rate Is Inversely Proportional to Head Loss

5. Reactor coolant filter and demineralizer head loss increase only slightly over time.

Using the above information, we will examine several transients.

1. Set PCV-145 to maintain a low pressure
   PCV-145 will open and increase letdown flow. Mass flow from the primary increases and pressure will decrease. As primary pressure decreases, letdown flow will decrease. Net overall effect will be a lower primary and letdown line pressure.

ATTACHMENT 10.3
Page 2 of 4

RHR AND CVCS OPERATION WITH SOLID RCS CONDITIONS

2. Set PCV-145 to maintain a higher pressure
PCV-145 will close and decrease letdown flow. Primary system pressure will increase. As primary system pressure increases, letdown flow will increase. The net effect will be a higher system pressure and higher letdown pressure.

3. Closing HCV-142
As HCV-142 is closed, PCV-145 will close to maintain letdown pressure constant. As HCV-142 and PCV-145 close, letdown flow will decrease and system pressure will increase. As system pressure increases, letdown flow will be restored to its normal value and the pressure increase will stop. Net result will be HCV-142 manually throttled, PCV-145 open less and system pressure higher.

4. Open HCV-142
The effect of opening HCV-142 is equal and opposite that of closing HCV-142. The net effect, steady state to steady state, is a lower system pressure and PCV-145 open further.

5. Open RHR-758
As HCV-758 is opened, FCV-605 will close (if in automatic) thus maintaining a constant RHR pump discharge pressure and constant letdown flow rate. However, during the time period that FCV-605 is matching RHR flow, there will be a pressure decrease and perturbation in letdown flow. The long term effect is more flow through the RHR heat exchanger and a decrease in RCS temperature. As RCS temperature decreases, system volume decreases. As system volume decreases, system pressure will decrease. As system pressure decreases, letdown pressure will decrease and PCV-145 will go closed. The net effect steady state to steady state is that PCV-145 will reduce letdown flow by an amount equal to that necessary to offset RCS shrinkage due to the cool down rate in progress at the time. As VCT level decreases due to reduced letdown flow, RCS makeup will occur to maintain RCS inventory. If FCV-605 is in manual, the effect on system pressure will be similar to that of throttling HCV-142. As HCV-758 is opened, RHR pump discharge pressure will decrease. Letdown flow will decrease. In this case the decrease in letdown flow will offset the decrease in RCS water volume due to cool down. However, since there are two variables changing, the overall effect is hard to determine.

ATTACHMENT 10.3
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RHR AND CVCS OPERATION WITH SOLID RCS CONDITIONS

6. Close HCV-758 => Similar To Temp ↑
The effect of closing HCV-758 is equal and opposite as that of opening HCV-758. Initially RCS pressure will increase, then steady state to steady state, an increase in letdown flow will stabilize pressure to offset the increased water volume due to the heat up.

7. Stop the running RHR pump
When the running RHR pump is stopped, letdown flow essentially drops to zero. At the same time that letdown flow goes to zero, RCS temperatures began to rise due to no flow through the coolers. Both of these factors will rapidly increase RCS pressure. If left with no Operator action, RCS pressure would eventually rise to a point to again establish letdown flow equal to charging flow. If charging flow is terminated, RCS pressure will still rise to a point sufficient to give letdown flow through HCV-142 and PCV-145 to offset increased RCS water volume. The problem is that this pressure is greatly above the setpoint for LTOPP operation and the RCS pressure/temperature limitation curve.

8. Letdown demineralizer or RCS filter become clogged (Loss of L/D flow)
For all of the above examples we have considered that demineralizer and filter Delta - P are constant. Over long periods of time the head loss across these devices increases. As the Delta - P across the demineralizers and RC Filter increase, letdown flow decreases. As letdown flow decreases, RCS pressure and therefore letdown pressure increase. As letdown pressure increases PCV-145 opens to restore pressure. This action restores letdown flow to its original value. Since this generally occurs over a long period of time, the only perceptual change that the Operator would notice is a gradual opening of PCV-145 over a period of time. If the demineralizers or RC Filter clog rapidly, as may occur during a CRUD burst or inadvertent valve closure, letdown flow would initially decrease. As flow decreases RCS pressure and letdown pressure will increase. PCV-145 will open. However, in this case since there is no flow path for letdown downstream of PCV-145, PCV-145 will have little or no effect on pressure. If left with no action, RCS pressure will continue to rise until LTOPP operation occurs. Relief CVC-209, located downstream of PCV-145 will operate to relieve pressure at 200 psig. However, it is doubtful if this pressure when combined with the head loss up stream is sufficiently low to prevent LTOPP operation. This same type of effect is seen if RHR-759 A & B and RHR-758 are closed simultaneously except that CVC-209 will not lift. LTOPP operation should handle this event.

ATTACHMENT 10.3
Page 4 of 4

RHR AND CVCS OPERATION WITH SOLID RCS CONDITIONS

9. Increase charging Flow
For all of the above examples we have considered charging flow to be constant while other variables change. In this case we will increase charging pump speed to increase charging flow rate.

As speed on the running charging pump is increased, charging to the RCS increases. RCS pressure will initially increase, thus increasing letdown pressure. As letdown pressure increases, PCV-145 will open to restore pressure to its set value. The net effect steady state to steady state will be an increase in letdown flow equal to that of the increase in charging flow. Final RCS pressure will be slightly higher than initial due to the increase in head loss upstream of PCV-145 from higher letdown flow. This may be manually offset by opening HCV-142 slightly. If charging flow is being increased to increase letdown flow for purification purposes, one must remember to perform the evolution slowly to prevent a pressure excursion that would cause LTOPP operation.

Summary:

As described above, any action that changes the equilibrium status of water flow from the primary to CVCS or from CVCS to the primary will effect system pressure. Assuming no actuation of other components and no operator action, system response will restore flow rates to an equal amount.

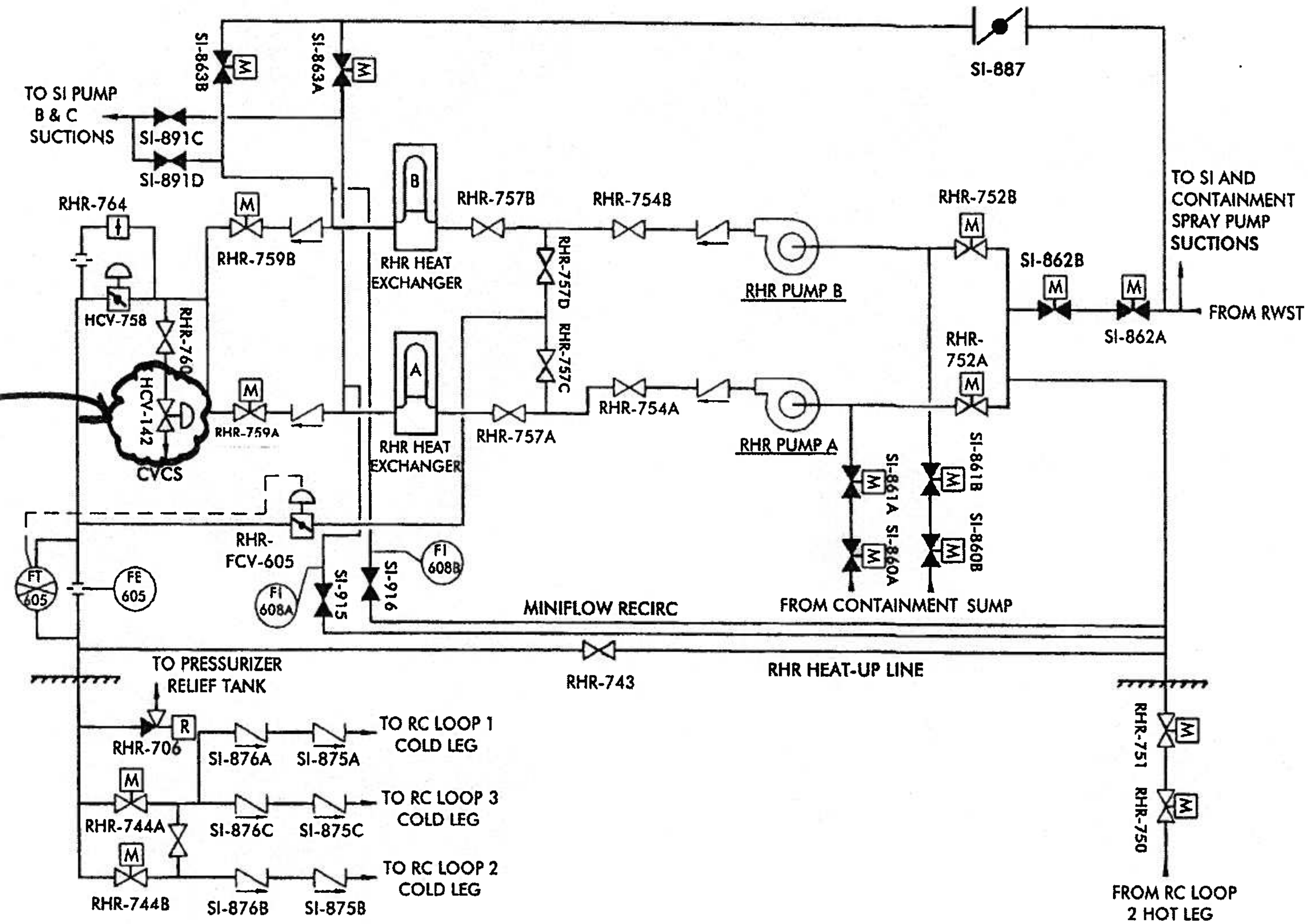
In the case where RCS temperatures are changed, letdown flow will change to offset the amount of water volume change occurring to maintain system equilibrium.

In most cases, since the Operator is controlling a pressure band of only 325 psig to 400 psig, the system can not be left to its own devices to restore equilibrium conditions. Particularly in the area of rapidly changing situations, e.g. failure of PCV-145, etc. The Operator must take action using PCV-145 as necessary to maintain pressure within the required band until equilibrium conditions can be restored.

RHR SYSTEM-CORE COOLING LINEUP

RHR-FIGURE-1

No Auto Function Set @ 40%



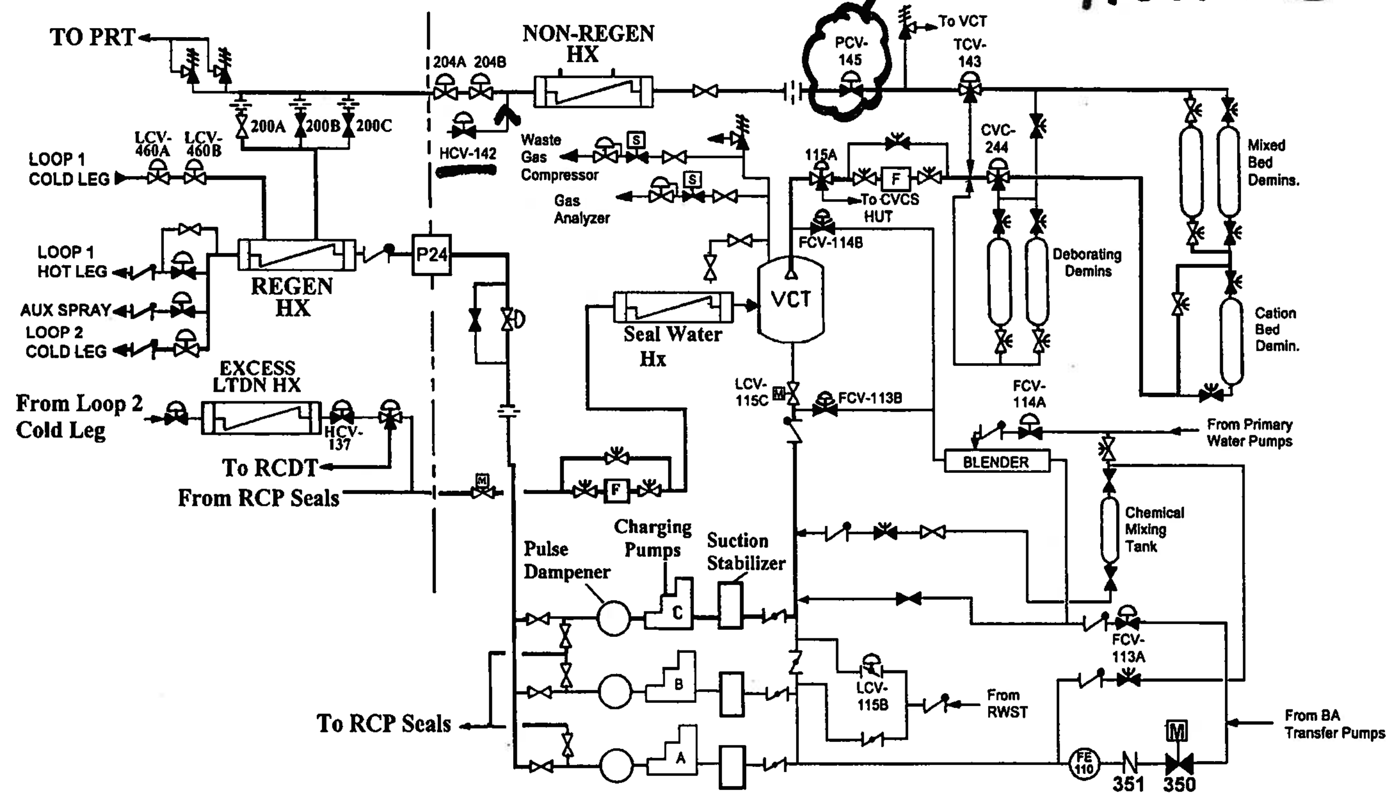
rhrf01

INFORMATION USE ONLY

CVCS FLOW DIAGRAM, SIMPLIFIED

CVCS-FIGURE-2

MAINTAINS LETDOWN Pressure



CVCSF02

INFORMATION USE ONLY

30. 004 K6.14 001

Given the following plant conditions:

- The plant is operating at 100% RTP.
- "C" Charging Pump is currently running in AUTO and "B" Charging Pump is running in MANUAL at minimum speed.
- Maintenance has been completed on "A" Charging Pump and WCC has dispatched an operator to remove the clearance and align the pump for recirculation.
- During the valve alignments the operator incorrectly aligns the recirculation path by having **BOTH** CVC-277C, Charging Pump "A" Recirc Root, **AND** CVC-290, Charging Pump "A" To Charging Line, **OPEN**.

Which ONE(1) of the following completes the statement below, assuming no operator action?

The output on "C" Charging Pump speed controller will rise __(1)__ and VCT level will __(2)__.

A. (1) and maintain PZR program level

(2) rise

B.✓ (1) to maximum

(2) rise

C. (1) and maintain PZR program level

(2) remain the same

D. (1) to maximum

(2) remain the same

The correct answer is B.

A. Incorrect - The charging pump speed will rise to attempt to maintain PZR level, however, all the charging flow will be routed through the recirc line and PZR level will not be maintained. The VCT level will rise due to no change in letdown flow plus all the charging pump recirc flow entering the VCT through the seal return line.

B. Correct - All charging flow will be routed through the recirculation line and the AUTO charging pump speed controller will go to maximum due to lowering PZR level. Since all charging flow is through the recirculation line back into the VCT along with normal letdown flow, the VCT level will rise.

C. Incorrect - The charging pump speed will rise to attempt to maintain PZR level, however, all the charging flow will be routed through the recirc line and PZR level will not be maintained. The candidate may think that the recirc line ties back into the letdown line.

D. Incorrect - The first part of the distractor is correct. The candidate may think that the recirc line ties back into the letdown line.

Question 30
Tier/Group 2/1
K/A Importance Rating - RO 2.7 SRO 3.0

Knowledge of the effect of a loss or malfunction on the following CVCS components:
Recirculation path for charging pumps

Reference(s) - Sim/Plant design, CVCS System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - CVCS-009
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7

Comments - K/A match because candidate is given a situation where the recirc path has been aligned to the VCT and a Charging Pump Discharge Valve is still open for an idle Charging Pump. The candidate must determine that all charging flow will be directed to the VCT causing PZR Level to lower and all charging flow will be lost to the regenerative heat exchanger causing the outlet temperature to rise.

Discussion with P. Capehart concerning K/A:
RNP's charging pump recirculation path is normally isolated and consists of manually operated valves. Agreed that it would be acceptable to write a question against operation of manual valve(s) or leakby and identify the impact on CVCS system.

Reviewed and approved by MAB.

31. 005 K3.01 001

Given the following plant conditions:

- Plant is in Mode 5 with the RCS solid.
- RCS pressure is 332 psig.
- RCPs have been secured.
- 2 Charging Pumps are operating in manual.

Subsequently:

- The operating RHR Pump trips

Which ONE (1) of the following identifies the change in the Reactor Coolant System for the stated conditions?

A.✓ RCS pressure will **rise** due to the loss of letdown flow AND RCS temperature will **rise** due to the loss of flow through the RHR Heat Exchangers.

B. RCS pressure will **lower** due to PCV-145 attempting to maintain letdown pressure AND RCS temperature will **rise** due to the loss of flow through the RHR Heat Exchangers.

C. RCS pressure will **rise** due to the loss of letdown flow AND RCS temperature will **lower** due to the charging flow into the RCS.

D. RCS pressure will **lower** due to PCV-145 attempting to maintain letdown pressure AND RCS temperature will **lower** due to the charging flow into the RCS.

Answer is A

A. Correct

B. Incorrect - With no RHR flow RCS temperature will rise due to a loss of cooling flow. The impact will be an increase in pressure due to PCV-145 attempting to maintain the letdown pressure by closing.

C. Incorrect - The first part of the distractor is correct. With no RHR flow RCS temperature will eventually rise due to a loss of cooling flow.

D. Incorrect - With the RCS solid and the RCPs secured, RCS pressure is maintained via the letdown flow through valve HCV-142, which has the driving head from the RHR Pump discharge pressure. With the RHR Pump tripped, the letdown flow will lower to zero GPM and PCV-145 will attempt to maintain the letdown pressure by closing, thus causing the pressure to rise. The pressure rise will be terminated when LTOP actuation occurs. With no RHR flow RCS temperature will eventually rise due to a loss of cooling flow.

Question 31
Tier/Group 2/1
K/A Importance Rating - RO 3.9 SRO 4.0

Knowledge of the effect that a loss or malfunction of the RHRS will have on the following: RCS

Reference(s) - Sim/Plant design, AOP-020, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - RHR 009
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.6
Comments -

ATTACHMENT 10.3
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RHR AND CVCS OPERATION WITH SOLID RCS CONDITIONS

6. Close HCV-758
The effect of closing HCV-758 is equal and opposite as that of opening HCV-758. Initially RCS pressure will increase, then steady state to steady state, an increase in letdown flow will stabilize pressure to offset the increased water volume due to the heat up.

* 7. Stop the running RHR pump
When the running RHR pump is stopped, letdown flow essentially drops to zero. At the same time that letdown flow goes to zero, RCS temperatures began to rise due to no flow through the coolers. Both of these factors will rapidly increase RCS pressure. If left with no Operator action, RCS pressure would eventually rise to a point to again establish letdown flow equal to charging flow. If charging flow is terminated, RCS pressure will still rise to a point sufficient to give letdown flow through HCV-142 and PCV-145 to offset increased RCS water volume. The problem is that this pressure is greatly above the setpoint for LTOPP operation and the RCS pressure/temperature limitation curve. *

8. Letdown demineralizer or RCS filter become clogged (Loss of L/D flow)
For all of the above examples we have considered that demineralizer and filter Delta - P are constant. Over long periods of time the head loss across these devices increases. As the Delta - P across the demineralizers and RC Filter increase, letdown flow decreases. As letdown flow decreases, RCS pressure and therefore letdown pressure increase. As letdown pressure increases PCV-145 opens to restore pressure. This action restores letdown flow to its original value. Since this generally occurs over a long period of time, the only perceptual change that the Operator would notice is a gradual opening of PCV-145 over a period of time. If the demineralizers or RC Filter clog rapidly, as may occur during a CRUD burst or inadvertent valve closure, letdown flow would initially decrease. As flow decreases RCS pressure and letdown pressure will increase. PCV-145 will open. However, in this case since there is no flow path for letdown downstream of PCV-145, PCV-145 will have little or no effect on pressure. If left with no action, RCS pressure will continue to rise until LTOPP operation occurs. Relief CVC-209, located downstream of PCV-145 will operate to relieve pressure at 200 psig. However, it is doubtful if this pressure when combined with the head loss up stream is sufficiently low to prevent LTOPP operation. This same type of effect is seen if RHR-759 A & B and RHR-758 are closed simultaneously except that CVC-209 will not lift. LTOPP operation should handle this event.

32. 006 K5.10 001

Which ONE (1) of the following identifies the reason for RCP restart IAW FRP-P.1, RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK, if the SI termination criteria cannot be satisfied?

A. Restores PZR spray to allow RCS depressurization in subsequent steps.

B. Equalizes S/G pressures to allow simultaneous cooldown of all three loops in subsequent steps.

C. Transfer core cooling to forced flow allowing the operators to terminate Safety Injection when the criteria are **NOT** satisfied.

D.✓ Mixes Safety Injection water and RCS water to raise the fluid temperature entering the Reactor Vessel downcomer.

The correct answer is D.

A. Incorrect - Restoring RCPs will allow for restoration of PZR spray, however this is not the basis for starting the RCPs when SI termination criteria cannot be satisfied. PZR spray is utilized in FRP-P.1 to reduce RCS pressure.

B. Incorrect - Restoring Reactor coolant flow will equalize S/G pressure to an extent. However, further cooldown is not a mitigative strategy in FRP-P.1.

C. Incorrect - Forced flow core cooling is desired but SI cannot be terminated until all the criteria are satisfied.

D. Correct.

Question 32
Tier/Group 2/1
K/A Importance Rating - RO 2.5 SRO 2.9

Knowledge of the operational implications of the following concepts as they apply to ECCS: Theory of thermal stress

Reference(s) - Sim/Plant design, FRP-P.1BD
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-P.1-003
Question Source - BANK (Not used on NRC Exam from 2004 to Present.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 45.7
Comments -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
16.	Determine If An RCP Can Be Started As Follows:	
	a. Check RCS subcooling - GREATER THAN 35°F [55°F]	a. Go To Step 44.
	b. Establish support conditions for running an RCP using OP-101, Reactor Coolant System and Reactor Coolant Pump Startup and Operation	b. Go To Step 44.
	c. Start one RCP using OP-101, Reactor Coolant System and Reactor Coolant Pump Startup and Operation	c. Go To Step 44.
	d. Go To Step 44	

****

CAUTION

If offsite power is lost after SI reset, manual action may be required to restart safeguards equipment.

****

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
17.	Perform The Following:	
	a. Reset SAFETY INJECTION	
	b. Momentarily place the CONTAINMENT SPRAY Key Switch to the OVRD/RESET position AND return to the NORMAL position	
18.	Reset The Following Containment Isolations:	
	• PHASE A	
	• PHASE B	

RNP STEP	WOG STEP	BASIS/DIFFERENCES
14-16	6	BASIS (Continued)

The subcooling criterion will ensure subcooled conditions and the RVLIS indication ensures the existence of an adequate vessel inventory such that core cooling is ensured. Refer to document SI TERMINATION/REINITIATION in the Generic Issues section of the Executive Volume.

If either of the termination criteria are not satisfied, then SI is required to ensure core cooling and should not be terminated. Most likely the cold leg/downcomer low temperature condition is due to SI water mixing effects and an RCP restart is attempted. Of the transients considered in PTS, the SBLOCA transient may result in a condition whereby Safety Injection (SI) flow cannot be terminated. In Westinghouse Owners Group (WOG) reports 0G-110 and 0G-117 titled "Evaluation of Alternate RCP Trip Criteria" and "Justification of Manual RCP Trip for Small Break LOCA Events" respectively, a range of SBLOCAs were identified where continued RCP operation or conversely untimely RCP restart could result in increased RCS inventory loss. The loss of additional inventory could ultimately result in deeper core uncovery transients which could in turn result in fuel cladding temperatures in excess of the plant's design basis FSAR analysis result. Therefore, from a SBLOCA standpoint, RCP restart at an inopportune time could result in a degraded core cooling scenario.
In WCAP-10319 titled "A Generic Assessment of Significant Flaw Extension, Including Stagnant Loop Conditions, from Pressurized Thermal Shock of Reactor Vessels on Westinghouse Nuclear Power Plants", numerous transient analyses including those of SBLOCA have been analyzed without RCP restart. The results of the stagnant loop evaluation demonstrate that the total expected frequency of significant flaw extension in a typical W PWR reactor vessel due to PTS, including the contributions from stagnant loop SBLOCA transients, does not exceed the NRC required RTPTS screening value of 270°Ffor axial flaws. Therefore, based on analyses results, RCP restart is not required to meet the NRC PTS risk goal for a typical W plant.

Therefore, an additional support condition, RCS subcooling, in addition to plant specific minimum support conditions is recommended to assure that no potential RCS inventory aggravation will occur due to RCP restart.

An analysis of the effect of an RCP restart has been made to ensure the safety of this action relative to vessel integrity. For conservatism in the analysis the assumption was made that a small preexisting flaw had grown and arrested at 75 percent of wall thickness before RCP start. Starting an RCP was shown not to result in any further flaw propagation and loss of vessel integrity. For a case where a flaw has not grown prior to RCP start, the subsequent heat-up of the downcomer region will decrease the possibility of flaw initiation.

Therefore, in order to mix the cold incoming SI water and the warm reactor coolant water and thereby decrease the likelihood of a PTS condition, an RCP restart is attempted. Whether an RCP is started or not, the next step performed (Step 24), if SI is still required, provides guidance on subsequent cooldown restrictions.

33. 007 A1.01 001

Given the following plant conditions:

- The plant is at 100% RTP.
- CVC-382, RCP Seal Return Line Relief, is leaking by its seat.
- PRT level currently at 77% and rising.

Which ONE(1) of the following completes the statements below?

The PRT high level alarm setpoint is __(1)__.

The basis for this setpoint is to minimize the possibility of __(2)__.

A. (1) 91%

(2) challenging the rupture discs following a 100% Load Rejection without a reactor trip

B. (1) 83%

(2) challenging the rupture discs following a 100% Load Rejection without a reactor trip

C. (1) 91%

(2) thermally shocking the pressurizer safeties and PORVs which could cause them to leak

D✓ (1) 83%

(2) thermally shocking the pressurizer safeties and PORVs which could cause them to leak

The correct answer is D.

A. Incorrect - 91% is the High PZR Level Reactor Trip setpoint. Candidate may think the higher level has reduced the PRTs ability to quench the steam if a Safety lifted. The safety valves are sized to handle the maximum surge rate resulting from a complete loss of load without reactor trip.

B. Incorrect - The first part of the distractor is correct. Candidate may think the higher level has reduced the PRTs ability to quench the steam if a Safety lifted. The safety valves are sized to handle the maximum surge rate resulting from a complete loss of load without reactor trip.

C. Incorrect - 91% is the High PZR Level Reactor Trip setpoint. The second part of the distractor is correct.

D. Correct

Question 33
Tier/Group 2/1
K/A Importance Rating - RO 2.9 SRO 3.1

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PRTS controls including: Maintaining quench tank water level within limits

Reference(s) - Sim/Plant design, OP-103, System Description, ITS Bases
Proposed References to be provided to applicants during examination - None
Learning Objective - PZR 004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 45.5
Comments -

4.0 PREREQUISITES

4.1 The N_2 Supply System is available to supply nitrogen to the PRT in accordance with OP-907.

4.2 The Primary Water System is available to supply makeup to the PRT in accordance with OP-915-1.

4.3 The Waste Gas System is available to receive off gas from the PRT in accordance with OP-702.

4.4 Instrument and Station Air is available to supply N_2, Primary Water and PRT valves in accordance with OP-905.

4.5 The Liquid Waste Disposal System is aligned to receive the Reactor Coolant Drain Pumps discharge in accordance with OP-701.

4.6 The Gas Analyzer is in service in accordance with OP-703.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 The Pressurizer Relief Tank temperature should be maintained less than or equal to 120°F.

5.2 A Nitrogen over pressure of 3 psig should be maintained in the PRT to prevent the formation of an explosive Hydrogen-Oxygen mixture.

5.3 If the PRT Hydrogen or Oxygen concentration exceeds 4% by volume, the PRT should be vented in accordance with OP-703.

5.4 When the Pressurizer temperature is greater than 200°F, the level in the PRT should not be allowed to exceed the high level alarm setpoint of 83% in order to minimize the possibility of thermal shocking the Pressurizer Safeties and PORVs, which could cause the Safeties and/or the PORVs to leak by or possibly inadvertently open. (SER 93-007)

5.5 This procedure has been screened in accordance with PLP-037 criteria and determined not applicable (N/A) to PLP-037.

6.0 SPECIAL TOOLS AND EQUIPMENT

N/A

7.0 ACCEPTANCE CRITERIA

N/A

necessary range of protection afforded by the OTΔT. This trip occurs when 2 out of 3 PZR Pressure Signals decreases below the trip setpoint. This trip is automatically blocked below 10% (P-7).

This trip is dynamically compensated based on the rate of change in pressure.

b. Setpoint - PC-455C, PC-456C, PC-457C
PM-455A, PM-456A, PM-457A

Trip Setpoint	1844 psig
Lead Time Constant	10 sec.
Lag Time Constant	1 sec.

4.1.5.13 High Pressurizer (PZR) Water Level Trip (Figure 31)

Distractor

a. The High PZR Water Level Trip provides a back-up to the High PZR Pressure Trip and prevents the PZR Safety and Relief Valves from relieving water for credible accident conditions. This trip occurs when 2 out of 3 PZR Water Level Signals exceeds the trip setpoint. This trip is automatically blocked below 10% (P-7).

b. Setpoint - LC-459A, LC-460A, LC-461A/91% of span

4.1.5.14 Steam/Feedwater Flow Mismatch Trip (Figure 32)

a. The Steam/Feedwater Flow Mismatch Trip provides protection for the Reactor against an anticipated Loss of Heat Sink. This trip occurs when 1 out of 2 flow elements sense that Feedwater Flow is < Steam Flow and 1 out of 2 Steam Generator(S/G) Level Elements decrease below the setpoint in any S/G.

b. Setpoint - FC-478A, FC-478B/0.64 x 10^6 lbs/Hr
FC-488A, FC-488B/0.64 x 10^6 lbs/Hr
FC-498A, FC-498B/0.64 x 10^6 lbs/Hr
AND
LC-474B, LC-475B/30% of Span
LC-484B, LC-485B/30% of Span
LC-494B, LC-495B/30% of Span

4.1.5.15 S/G Low-Low Water Level Trip (Figure 33)

a. The S/G Low-Low Water Level Trip provides protection for the Reactor by preventing operation without adequate heat removal capability in the event of a sustained Steam/Feedwater Flow mismatch which is sufficiently small not to be sensed by the Steam/Feedwater Flow Mismatch Trip. This trip occurs when 2 out

34. 007 K3.01 001

Given the following plant conditions:

- The plant had been operating at 100% RTP when a Reactor Trip and Safety Injection occurred.

- The following annunciators were noted as being in alarm:
  - APP-003-B3, PRT HI TEMP
  - APP-003-D3, PRT HI/LO LEVEL
  - APP-003-C3, PRT HI PRESS, alarmed and cleared

- While performing PATH-1 actions the following indications were observed:
  - R-2, CV Low Range Monitor - Rising
  - CV Sump Level - Rising
  - CV Pressure - Rising

Which ONE(1) of the following identifies the cause of the indications given, assuming NO operator actions?

A. SI-857B, Loop "B" Cold Leg Inj Relief to PRT, failed open

B. Reactor Vessel Head inner o-ring fails

C.✓ PZR Safety Valve failed open

D. "A" RCP #2 seal failure

The correct answer is C.

A. Incorrect - This failure would give you the APP-003-D3, PRT HI/LO LEVEL, alarm only. If the rupture disc did rupture then the CV Sump Level would also rise.

B. Incorrect - This failure would give you the CV indications if the outer o-ring had also failed. Would not give you the PRT indications. The inner o-ring leakage goes to the RCDT.

C. Correct - The failed open safety valve resulted in the PRT Rupture disc limit being exceeded giving you the indications above.

D. Incorrect - A failure of #2 seal would give you indications of a rising level in the RCDT, but not the PRT.

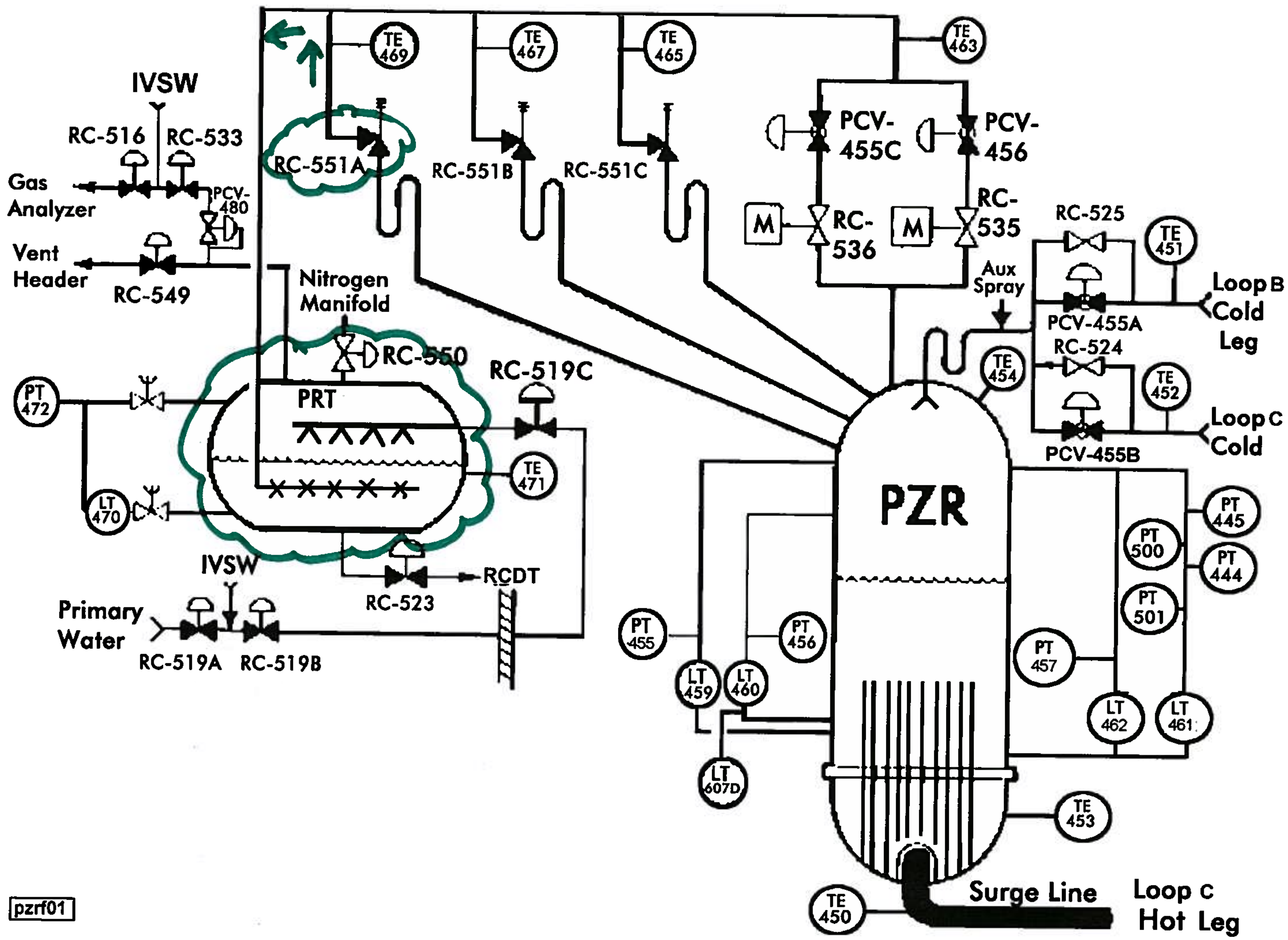
Question 34
Tier/Group 2/1
K/A Importance Rating - RO 3.3 SRO 3.6

Knowledge of the effect that a loss or malfunction of the PRTS will have on the following: Containment

Reference(s) - Sim/Plant design, APP-003-D3, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - PZR 007
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.6
Comments -

SYSTEM SIMPLIFIED DIAGRAM

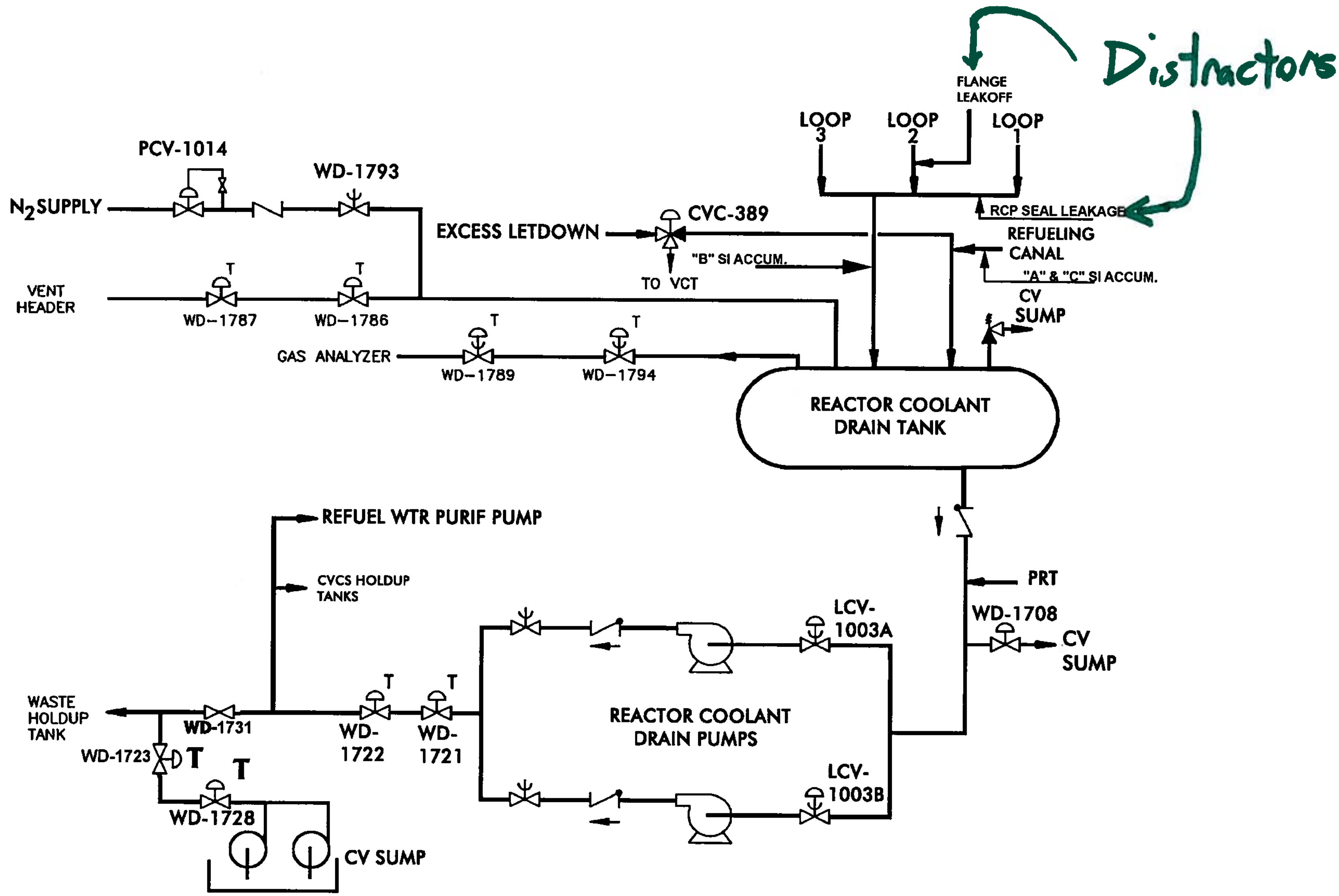
PZR-FIGURE-1



INFORMATION USE ONLY

RCDT LOADS

WD-FIGURE-2



WDF02

INFORMATION ONLY

During operation, gas samples are drawn periodically from tanks discharging to the waste gas vent header as well as from the particular WGDT being filled at the time, and automatically analyzed to determine their H_2 and oxygen (O_2) content. The H_2 concentration will vary considerably from tank to tank. There should be no significant O_2 content in any of the tanks. An alarm will warn the operator if any sample shows 3% by volume of O_2. This allows time to take the required action before the combustible limit is reached. Another tank is placed in service while the operator locates and eliminates the source of O_2.

Radioactive depleted resins are sluiced from their respective ion exchange vessels into the SRST for temporary storage. To dispose of the resins, the system is lined up from the SRST to the spent resin fill connection in the shipping bay of the Radwaste Building. A flexible hose is connected to this fill connection at one end and the other is placed into a high integrity container (HIC) which is located in a shielded bunker. The SRST is then pressurized with low pressure N_2 and the resins are forced up to the drumming room and down to the Radwaste Building shipping bay, via installed piping, and down through the flexible hose into the HIC. Once full, the HIC can be transported overland to a non-company facility for ultimate disposal.

A compactor is available for compacting solid radioactive trash into drums which can be shipped out for off-site disposal at non-company facilities. This equipment is not currently used.

3.0 COMPONENT DESCRIPTION

3.1 Reactor Coolant Drain Tank (RCDT)

Supplier	Westinghouse
Number	1
Volume	350 gallons
Design pressure, internal	25 psig
Design pressure, external	60 psig
Design temperature, internal	267°F
Design temperature, external	120°F
Normal operating pressure range	0.5 - 2.0 psig
Normal operating temperature range	80 - 200°F
Material of construction	Austenitic SS

The RCDT is an enclosed stainless steel tank mounted on the first floor in the CV. Although this tank is part of the WDS, its sources of water are reusable sources which can be processed for boric acid reclamation. Sources of water which drain to the RCDT are:

- Reactor coolant loop drains
- PRT
- RCPs, No. 2 seal leak-off from standpipes
- Excess letdown
- Reactor vessel flange leak-off detection
- Safety Injection (SI) accumulator drains

Distractors

ALARM

PRT HI/LO LVL *** WILL REFLASH ***

AUTOMATIC ACTIONS

1. Not Applicable

CAUSE

High

1. Excessive makeup water added
2. In leakage from Makeup Water, Pressurizer Relief Valves, Pressurizer Safety Valves, RHR Loop Relief Valves, Letdown Relief Valves, Seal Water Return Relief Valve, SI Test Line Relief Valve, or SI Cold Leg Injection Header Relief Valve
3. Opening of Pressurizer Safety or PORV

Low

1. Leakage from PRT to the Reactor Coolant Drain Tank or other area.
2. Excessive draining.

OBSERVATIONS

1. PRT Level (LI-470), Pressure (PI-472), and Temperature (TI-471)
2. Pressurizer Safety Valve Line Temperatures (TI-465, TI-467, TI-469)
3. PORV Discharge Line Temperature (TI-463)

ACTIONS

		CK (✓)
1.	**IF** a PZR PORV or Safety fails open while greater than 350°F, **THEN REFER TO** PATH-1 or EOP-E-0, Reactor Trip or Safety Injection.	____
2.	**IF** level is high, **THEN DRAIN** the PRT using OP-103.	____
3.	**IF** level is low, **THEN ADD** Primary Water to the PRT using OP-103.	____

DEVICE/SETPOINTS

1. LC-470 / 83%
2. LC-470 / 68%

POSSIBLE PLANT EFFECTS

1. None Applicable

REFERENCES

1. PATH-1, EOP Network
2. EOP-E-0, Reactor Trip or Safety Injection
3. OP-103, Pressurizer Relief Tank Control System
4. CWD B-190628, Sheet 461, Cable M, N

35. 008 G2.4.50 001

Given the following plant conditions:

- Unit operating at 100% RTP.
- OST-155, Safety Injection System Integrity Test, is in progress with SI Pump C operating.
- APP-002-E5, SI PMP COOL WTR LO FLOW, is received.

Which ONE(1) of the following completes the statements below IAW APP-002-E5?

The SI Pump Cooling Water Low Flow alarm setpoint is __(1)__ GPM.

The Reactor Operator will __(2)__ .

A. (1) 100

(2) continue to operate the SI Pump provided the 30 minute recirculation time is NOT exceeded

B. (1) 50

(2) continue to operate the SI Pump provided the 30 minute recirculation time is NOT exceeded

C. (1) 100

(2) stop SI Pump C immediately

D✓ (1) 50

(2) stop SI Pump C immediately

Answer is D

A. Incorrect - APP-002-E5 states "If SI Pumps are operating under non-emergency conditions OR long term recirculation, THEN STOP the pumps." OST-155 is a system integrity test that is performed annually and is limited to 30 minute run time due to the pumps being on recirc. The setpoint for FIC-658, CCW SI Pump Flow Indicator, is 50 GPM and the 100 GPM is the setpoint for the RCP thermal barrier high flow. Also, 100 gpm is the low flow setpoint for CCW to CRDM LO FLOW.

B. Incorrect - See discussion in A above.

C. Incorrect - The setpoint for FIC-658 , CCW SI Pump Flow Indicator, is 50 GPM and the 100 GPM is the setpoint for the RCP thermal barrier high flow. Also, 100 gpm is the low flow setpoint for CCW to CRDM LO FLOW.

D. Correct

Question 35
Tier/Group 2/1
K/A Importance Rating - RO 4.2 SRO 4.0

Component Cooling Water System (CCWS): Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.

Reference(s) - Sim/Plant design, APP-002-E5, System Description, APP-001, OST-155
Proposed References to be provided to applicants during examination - None
Learning Objective - SI SD-002-009
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.10 / 43.5 / 45.3
Comments -

ALARM

SI PMP COOL WTR LO FLOW

AUTOMATIC ACTIONS

1. None Applicable

CAUSE

1. Misaligned valve or leak in lines supplying CCW to or from the SI Pumps.

OBSERVATIONS

1. None applicable (see actions)

ACTIONS — CK (✓)

1. **IF** long term post accident recirculation is **NOT** in progress, **THEN DISPATCH** personnel to check CCW flow to the SI Pump Seal Coolers, FIC-658. ______
2. **IF** SI Pumps are operating under non-emergency conditions **OR** long term recirculation, **THEN STOP** the pumps. ______
3. **IF** a loss of CCW has occurred, **THEN REFER TO** AOP-014.
4. **IF** valve alignment is **NOT** correct, **THEN VERIFY** correct valve alignment using OP-306. ______
5. **IF** a CCW leak is present, **THEN ISOLATE** the leak. ______

DEVICE/SETPOINTS

1. FIC-658 < 50 gpm

POSSIBLE PLANT EFFECTS

1. Loss of SI Pump Seals. (If in recirculation mode)
2. Possible entry into TECH SPECS LCO

REFERENCES

1. AOP-014, Component Cooling Water System Malfunction
2. ITS LCO 3.5.2, 3.5.3
3. Flow Drawing, 5379-376, Sh 4
4. CWD B-190628, 488G
5. OP-306, Component Cooling Water System

ALARM

CCW TO CRDM LO FLOW

AUTOMATIC ACTIONS

1. None Applicable

CAUSE

1. Loss of Component Cooling Water
2. Phase B Containment Isolation Signal
3. Local isolation of Cooling Water to or from Coolers
4. Break in CCW Line to/from CRDM fan coolers

OBSERVATIONS

1. Position of CC-716A, CC-716B and CC-730
2. Component Cooling Water Flow (FI-613)
3. Annunciator APP-001-B1, RCP BRG COOL WTR LO FLOW
4. Component Cooling Water Surge Tank Level (LI-614B)

ACTIONS — CK (✓)

1. **IF** a loss of CCW has occurred, **THEN REFER TO** AOP-014. ____
2. **IF** alarm is due to intentional operator action, **THEN** no further action required. ____
3. **MINIMIZE** Control Rod Movement until trouble is corrected. ____
4. **IF** a Phase B Isolation has occurred, **THEN REFER TO** EOP Network. ____

DEVICE/SETPOINTS

1. FIC-678 / 100 gpm Distractor

POSSIBLE PLANT EFFECTS

1. None (for only loss of CRDM cooling water)

REFERENCES

1. ITS LCO 3.7.6
2. AOP-014, Component Cooling Water System Malfunction
3. EOP Network
4. CWD B-190628, Sheet 516, Cable H

ALARM

RCP THERM BAR COOL WTR HI FLOW

AUTOMATIC ACTIONS

1. FCV-626, THERM BAR FLOW CONT, closes

CAUSE

1. RCP Thermal Barrier failure
2. RCP Number 1 Seal Failure
3. CCW Pump Starting on depressurized system

OBSERVATIONS

1. Radiation Monitoring System, R-17
2. Labyrinth Seal ΔP (PI-125A, PI-128A, PI-131A)
3. RCP Seal Leakoff Temperatures **AND** flows (FR-154, RCP Temperature Recorder, and Computer)
4. RCP Number 1 Seal ΔP (PI-154A, PI-155A, PI-156A)
5. FCV-626 position

NOTE: High Seal Leakoff temperature and flow will be present with the alarm on a Number 1 Seal failure.

Radiation Monitor R-17 will alarm or trend up on a Thermal Barrier failure.

An OMM-007 EIR is required for a failed flow instrument.

ACTIONS — CK (✓)

NOTE: If more than 15 minutes elapses without RCP Seal Cooling, then Seal Cooling must be isolated before starting CCW OR Charging to prevent Seal damage.

1. **IF** CCW AND Seal Injection are lost to any RCP, **THEN REFER TO** AOP-018. ____
2. **IF** result of CCW Pump start only, **THEN REOPEN** FCV-626. ____
3. **IF** a failure of an RCP Thermal Barrier has occurred, **THEN REFER TO** AOP-014. ____
4. **IF** a RCP Number 1 Seal failure has occurred, **THEN REFER TO** AOP-018. ____

DEVICE/SETPOINTS

1. FIC-626 / 100 gpm

Distractor

POSSIBLE PLANT EFFECTS

1. Loss of RCS inventory.

REFERENCES

1. ITS LCO 3.4.4, LCO 3.4.5, LCO 3.4.6 and LCO 3.4.13
2. AOP-014, Component Cooling Water System Malfunction
3. AOP-018, Reactor Coolant Pump Abnormal Conditions
4. OMM-007, Equipment Inoperable Record
5. CWD B-190628, Sheet 234, Cable J

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Each Safety Injection Pump run shall **NOT** exceed 30 minutes while on mini-flow recirculation. Distractor

5.2 If any of the following are observed when an SI Pump is started, the SI Pump could be damaged and should be stopped immediately:

- Any unusual noise heard from the pump
- SI Pump discharge pressure indicates the pump may be cavitating by large pressure swings
- Recirculation line or pump casing becomes **HOT** to touch

5.3 The performance of this OST shall be coordinated with other plant evolutions such that the minimum equipment operability requirements of the Technical Specifications are met.

5.4 To comply with the requirements of ITS LCO 3.5.2 and LCO 3.5.3, SI-868A, SI-868B, **AND** SI-868C **SHALL NOT** be closed with the plant in Modes 1, 2, 3, or 4.

5.5 Opening any of the test line/leakoff line isolation valves (SI-895U, SI-895T, SI-883W, and SI-883L) will place the plant in a REQUIRED ACTION STATEMENT in accordance with ITS LCO 3.5.2 with the plant in Modes 1, 2, **OR** 3 for failure to meet the requirements of SR 3.5.2.2.

5.6 Opening SI-895T, SI-883W, or SI-883L will place the plant in a REQUIRED ACTION STATEMENT in accordance with ITS LCO 3.6.3.C in Modes 1, 2, 3, and 4. (The Safety Injection system is a closed system outside Containment.)

5.7 Opening SI-883W or SI-883L will place the plant in a REQUIRED ACTION STATEMENT in accordance with ITS LCO 3.6.8 in Modes 1, 2, 3, and 4 for failure to maintain valve alignment tested to meet the requirements of SR 3.6.8.6.

5.8 When testing with RCS greater than or equal to 1700 psig, the BIT header should be pressurized prior to opening valves SI-895T, SI-883W, or SI-883L to prevent SI header pressure fluctuations from upsetting the SI Accumulator check valves. (CR 97-01957)

INIT

8.2 Safety Injection Pump "A"

NOTE: The drain line downstream of SI-888T, SI PUMP "A" DRAIN, goes to a covered drain requiring breaking the line to check for leakage through the drain valves. (NCR 24074)

8.2.1 **DISCONNECT** drain line downstream of SI-888T, SI PUMP "A" DRAIN. ____ MM

8.2.2 **VERIFY** breaker 52/21C for SI Pump "A" is **RACKED IN**. ____

CAUTION

Each pump run shall **NOT** exceed 30 minutes while on mini-flow recirculation.

Distractor

If any unusual noise is heard from the pump, SI Pump discharge pressure indicates the pump may be cavitating by large pressure swings **OR** the recirculation line or pump casing becomes **HOT** to touch, the SI Pump could be damaged and should be stopped immediately.

8.2.3 **START** SI PUMP "A" **AND RECORD** the time.

Time STARTED ________ ____

8.2.4 **CHECK** SI PUMP "A" discharge pressure is normal **AND** the recirculation line and pump casing are **NOT** HOT to the touch. ____

8.2.5 **IF** SI Pump discharge pressure indicates cavitation is occurring **OR** the recirculation line **OR** pump casing becomes HOT to the touch, **THEN STOP** SI PUMP "A" **AND DECLARE** SI PUMP "A" inoperable. ____

36. 010 K1.03 001

Given the following plant conditions:

- The plant is in Mode 1 at 100% RTP
- The Pressurizer Pressure Controller, PC-444J, is in AUTOMATIC

Which ONE (1) of the following identifies how RCS pressure and PC-444J Controller output will respond if the controller potentiometer setpoint is lowered from 6.7 to 6.4 ?

	RCS Pressure	**Controller Output (Demand)**
A.	Rise	Rise
B.	Rise	Lower
C.✓	Lower	Rise
D.	Lower	Lower

The correct answer is C.

A. Incorrect - Lowering the setpoint will cause the controller to maintain pressure in a lower pressure band. Therefore pressure will lower. RNP does have controllers that are reverse acting such as the S/G PORV controllers. The second part of the distractor is correct for the given conditions.

B. Incorrect - Lowering the setpoint will cause the controller to maintain pressure in a lower pressure band. Therefore pressure will lower. RNP does have controllers that are reverse acting such as the S/G PORV controllers. The second part of the distractor is correct for a rise in RCS pressure.

C. Correct.

D. Incorrect - The first part of the distractor is correct. PC-444J output signal rises to lower the pressure to the new setpoint.

Question 36
Tier/Group 2/1
K/A Importance Rating - RO 3.6 SRO 3.7

Knowledge of the physical connections and/or cause-effect relationships between the PZR PCS and the following systems: RCS

Reference(s) - Sim/Plant design, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - PZR 007
Question Source - BANK (Not used on NRC Exam from 2004 to Present.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.2 to 41.9 / 45.7 to 45.8
Comments -

5.1.1 PZR Pressure Control (PZR-Figure 6 & PZR-Figure 7)

Pressure control is accomplished via pressure controller PC-444A which is a Proportional + Integral controller; the Derivative section has been defeated. This means the controller develops an output signal that is determined by how far pressure is from setpoint (Proportional) and how long the pressure has been away from setpoint (Integral).

PT-444 sends a pressure signal to PC-444A which is compared to the pressure setpoint developed by PC-444J which is controlled on the RTGB. PC-444J is a Hagan Manual-Auto station with a 10 turn pot capable of developing a control setpoint over the entire pressure range of PT-444. PT-444 ranges from 2500 to 1700 psig therefore PC-444J is capable of 800 psi range of control. For Example if the operator desires the controller to maintain normal pressure of 2235 psig the pot setting would be determined as follows:

$$\frac{2235 - 1700}{800} * 10 = 6.69 \text{ on the 10 turn pot.}$$

The output of PC-444J (setpoint signal) is sent to PC-444A to be compared to the actual pressure. PC-444A has a gain of 2 which effectively cuts in half the range of control of PZR pressure to 400 psi around the setpoint determined by PC-444J. The controller output is then directed to the proportional heaters, spray valves via controllers PC-444C and PC-444D, backup heaters, PZR PORV 456 and PI-458 and is displayed on the meter on PC-444J

The components operated by PC-444A operate at a fixed deviation from setpoint or controller output as observed on the meter on PC-444J, no matter what setpoint is dialed in on PC-444J. For example the backup heaters are set to turn on 25 psi below set pressure. If set pressure is 2235 psig, their setpoint would be 2210 psig and the control output when they came on would be as follows:

$$\frac{2210\text{-}2035}{400} = .4375 \text{ or } 43.75\% \text{ demand}$$

If the pot on PC-444J were then set at 6.25 this would give a set pressure of 2200 psig. When the output of PC-444A was at 43.75% the backup heaters would come on, pressure would be 2175 psig; 25 psi below set pressure. The setpoints normally listed for heater, spray, and PCV-456 setpoints are based on a set pressure of 2235 psig where PC-444J is normally set.

As stated before, PC-444A is a Proportional + Integral controller, therefore controller output may not correspond exactly to the pressure monitored by the operator. If pressure is away from setpoint for an extended period of time the controller output may saturate while increasing its output trying to return pressure to setpoint.

after reaching 450°F. Refer to Normal Operation.

4.2 Power Operated Relief Valve Controls

The controls for the S/G PORVs are located in the Secondary Control Panel on the mezzanine level of the turbine building, with the exception of the automatic setpoint adjustment potentiometer, which is located on the RTGB. Their normal setpoint at power is 1035 psig, which is 30 psi above the pressure corresponding to the no load Tavg of 547°F. The setpoint can be changed by adjusting the potentiometer on the RTGB. This 10 turn potentiometer controls over a 0 - 1500 psig range, with a setting of 10.0 corresponding to 0 psig. This controller is reverse acting. Instead of the potentiometer increasing setpoint with increased value, raising the setting decreases the setpoint at which the pressure will be controlled. When actual pressure increases to the setpoint, the PORV throttles open to relieve pressure.

Distractor Justification

The controllers for each S/G PORV (PIC-477, PIC-487 and PIC-497), are adjusted at the secondary control panel. These controllers are pneumatic (with no electronics) and sense S/G pressure directly off the main steam lines upstream of the MSIVs. The directions for adjusting these controllers, which requires coordination between the Outside Auxiliary Operator and the Control Room, are contained in GP-002 and GP-003.

The PORVs can only be controlled by the steam dump controller if the system is selected to Tavg mode, and then, only if a turbine trip has not occurred.

4.2.1 Switches

There are three DEFEAT switches located at the Secondary Control Panel to allow manual control of the S/G PORVs from the Secondary Control Panel. After placing each switch in the DEFEAT position, the S/G PORV is controlled by selecting MANUAL on the transfer switch located inside the controller box and using the manual thumbwheel on the pressure controller. When in the DEFEAT position, automatic control from the RTGB is removed, as is the ability to place the S/G PORV under steam dump control in the event of a 50% load rejection without a turbine trip. Annunciators on APP-036 indicate remote indication of this action. Local manual operation of the PORVs is directed by EOPs and DSPs.

4.2.2 PORV Control Power Supplies

Each RTGB mounted PORV controller is powered from a DC power supply located under RTGB. These DC power supplies are fed from instrument bus receptacles under the RTGB. The PORV solenoids, used to actuate the PORVs in the steam dump mode,

37. 010 K4.01 001
Which ONE(1) of the following completes the statement below?

A design feature of the Pressurizer maintains a small amount of flow in the spray lines in order to ....

A. maintain PZR spray nozzle full of subcooled water.

B. maintain a small differential across the spray valves.

C. maintain a constant firing rate to the Control Group heaters.

D✓ reduce thermal stresses in the spray piping and auxiliary spray connection.

The correct answer is D.

A. Incorrect - The small amount of flow will not maintain the spray nozzle full of water. The small amount of water flow will eliminate the potential of thermal stresses if no water flow was present.

B. Incorrect - Although this flow does minimize the D/P across the spray valves this is not the reason for maintaining a continuous flow.

C. Incorrect- A constant flow to the pressurizer could "theoretically" be established to maintain a constant firing rate. This flow rate is not known nor attempted to be established.

D. Correct - Exert from PZR System Description: A small continuous spray flow is provided, by means of the throttle valves (needle valves) which bypass the spray valves, to help ensure that the PZR liquid is in chemical equilibrium with the rest of the reactor coolant system (RCS) **and to prevent thermal shock of the spray piping and the auxiliary spray connection.**

Question 37
Tier/Group 2/1
K/A Importance Rating - RO 2.7 SRO 2.9

Knowledge of PZR PCS design feature(s) and/or interlock(s) which provide for the following: Spray valve warm-up

Reference(s) - Sim/Plant design, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - PZR 004
Question Source - BANK (Not used on an NRC Exam from 2004 to present.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7
Comments -

The control bank and both backup groups are operated from the RTGB.

Power Supply:	Control Bank	- 480V BUS 2B
	Backup Group A	- 480V BUS 1
	Backup Group B	- 480V BUS 2A

The capability exists to power 150 kW of PZR heaters from Emergency Bus E1 and another 150 kW of heaters from emergency bus E2. This capability would be used during a loss of offsite power event to ensure proper RCS pressure control capability is maintained. The power supply must be manually transferred to the selected emergency bus following the loss of offsite power to ensure that the PZR temperature remains above the RCS temperature. Once the power supply is transferred, the heaters are controlled from the RTGB. If the PZR heaters are being powered from one of the emergency busses, they will automatically trip upon receipt of a Safety Injection Signal, to ensure the Emergency Diesel Generators are not overloaded by these non-safety related loads. This trip feature is enabled by the PZR Heater "Arm" switch in the E1/E2 room. PZR control group heaters can also be energized from the DS bus in the event of a loss of all AC power.

3.3 PZR Spray Lines

Spray nozzle press drop at max. flow	15.0 psi at 70°F
Continuous spray rate	1 gpm
Pipe Diameter	4 in.
Pipe Schedule	160
Design Pressure	2485 psig
Design Temperature	650°F

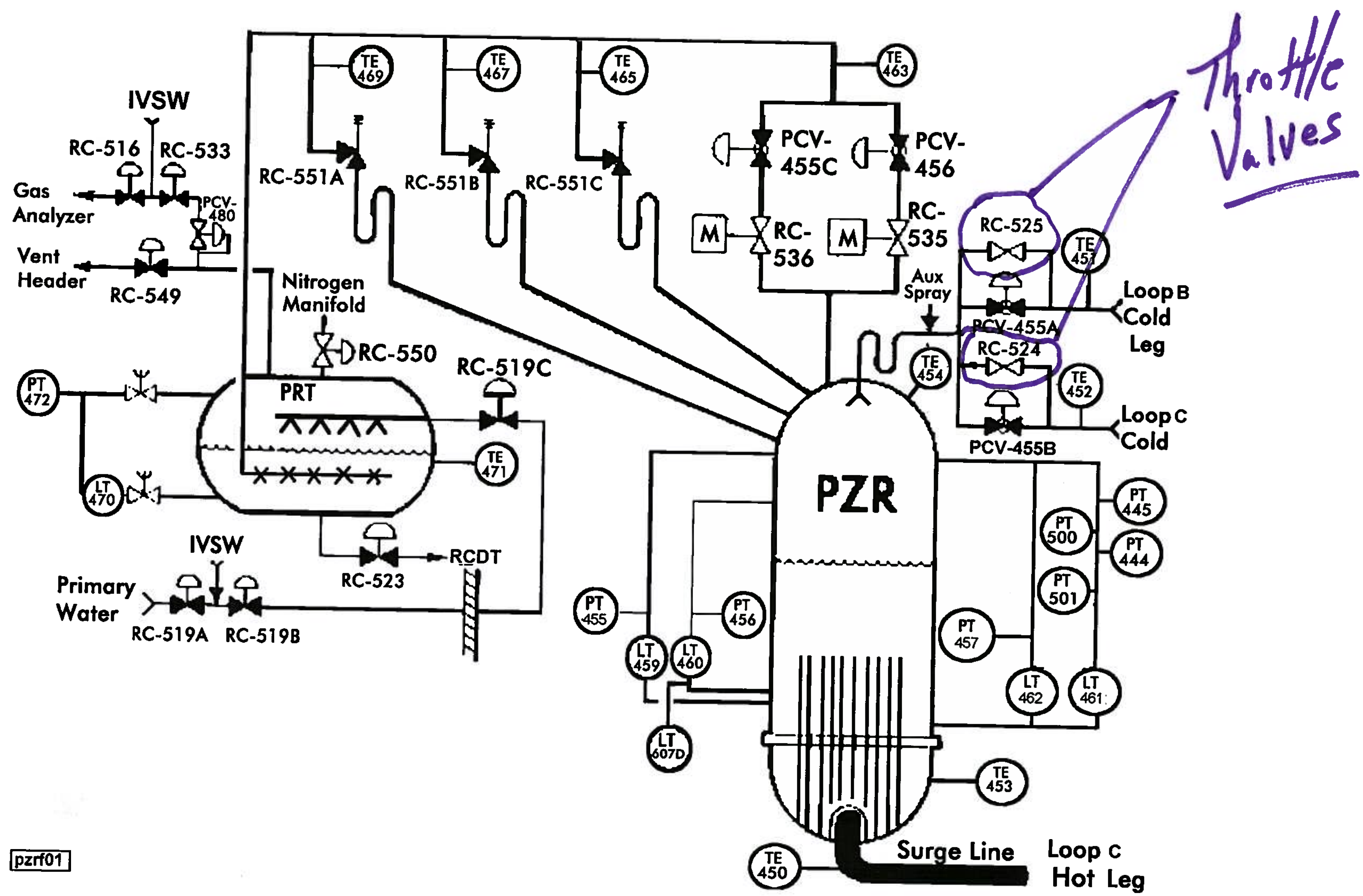
The PZR spray system is designed to pass a total flow of 600 gpm, 300 gpm per valve. The driving force of the spray water is a combination of the differential pressure between the hot and cold legs and the velocity head obtained by using a scoop in the reactor coolant piping.

The spray nozzle, which is also protected with a thermal sleeve, is connected to the head of the PZR. It is designed to produce a narrow angle cone spray pattern that prevents cold water impingement on the PZR walls.

The spray water is drawn from cold legs of loops B and C. The two lines tie together downstream of the control valves, form a loop seal, and supply water through a single spray nozzle. The loop seal is provided to prevent the backup of steam into the piping when the spray valves are closed. A small continuous spray flow is provided, by means of the throttle valves (needle valves) which bypass the spray valves, to help ensure that the PZR liquid is in chemical equilibrium with the rest of the reactor coolant system (RCS) and to prevent thermal shock of the spray piping and the auxiliary spray connection.

SYSTEM SIMPLIFIED DIAGRAM

PZR-FIGURE-1



INFORMATION USE ONLY

38. 012 A3.05 001

Given the following plant conditions:

- Unit at 20% RTP
- Power Range channel N-42 has been removed from service IAW OWP-011 to support drawer calibration.

Subsequently:

- Inverter B trips

What impact will the failure have on the Reactor Protection System?

A.✓ Reactor will trip from Power Range High Flux (HIGH) setpoint.

B. Reactor will trip from Power Range High Flux (LOW) setpoint.

C. Reactor will NOT trip due to power being > P-10 permissive.

D. Reactor will NOT trip due to N-42 being bypassed.

Answer is A

A. Correct

B. Incorrect - With N-42 being removed from service IAW OWP-011, the bistables for Overtemperature Delta T, Overpower Delta T and Power Range High Flux (HIGH) setpoint have been manually tripped. The bistable for Power Range High Flux (LOW) setpoint is NOT tripped due to power being above the P-10 permissive setpoint (10%). With the failure of Inverter B, Instrument Busses 3 and 8 will be de-energized and result in all of the bistables associated with Channel 3 tripping from the loss of power, thus the reactor will trip from the N-42 and N-43 high flux trip (HIGH) bistables being tripped.

C. Incorrect - Power being greater than the P-10 permissive does mean that the trip will not be caused by the Power Range High Flux (LOW) trip.

D. Incorrect - Although N-42 is bypassed the bistables for its associated trips are inserted when removing it from service. This changes the PRNI coincidence from 2 of 4 to 1 of 3.

Question 38
Tier/Group 2/1
K/A Importance Rating - RO 3.6 SRO 3.7

Ability to monitor automatic operation of the RPS, including: Single and multiple channel trip indicators

Reference(s) - Sim/Plant design, System Description, OWP-011
Proposed References to be provided to applicants during examination - None
Learning Objective - RPS 006
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.5
Comments -

LP 33 - Exit LP, transfer from LP 29 to 125Vdc MCC-A.

3.8.1.2 Photo Cell Actuation

LP 22 - Turbine Area Mezzanine Floor
LP 26, circuits 3 & 19 - Outside Control Room and Aux. Bldg. East stairwell
LP 34 - 230KV switchyard
LP 35 - Intake Structure
With each breaker in each LP labeled as to what lights it energizes or de-energizes, the breakers desired to be put in-service can be placed in the ON position and those breakers desired to be out of service placed in the OFF position.

3.9 Power Panels

These smaller electrical panels are located in various areas remote to their source of supply. These panels provide power to equipment located in the vicinity of the panel. An Electrical Distribution Procedure, EDP-007, describes their location, power supply, and the equipment that they provide power to.

3.10 Instrument Bus Equipment (See Figure 3)

The instrument power is provided from a reliable source to supply vital plant instrumentation during all plant conditions. The loads supplied by each IB can be found in the Electrical Distribution Procedure, EDP-008.

The instrument buses are normally fed from:
IB No. 1 from MCC-5
IB No. 2 from Inverter A
IB No. 3 from Inverter B
IB No. 4 from MCC-6
IB No. 6 from IB No. 1
IB No. 7 from IB No. 2
IB No. 8 from IB No. 3
IB No. 9 from IB No. 4

An alternate power supply from MCC-8 is provided for IBs 1 through 4 but only one IB should be supplied by MCC-8, to maintain train separation. The breakers that supply normal and alternate power are located in a cabinet below the IB Panel they supply. The breakers for normal & alternate power are mechanically interlocked so that both cannot be closed at the same time. These breakers are a break-before-make setup and should

When an Intermediate Range Channel is blocked or bypassed, the Rod Stop associated with that Intermediate Range is blocked.

b. Setpoint - NC-35F, NC-36F/Reactor Trip Current equivalent to 25% Full Power

Setpoint - NC-35E, NC-36E/Rod Stop Current equivalent to 20% Full Power

4.1.5.3 Power Range High Flux Trip - Low Setpoint (Figure 20)

a. The Power Range High Flux Trip - Low Setpoint provides protection for power excursions beginning from low power during a startup and trips the Reactor when 2 out of 4 Power Range Channels exceeds the Trip Setpoint. The trip may be manually blocked when 2 out of 4 Power Range Channels exceed 10% (P-10). The manual block is automatically removed when 3 out of 4 Power Range Channels are below 10% (P-10).

b. Setpoint - NC-41P, NC-42P, NC-43P, NC-44P/24% Reactor Power

4.1.5.4 Power Range High Flux Trip - High Setpoint (Figure 21)

a. The Power Range High Flux Trip – High trip function ensures that protection is provided, from all power levels, against a positive reactivity excursion leading to DNB during power operations. These can be caused by rod withdrawal or reduction in RCS temperature. The Power Range High Flux - High Setpoint trips the Reactor when 2 out of 4 Power Range Channels exceeds the Trip Setpoint. The trip cannot be blocked.

b. Setpoint - NC-41R, NC-42R, NC-43R, NC-44R/108% Reactor Power *

* May be set at lower values based on plant conditions.

4.1.5.5 Overtemperature ΔT Trip (OTΔT) (Figure 22)

a. The OTΔT Trip provides protection for the Reactor against Departures from Nucleate Boiling (DNB) and trips the Reactor when 2 out of 3 Reactor Coolant Loop ΔT's (T_h-T_c) exceeds the calculated ΔT Setpoint. The OTΔT Setpoint is not a fixed number. It is calculated continuously with inputs from Tavg, PZR Pressure, and Power Range Upper & Lower detector Current Signals f(ΔI). To help prevent this trip from occurring, when the OTΔT nears the Reactor Trip Setpoint:

- REACTOR TRIP BLOCK (<P-8)

  Provided by PR channels with a setpoint of <40% and a coincidence of 3/4 < setpoint. The permissive light on the RTGB will light when < setpoint. The permissive's function is to prevent a Rx trip from a loss of flow or RCP breaker open in a single loop or Turbine trip. The trip auto reinstates above setpoint when 2/4 PR channels are >40%.

- POWER ABOVE P-10

  Provided by PR channels with a setpoint of 10% and a coincidence of 2/4 > setpoint. Allows manual blocking of IR rod stop (20% setpoint), high flux reactor trip (low setpoint @ 24%), and IR reactor trip (25% current equivalent). Also will auto deenergize SR by removing detector high voltage.

  When P-10 is actuated it also provides an input into the permissive REACTOR TRIP BLOCK P-7. This will re-instate the "at power" trips, which had been blocked. These trips are: high pressurizer level, low reactor coolant flow, and low pressurizer pressure.

4.6.2 Refer to Attachment 10.1 for a complete listing of the NIS Instrument Setpoints.

4.6.3 Refer to Attachment 10.2 for a complete listing of the NIS Monitor Lights.

4.6.4 Refer to Attachment 10.3 for a complete listing of the NIS Status Lights

4.7 Power Supplies N-43

NIS Cabinets A, B, C, and D receive power from the Instrument Buses 1, 2, 3, and 4 respectively.
R.G. 1.97 Excore Neutron Flux Monitoring System Channel N-51 receives power through Kirk-Key lock transfer switches powered from Instrument Bus No. 1 and DSS 120Vac panel.

R.G. 1.97 Excore Neutron Flux Monitoring System Channel N-52 receives power from Instrument Bus No. 8.

4.8 Monitor Lights

4.8.1 SR

- SOURCE RANGE TRIP BLOCKED
- NIS TRIP BYPASS NI 31 (in bypass)
- NIS TRIP BYPASS NI 32 (in bypass)

39. 013 K2.01 001

Which ONE (1) of the following identifies the power supply to the ESFAS interposing relays?

	Train "A"	Train "B"
A.✓	IB-7A	IB-3
B.	IB-6	IB-9
C.	IB-2	IB-8
D.	IB-1	IB-4

The correct answer is A.

A. Correct.

B. Incorrect. Instrument Buses 6 and 9 are powered from MCC-5 and MCC-6, respectively. This would equate to a separation of trains similar to Instrument Buses 7A and 3 which are powered from MCC-A and MCC-B, respectively.

C. Incorrect. These selections are instrument busses that are supplied via MCC-A and MCC-B similar to the correct answers.

D. Incorrect. Instrument Buses 1 and 4 are powered from MCC-5 and MCC-6, respectively. This would equate to a separation of trains similar to Instrument Buses 7A and 3 which are powered from MCC-A and MCC-B, respectively.

Question 39
Tier/Group 2/1
K/A Importance Rating - RO 3.6 SRO 3.8

Knowledge of bus power supplies to the following: ESFAS/safeguards equipment control

Reference(s) - Sim/Plant design, System Description.
Proposed References to be provided to applicants during examination - None
Learning Objective - ESF 003
Question Source - BANK (Not used on an NRC Exam from 2004 to present.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7
Comments -

The RSPS receives redundant inputs that include process variables, nuclear measurements, and equipment operational status. These inputs are provided by the Nuclear Instrumentation System, Analog Process Instrumentation and Control System, the Electrical Power Distribution System, and the Turbine Control System. Inputs to the Reactor Trip System are developed by redundant coincidence logic within the Reactor Protection Relay Racks, while inputs to the ESFAS are developed via similar logic within the Safeguards Relay Racks. These inputs enable the Reactor Trip System and the ESFAS to perform their respective protective actions.

2.3 System Description

The ESFAS consists of two completely independent trains (A and B). The trains receive DC power from "A" and "B" station batteries respectively. AC power is supplied by station battery backed instrument buses. Instrument Bus 7A supplies Train "A" and Instrument Bus 3 supplies Train "B". Both trains have a complete set of matrices and both receive the same actuating signals. All of the circuits are redundant unless otherwise noted.

The bistables generating the input signals, with the exception of the Hi-Hi Containment Pressure bistables, are designed to actuate upon a loss of power.

3.0 COMPONENT DESCRIPTION

3.1 ESFAS Cabinets

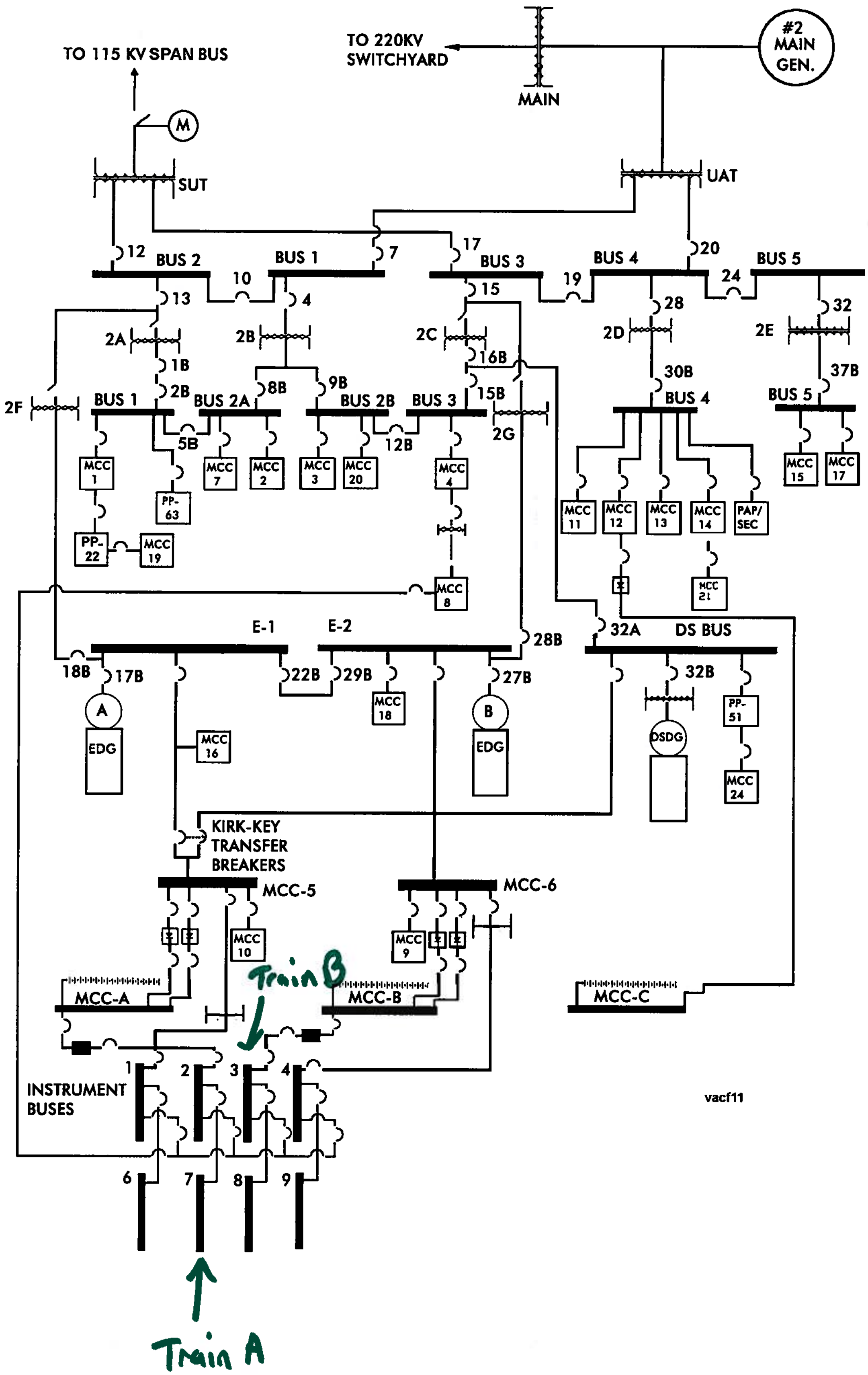
Two trains of ESFAS cabinets are provided. They operate completely independent from each other. Switches, pushbuttons and status lights are provided for periodic on-line testing of the ESFAS circuits.

The cabinets, located in the E-1 and E-2 room, are supplied power from independent 125 VDC supplies. The DC power for Train "A" is supplied from MCC "A"; Train "B" is supplied from MCC "B". MCC"A" and "B" are located in the A/B Battery Room. This DC power is used to actuate components.

Instrument Bus 7A supplies AC power to Train "A" while Instrument Bus 3 supplies AC power to Train "B". The independent 120VAC power from the Instrument buses supply the power for the interposing relays. The interposing relays, which are controlled by timer relays, control contacts in the control circuits for the components actuated by the Safeguard Sequencers. The interposing relays are auxiliary relays which were added as a result of a plant modification to correct a timer accuracy problem. The old relays' time accuracy tolerance was excessive. The new timer relays require the interposing relays for proper operation because the new timer relays are not sized for DC power interruption. There is one interposing relay for each timer relay. The interposing relays are located in

PLANT AC DISTRIBUTION

VAC-FIGURE-11



INFORMATION USE ONLY

40. 022 A3.01 001
A Large Break LOCA concurrent with a loss of the Startup Transformer has occurred.

- Train "A" Engineered Safeguards Sequencer did NOT automatically actuate.
- Both "A" and "B" CV Spray Pumps tripped.

Which ONE (1) of the following completes the statement below?

The **MINIMUM** action required to ensure containment pressure remains below its design limit is to verify __(1)__ automatically started **AND** manually start __(2)__ and ensure all associated cooling water outlet low flow alarms are clear.

A. (1) HVH-3 OR HVH-4

(2) HVH-1 OR HVH-2

B.✓ (1) HVH-3 AND HVH-4

(2) HVH-1 AND HVH-2

C. (1) HVH-1 OR HVH-2

(2) HVH-3 OR HVH-4

D. (1) HVH-1 AND HVH-2

(2) HVH-3 AND HVH-4

The correct answer is B.

A. Incorrect. With no CV Spray pumps operating, all four CV HVH units are required to maintain CV design pressure.

B. Correct.

C. Incorrect. Trains are swapped. With no CV Spray pumps operating, all four CV HVH units are required to maintain CV design pressure.

D. Incorrect. Trains are swapped. Train "B" components need to be verified running and Train "A" components must be manually started.

Question 40
Tier/Group 2/1
K/A Importance Rating - RO 4.1 SRO 4.3

Ability to monitor automatic operation of the CCS, including: Initiation of safeguards mode of operation

Reference(s) - Sim/Plant design, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - ESF 007
Question Source - BANK (Last used on 2004 NRC Exam. Question format modified.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.5
Comments -

and containment high radioactivity signals.

4. Control Rod Drive Mechanism Cooling (HVH-5A and HVH-5B)

During normal power operation, the system is continuously operating. During post-accident conditions, the system is inoperative. The system is operated by placing one of the fans in service when Reactor Coolant System temperature is above 350°F.

5. Reactor Support Cooling (HVE-6A and HVE-6B)

During normal power operation, the system is continuously operating. During post-accident conditions, the system is inoperative. The system is operated by placing one of the fans in service when RCS temperature is above 200°F. If BOTH fans are lost, for more than 72 hours, the plant shall be shutdown and cooled down to < 350°F.

6. Reactor Concrete Shield Cooling (HVH-9A and HVH-9B)

During normal power operation, the system is continuously operating. During post-accident conditions, the system is inoperative. The system is operated by placing one of the fans in service when Reactor Coolant System temperature is above 350°F. If BOTH fans are lost, the plant shall be shutdown and cooled down to < 350°F within 6 hours.

7. Containment Air Recirculation Cooling (HVH-1 through HVH-4)

The containment air recirculation coolers are normally in use during plant operation. These units are in the automatic sequence which actuates the ESF equipment upon receiving the necessary signals indicating an accident condition, e.g., a high containment pressure signal automatically actuates the SI safety feature sequence which starts any stopped fan cooler unit.

Any of the following combinations of equipment will provide sufficient heat removal capability to maintain the post-accident containment pressure below the design value:

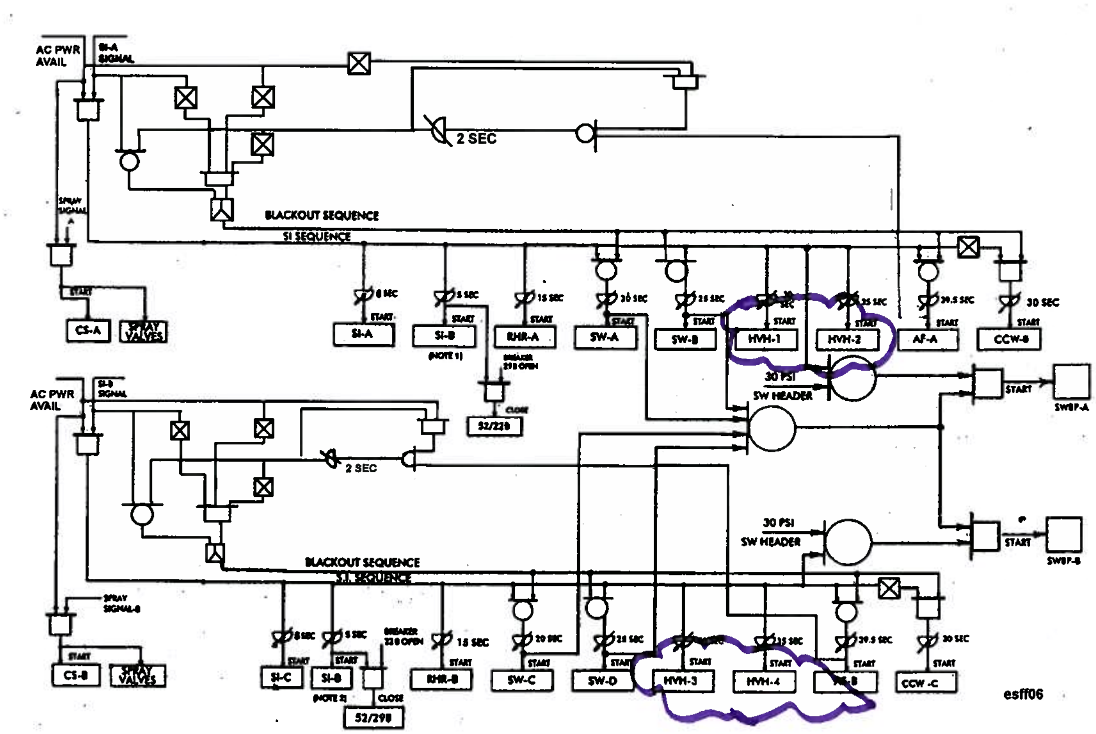
- All four containment cooling units
- Two of the four containment cooling units and one containment spray pump
- Two containment spray pumps and no containment cooling units

The Containment Air Recirculation Cooling system is dependent on the operation of the Electrical and Service Water systems. Cooling water to the coils is supplied from the Service Water system. Four service water pumps and two service water booster pumps are provided, only two and one of which respectively are required to operate during the post-accident period.

Flow switches in the system, operating both normally and post-accident, indicate whether air is circulating in accordance with the design arrangement. Low flow alarms are provided in the control room.

LOGIC DIAGRAM - SAFEGUARDS SEQUENCING LOGIC

ESF-FIGURE-6



INFORMATION USE ONLY

There are several different functions provided by this actuation.

1. Safety Injection - This lines up the Emergency Core Cooling System (ECCS) for the injection phase by operating the following valves:

HIGH HEAD SAFETY INJECTION

VALVE	TRAIN	SAFEGUARD POSITION
* SI-867A	A	Open
* SI-867B	B	Open
SI-870A	A	Open
SI-870B	B	Open

SAFETY INJECTION ACCUMULATORS

VALVE	TRAIN	SAFEGUARD POSITION
*SI-865A	A	Open
*SI-865B	B	Open
*SI-865C	A	Open

NOTE: * These valves should already be open, but do receive an open signal.

LOW HEAD SAFETY INJECTION

RHR-744A	A	Open
RHR-744B	B	Open

The Status Light Panels on the RTGB will indicate at a glance if all the safeguard valves are in their proper position. Lights will be pink when in the proper position.

2. Starting of safeguard pumps and containment recirculation units. This equipment is timed onto their emergency busses to prevent overloading the diesel generator and the emergency bus. If equipment was already running, it will continue.

"A" - TRAIN

- 5 Seconds - "A" SI Pump starts.
- 5 Seconds - "B" SI Pump starts if Breaker 52/22B is racked in.
- 15 Seconds - "A" RHR Pump starts.
- 20 Seconds - "A" Service Water Pump starts and a start signal is supplied

to both Service Water Booster Pumps.

- 25 Seconds - "B" Service Water Pump starts and a start signal is supplied to both Service Water Booster Pumps.
- 30 Seconds - No. 1 HVH Unit starts.
- 35 Seconds - No. 2 HVH Unit starts.
- 39.5 Seconds - "A" Auxiliary Feed Pump starts, FCV-1424 modulation is enabled, V2-16A/B/C open, and SGBD isolation valves for all SG's close.

"B" - TRAIN

- 5 Seconds - "C" SI Pump starts.
- 5 Seconds - "B" SI Pump starts if Breaker 52/29B is racked in.
- 15 Seconds - "B" RHR Pump starts.
- 20 Seconds - "C" Service Water Pump starts and a start signal is supplied to both Service Water Booster Pumps.
- 25 Seconds - "D" Service Water Pump starts and a start signal is supplied to both Service Water Booster Pumps.
- 30 Seconds - No. 3 HVH Unit starts.
- 35 Seconds - No. 4 HVH Unit starts.
- 39.5 Seconds - "B" Auxiliary feed pump starts, FCV-1425 modulation is enabled, V2-16A/B/C open, and SGBD isolation valves for all SG's close.

During SI sequencing, WCCU-1A and 1B are inhibited and are not available until 10 seconds after the AFW Pumps receive their start signal. This ensures the AFW Pumps are at their normal running current before the inhibit is removed.

These actions have completed the requirements for injection from high head and low head Safety Injection and have ensured a path is available from the accumulators. Injection will now commence dependent upon Reactor Coolant System pressure. "B" SI Pump is designated as a maintenance pump and will only be used in the event either "A" or "C" SI Pump is declared out of service.

Operation of the Service Water Booster Pumps and the Containment air recirculation units are now cooling and depressurizing the CV if the accident was a loss-of-coolant or steam line break inside containment.

The operation of the Auxiliary Feed System ensures the availability of the steam generators for decay heat removal.

6.1.5 Phase A CV Isolation and Isolation Valve Seal Water System Actuation

Containment isolation valves in non-essential process lines are shut to minimize the leakage from containment. To ensure that the valve seats do not allow leakage from

41. 022 A4.05 001

Given the following plant conditions:

- It is July 31 and the plant is at 100% RTP.
- Containment temperatures have been slowly approaching the ITS limit.
- ERFIS has just failed.

Which ONE(1) of the following identifies the **correct order of preference** for obtaining the **"official"** Containment Temperature IAW PLP-118, Hot Weather Operations?

1. RTGB Edge meter
2. Make a containment entry to obtain temperature readings.
3. Perform SPP-035, Containment Bulk Average Temperature Measurement

A. 1, 2, 3

B. 1, 3, 2

C. 2, 1, 3

D.✓ 3, 1, 2

The correct answer is D.

A. Incorrect - RNP has very limited containment temperature instrumentation. These temperature instruments are located in the RCP Pump Bays and on the CV Operating Deck. These do not provide a representative indication of the Bulk CV Temperature. SPP-035 uses temperature resistance readings from the five CV temperature probes and processes the information through MathCad program to compute a Bulk Weighted CV Temperature.

B. Incorrect - See discussion in "A"

C. Incorrect - See discussion in "A". A containment entry to obtain temperatures would be a last resort based on personnel safety implications.

D. Correct.

Question 41
Tier/Group 2/1
K/A Importance Rating - RO 3.8 SRO 3.8

Ability to manually operate and/or monitor in the control room: Containment readings of temperature, pressure, and humidity system

Reference(s) - Sim/Plant design, PLP-118, SPP-035
Proposed References to be provided to applicants during examination - None
Learning Objective - CVHVAC 007
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7 / 45.5 to 45.8
Comments -

8.1.5 The following is applicable to Containment temperature:

NOTE:	The Containment average air temperature on ERFIS (CVT0001) uses the volumetric weighted average developed by Engineering (RNP-M/HVAC-1061). This value should be used as the "official" temperature. If ERFIS is out of service and ITS SR 3.6.5.1 frequency will be exceeded, then containment temperature should be obtained in the following order of preference and used as the "official" temperature: - Perform SPP-035 - Use the RTGB meter - Make a containment entry to obtain temperature readings

1. **IF** containment temperature exceeds 115 degrees, **THEN EVALUATE** the need to initiate the installation of supplemental cooling for HVH-1, 2, 3, & 4 per SPP-038.

NOTE:	The following action places Deep Well Pump A in an unavailable status, so due consideration of plant risk is necessary.

2. **IF** containment temperature is greater than or equal to 118.5°F, **THEN COORDINATE** with maintenance and OSU to begin deepwell water injection into the HVH Service Water IAW SPP-038.

NOTE:	A release permit for a containment purge should be ready to be issued in the event containment temperature exceeds 120°F and is **NOT** expected to decrease below 120°F in the next 8 hours.

3. **IF** containment temperature is greater than or equal to 119°F, **THEN ATTEMPT** to maintain containment pressure less than 0.1 psig by performing pressure releases as necessary to allow a containment purge to be started in as short a time as possible to provide for additional cooling.

42. 026 K1.01 001

Given the following plant conditions:

- A Large Break LOCA and Loss of Offsite Power have occurred.
- EDG B tripped while starting.
- RWST is at 9% level.
- Alignment to the CV Sump has been completed.
- CV Pressure is currently 12 psig.

Which ONE (1) of the following completes the statement below?

SI-844A and B, CV Spray Pump Suction Isolation Valves, will remain __(1)__ and RHR Pump A will supply suction to allow operation of CV Spray Pump(s) __(2)__.

A. (1) closed

(2) "A" ONLY

B. (1) closed

(2) "A" and "B"

C✓ (1) open

(2) "A" ONLY

D. (1) open

(2) "A" and "B"

Answer is C

A. Incorrect - SI-844A/B are normally open valves and are not impacted by the loss of E2. SI-844A/B are not cycled prior to or during alignment for piggy-back mode of operation. Without power to "B" train components only "A" CV Spray Pump will be operable. Also, Attachment 1 of EPP-9 closes RHR Pump Suction Valves RHR-752A/B prior to initiating cold leg recirculation. The candidate could confuse this with having to close SI-844s.

B. Incorrect - SI-844A/B are normally open valves and are not impacted by the loss of E2. SI-844A/B are not cycled prior to or during alignment for piggy-back mode of operation. Without power to "B" train components only "A" CV Spray Pump will be operable.

C. Correct

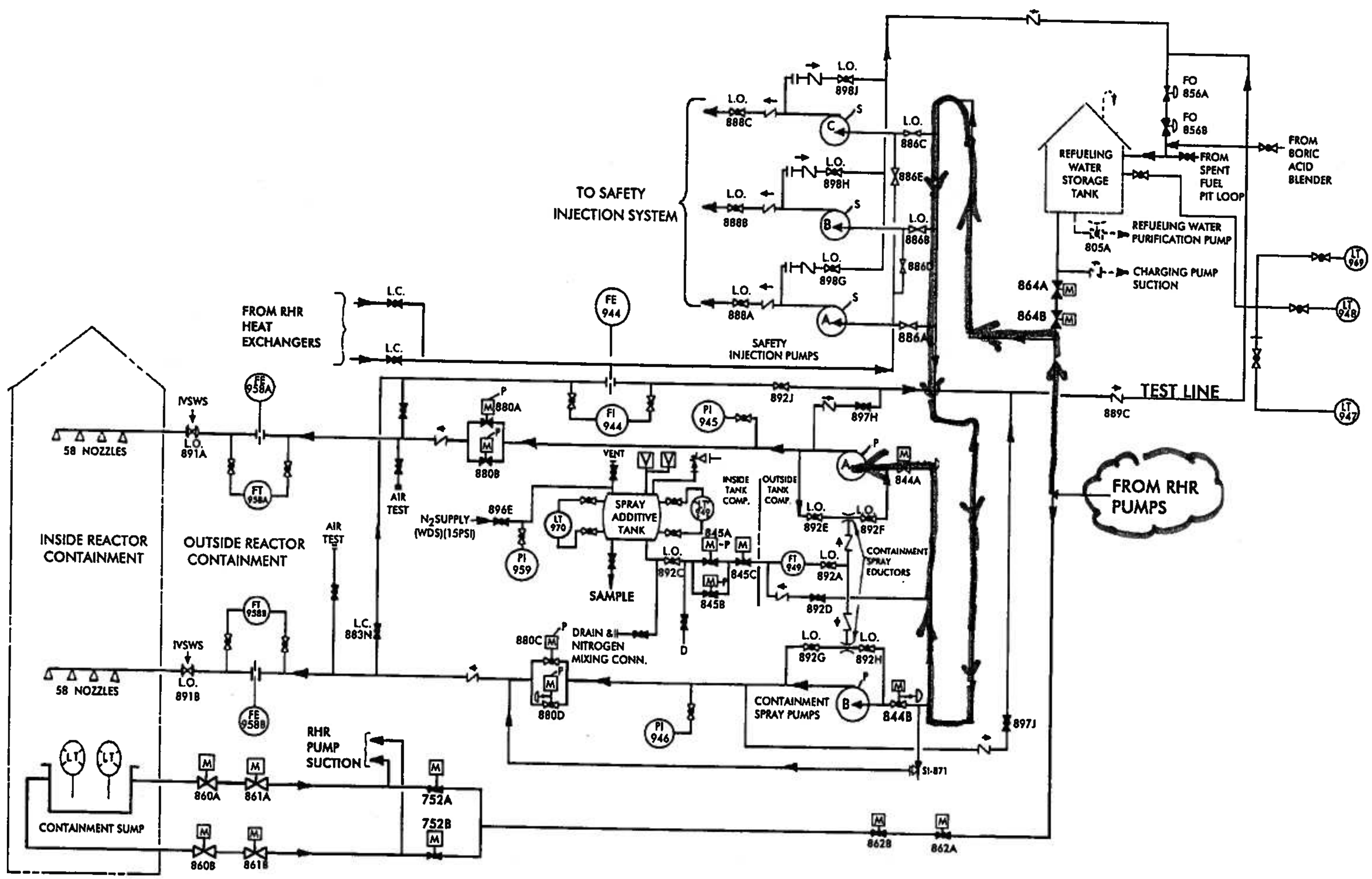
D. Incorrect - SI-844A/B are not cycled prior to or during alignment for piggy-back mode of operation. Without power to "B" train components only "A" CV Spray Pump will be operable.

Question 42
Tier/Group 2/1
K/A Importance Rating - RO 4.2 SRO 4.2

Knowledge of the physical connections and/or cause-effect relationships between the CSS and the following systems: ECCS

Reference(s) - Sim/Plant design, System Description, EPP-9
Proposed References to be provided to applicants during examination - None
Learning Objective - CSS SD-024-009
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.2 to 41.9 / 45.7 to 45.8
Comments -

SYSTEM FLOWPATH FOR RECIRCULATION PHASE
CSS-FIGURE-2



cssf02

INFORMATION USE ONLY

requirement. Various analyses use the value that is conservative for the situation. For example NPSH uses maximum flow; iodine removal uses minimum flow. Westinghouse WCAP 12070 has a section discussing the CS system and flows.

The spray pump seals are cooled by CCW. CCW needs to be in operation during initial recirculation phase (post-LOCA, when the pumps could be exposed to hotter water from the CV). There is an annunciator on the RTGB, "CV SPY PMP COOL WTR LO FLOW", APP-002-E1 set at 30 gpm, to warn the operators of the possibility of overheating the pumps. A precaution in OP-202 states, "Prior to operating a pump, CCW shall be available to the Seal Water Heat Exchanger".

Electrical power supplies are:

"A" Spray Pump - 480V Bus E1
"B" Spray Pump - 480V Bus E2

NOTE: The following starting duty limitations apply to the Containment Spray Pump. (CSS-Figure-4)

1) IF the pump has not been run in the last 45 minutes, THEN 2 consecutive starts are allowed.

2) IF the pump has been started 2 times in the last 45 minutes, AND neither of the last 2 starts was a run of at least 20 minutes, THEN no further starts are allowed for 45 minutes.

   a. Any run in the previous 45 minutes is considered one of the 2 allowed starts.

3) IF the pump was run at least 20 minutes and stopped, THEN 1 start is allowed with no waiting period.

3.2 Spray Additive Tank

Number	1
Type	Horizontal
Volume	5100 gal
Design Pressure	300 psig
Vacuum	2 psid vacuum
Design Temperature	300°F
Fluid	30% by weight NaOH

into the suction of the spray pumps. As the velocity increases the pressure decreases at the constricted section. The SAT is connected at this low pressure area.

3.4 Major Valves

3.4.1 Suction Relief Valve, SI-871

The purpose of the SI-871 is to protect the suction piping from overpressurization. The relief valve is set at 200 psig. It relieves to "B" Spray Header downstream of SI-880C and SI-880D.

3.4.2 CV Spray Pump Suction Valves, SI-844A and SI-844B

The purpose of the suction valves is to allow pump isolation for maintenance. They are motor operated and controlled with a close/open switch from the RTGB. At power, these valves are normally open. SI-844A and SI-844B are powered from MCC-5 and MCC-6, respectively.

3.4.3 Spray Additive Tank Discharge Valves, SI-845A and SI-845B

The purpose of the SAT discharge valves is to isolate the SAT from the eductors. These parallel valves are motor operated and are normally closed, but will open automatically on spray signal (P-signal). They are controlled from the RTGB with a Close/Auto/Open switch (spring return to Auto from open) and are powered from MCC-5 for SI-845A and MCC-6 for SI-845B.

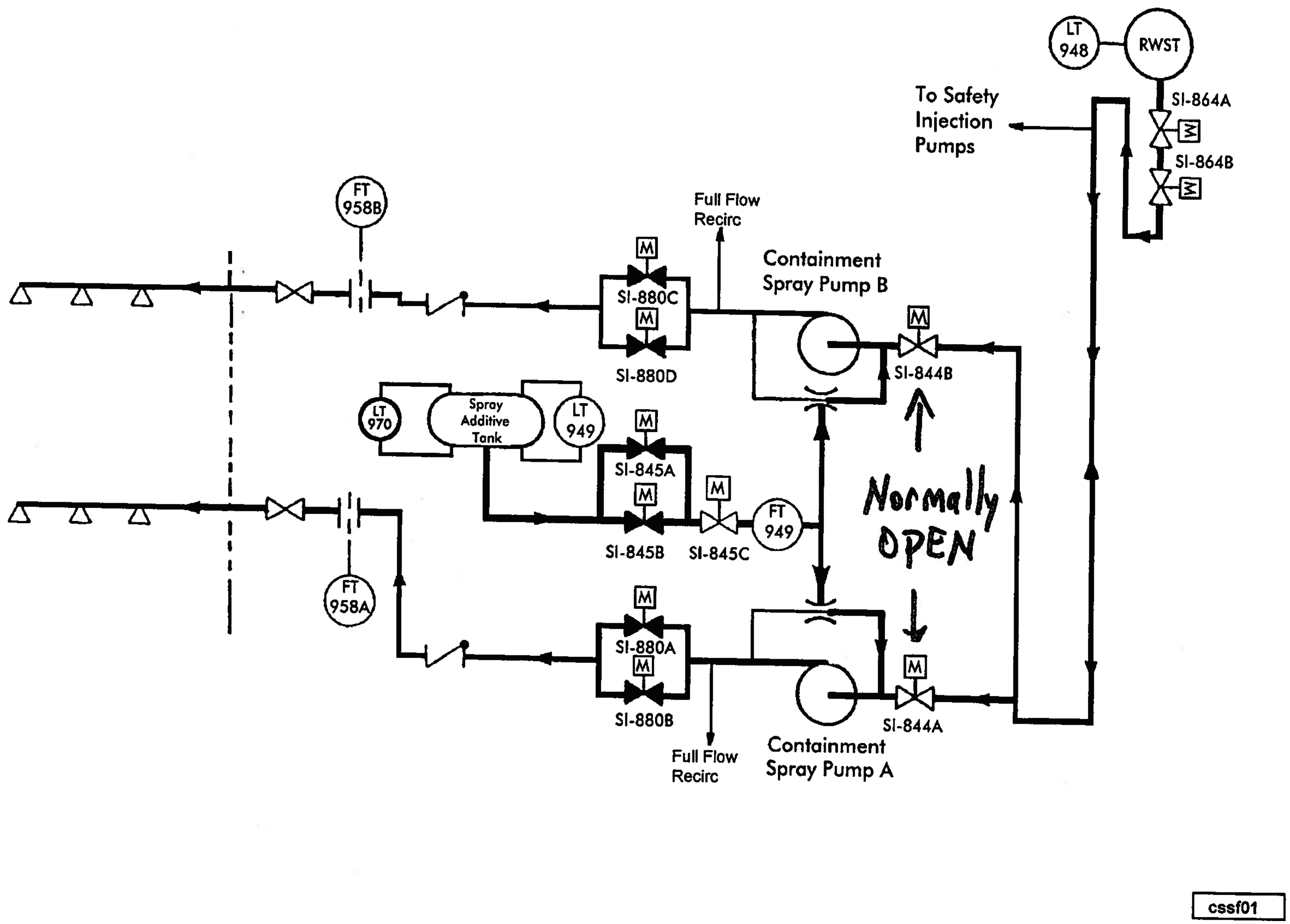
3.4.4 Spray Additive Tank Throttling Valve, SI-845C

The Spray Additive Tank throttling valve is used to adjust the flowrate of NaOH to the eductor thereby controlling the concentration of NaOH in the spray being delivered to the CV. It is a normally open, motor operated valve powered from MCC-5 and is controlled with a close/open switch (spring return to center) located on the RTGB. Being a throttling valve, the valve will operate as long as the switch is held. Emergency Operating Procedure PATH-1 checks the spray additive line flow throttled to 12 gpm.

3.4.5 Containment Spray Pump Discharge Valves SI-880A, 880B, 880C and 880D

The purpose of the spray pump discharge valves is to isolate the spray pump discharge from the spray headers. There are two parallel, motor operated valves on each spray pump discharge header. SI-880A and SI-880B are on Spray Pump "A" discharge and SI-880C and SI-880D are on Spray Pump "B" discharge. They are normally closed and will automatically open on a spray signal (P-signal). They are controlled from the RTGB with a Close/Open switch (spring return to center). The power supplies are MCC-5 for SI-

CONTAINMENT SPRAY FLOWPATH
CSS-FIGURE-1



INFORMATION USE ONLY

43. 026 K3.02 001

Given the following plant conditions:

- The plant had been operating at 100% RTP when a Large Break LOCA occurred.
- A malfunction in the CV Spray System results in SI-845C, Spray Additive Tank Outlet Throttle, **failing closed** when CV Spray was initiated. The valve was unable to be manually opened.
- The crew has transitioned to "Piggy-Back" Mode IAW EPP-9, Transfer to Cold Leg Recirculation, with CV Pressure at 14 psig.

Which ONE(1) of the following completes the statement below?

The containment sump water will be __(1)__ and the ECCS Components in service during cold leg recirculation will be more susceptible to __(2)__.

A. (1) acidic

(2) gas binding

B. (1) caustic

(2) gas binding

C.✓ (1) acidic

(2) chloride stress corrosion

D. (1) caustic

(2) chloride stress corrosion

The correct answer is C.

A. Incorrect - The first part of the distractor is correct. The gas levels in the CV will be higher, however, these gases will not become entrained in the CV sump water. Also, candidates should be familiar with recent issues regarding gas binding in ECCS components and think that this is a valid concern.

B. Incorrect - The CV sump water would become slightly caustic if the NaOH from the SAT was injected into the spray system. The RCS contains boric acid so the sump water would be acidic. The gas levels in the CV will be higher, however, these gases will not become entrained in the CV sump water. Also, candidates should be familiar with recent issues regarding gas binding in ECCS components and think that this is a valid concern.

C. Correct.

D. Incorrect - The CV sump water would become slightly caustic if the NaOH from the SAT was injected into the spray system. The RCS contains boric acid so the sump water would be acidic. The second part of the distractor is correct.

Question 43
Tier/Group 2/1
K/A Importance Rating - RO 4.2 SRO 4.3

Knowledge of the effect that a loss or malfunction of the CSS will have on the following: Recirculation spray system

Reference(s) - Sim/Plant design, System Description, EPP-9BD
Proposed References to be provided to applicants during examination - None
Learning Objective - CSS SD-024-009
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.6
Comments - Discussion with P. Capehart on 6/15/11: Clarified that "recirculation spray system" is equivalent to CV spray operation while in long-term recirculation (piggy-back) mode of operation.

The Spray Additive System is a subsystem of the CSS that assists in reducing the iodine fission product inventory in the containment atmosphere resulting from a Design Basis Accident (DBA). Radioiodine in its various forms is the fission product of primary concern in the evaluation of a DBA. It is absorbed by the spray from the containment atmosphere. To enhance the iodine absorption capacity of the spray, the spray solution is adjusted to an alkaline pH that promotes iodine hydrolysis, in which iodine is converted to nonvolatile forms. Because of its stability when exposed to radiation and elevated temperature, sodium hydroxide (NaOH) is the preferred spray additive. The NaOH added to the spray also ensures a pH value of between 8.5 and 11.0 of the solution recirculated from the containment sump. This pH band minimizes the evolution of iodine as well as the occurrence of chloride and caustic stress corrosion on mechanical systems and components. An eductor mixes the NaOH solution and the borated water and discharges the mixture into the spray pump suction line. The eductors are designed to ensure that the pH of the spray mixture is between 8.8 and 10.0 during the injection phase.

2.3 System Flow Paths

Two motor-driven centrifugal pumps take a suction from the RWST and discharge chemically treated (NaOH) borated water to six (6) Spray rings inside containment.

The SAT contents with NaOH solution is mixed with the RWST water at the spray pump suction through an eductor. The SAT discharge is throttled to 12 gpm. This solution is made available to help capture radioactive iodine because gaseous iodine is only slightly soluble in water. In a basic pH, iodine breaks down to form iodide and hypoiodite ($I_2 + 2OH^- \rightarrow I^- + IO^- + H_2O$). Iodine is removed by breaking it down into ions that are more soluble in water. In addition, this solution is mixed with the boric acid and the resultant pH helps to prevent chloride and caustic stress corrosion of stainless steel pipes & components following SI. The SAT is isolated when the tank is emptied.

The spray piping headers are located in the upper dome of the containment to maximize the spray fall height. The spray nozzles closest to the containment liner are oriented inward to ensure that spray effectiveness is not lost by spraying against the containment liner. Nozzle orientation and spacing is placed so that the volume covered is maximized.

After the RWST empties (<9%), the CSS is realigned for the post-accident recirculation phase. (CSS-Figure-2) Following the injection phase, coolant collected in the containment sump is recirculated via the RHR (LHSI) pumps to the RCS and, if necessary, to the CSS. If spray is needed during the recirculation phase, the operator realigns motor-operated valves from the control room.

2.4 System Description

44. 039 K4.06 001

Given the following plant conditions:

- The plant is operating at 100% RTP.
- Steam line break occurs on Steam Line A just outside the CV wall.
- MSIV "A" fails to close when demanded.

Which ONE (1) of the following identifies the design feature that will ensure that all of the S/Gs do NOT blowdown through the faulted steam line?

A. MSIV auto closure on High Steam Line Flow with Low Tave signal.

B. MSIV auto closure on High Steam Line Delta P signal.

C✓ Check valves downstream of each MSIV.

D. Check valves upstream of each MSIV.

Answer is C

A. Incorrect - Check valves are installed on the downstream side of each of the MSIVs. These serve to ensure that back flow is prevented when a faulted steam line occurs on one steam line. MSIV auto closure signal does exist when 2 out of 3 steam lines have a high steam line flow signal, coincident with a Low Tave or Low Steam Line pressure, which provides protection for a steam break downstream of the MSIVs.

B. Incorrect - High Steam Line Delta P signal will provide a Safety Injection signal for 1 faulted S/G but does not provide any signal for closure of the MSIVs.

C. Correct

D. Incorrect - The check valve design feature is correct but the location within the system is incorrect.

Question 44
Tier/Group 2/1
K/A Importance Rating - RO 3.3 SRO 3.6

Knowledge of MRSS design feature(s) and/or interlock(s) which provide for the following: Prevent reverse steam flow on steam line break

Reference(s) - Sim/Plant design, System Description, ITS 3.3.2 Bases
Proposed References to be provided to applicants during examination - None
Learning Objective -MSS 004
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7
Comments -

MSIVs.

4.1.4 Steam Line Pressure (ESF-Figure-1 & 3)

Steam Line Pressure measurement is utilized for steam line break protection. Low steam line pressure (614 psig) in two of three main steam lines or Low Tavg (543°F) in two of three loops, coincident with high steam line flow in two-of-three main steam lines, will initiate the Steam Line Isolation and Safety Injection signals. This is to protect against: a steam line break downstream of the main steam check valves, a feed line break, and/or an inadvertent opening of a SG safety.

In addition, each steam line pressure measurement is compared with a main steam header pressure measurement to determine if a high steam line differential pressure exists. A coincidence of two-of-three steam line differential pressures (100 psid) in any one steam line, that is, steam line pressure lower than main steam header pressure, will initiate a Safety Injection signal.

The steam header pressure is electronically limited to a minimum value of 585 psig. Therefore, this SI signal must be blocked before a plant cooldown is started to prevent SI actuation when S/G pressures drop below 485 psig(approximately 467°F). The steam line differential pressure circuit detects faults upstream of the MSIVs. Since the steam line check valves prevent reverse flow to the faulted S/G, excessive steam line differential pressure does not close the MSIVs.

4.1.5 Containment Pressure (ESF-Figure-4 & 5)

Containment Pressure measurement is utilized to initiate Emergency Core Cooling in response to a Loss of Coolant Accident (LOCA), and to provide containment pressure protection for either a LOCA, a feed line break inside containment, or a Main Steam Line Break inside containment. Nine pressure comparators, with inputs from six pressure transmitters, are used as inputs to ESFAS. Three pressure comparators provide an input for Hi Containment Pressure at 4 psig increasing pressure. Six pressure comparators provide an input for Hi-Hi Containment Pressure at 10 psig.

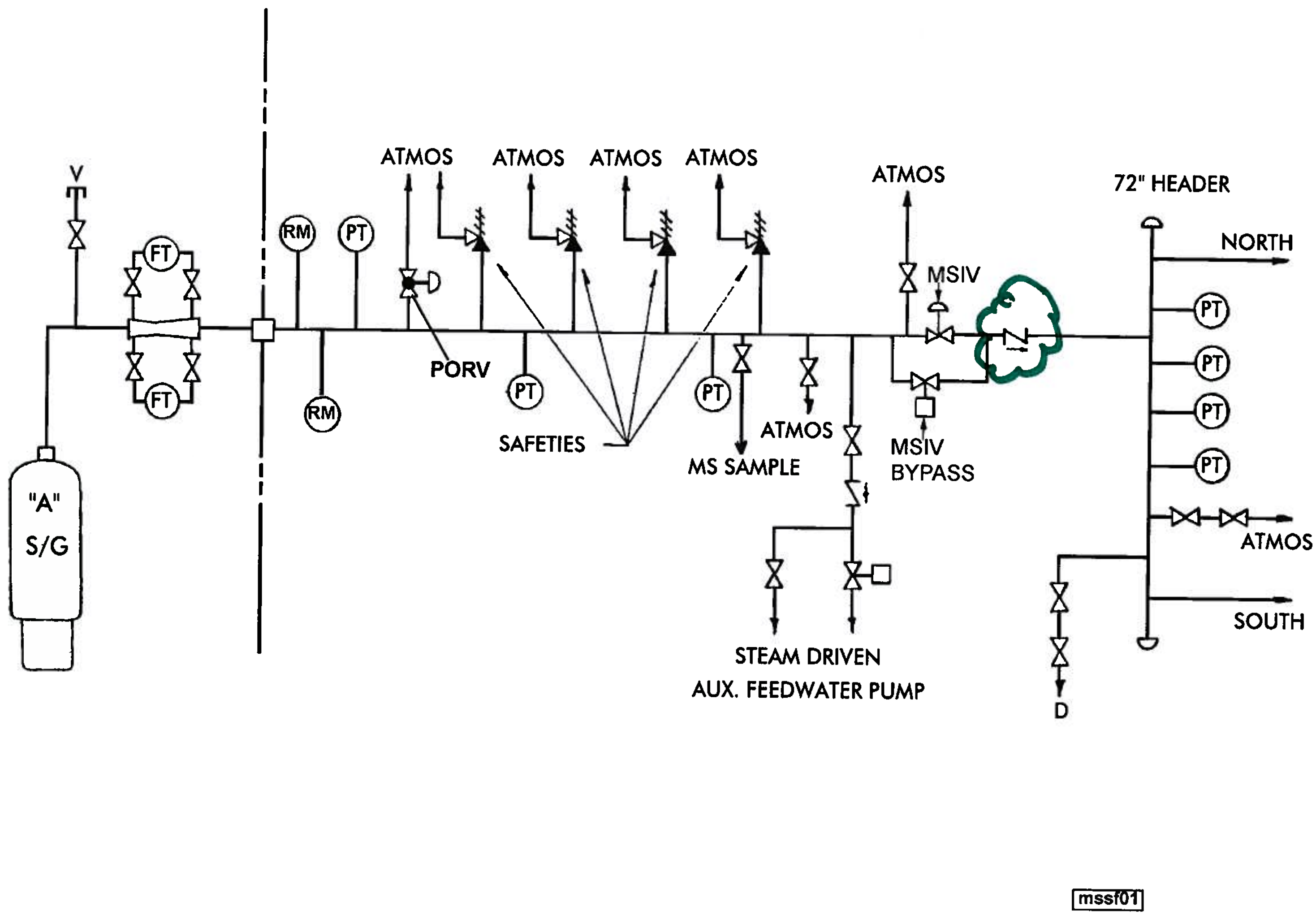
A coincidence of two of three Hi Containment Pressure (4 psig) will initiate a Safety Injection signal.

A coincidence of two separate two-of-three Hi-Hi Containment Pressure signals (10 psig), i.e., two-of-three twice, will initiate the following signals:

Steam Line Isolation,
Containment Spray Actuation
Containment Isolation Phase "B"
Safety Injection Signal(This SI is not credited and is blocked by the Tavg Block)

SYSTEM DIAGRAM (S/G TO 72" HEADER)

MSS-FIGURE-1 (Rev 0)



INFORMATION USE ONLY

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b. Containment Isolation – Phase B Isolation (continued)

in the primary or secondary systems to pressurize the containment to require Phase B containment isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

(3) Phase B Isolation – Containment Pressure

The basis for containment pressure MODE applicability is as discussed for ESFAS Function 2.c above.

4. Steam Line Isolation

Isolation of the main steam lines provides protection in the event of an SLB inside or outside containment. Rapid isolation of the steam lines will limit the steam break accident to the blowdown from one SG, at most. For an SLB upstream of the main steam isolation valves (MSIVs), inside or outside of containment, closure of the MSIVs limits the accident to the blowdown from only the affected SG. For an SLB downstream of the MSIVs, closure of the MSIVs terminates the accident as soon as the steam lines depressurize.

a. Steam Line Isolation – Manual Initiation

Manual initiation of Steam Line Isolation can be accomplished from the control room. There are three pushbuttons in the control room, one for each steam line. Each pushbutton actuates both trains of Steam Line Isolation for its corresponding MSIV. The LCO requires one channel per line to be OPERABLE.

b. Steam Line Isolation – Automatic Actuation Logic and Actuation Relays

Automatic actuation logic and actuation relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b. Steam Line Isolation – Automatic Actuation Logic and Actuation Relays (continued)

Manual and automatic initiation of steam line isolation must be OPERABLE in MODES 1, 2, and 3 when there is sufficient energy in the RCS and SGs to have an SLB or other accident. This could result in the release of significant quantities of energy and cause a cooldown of the primary system. The Steam Line Isolation Function is required in MODES 2 and 3 unless all MSIVs are closed. In MODES 4, 5, and 6, there is insufficient energy in the RCS and SGs to experience an SLB or other accident releasing significant quantities of energy.

c. Steam Line Isolation – Containment Pressure – High High

This Function actuates closure of the MSIVs in the event of a LOCA or an SLB inside containment to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. Actuation logic is discussed under "Containment Spray – Containment Pressure," Function 2.c.

Containment Pressure – High High must be OPERABLE in MODES 1, 2, and 3, when there is sufficient energy in the primary and secondary side to pressurize the containment following a pipe break. This would cause a significant increase in the containment pressure, thus allowing detection and closure of the MSIVs. The Steam Line Isolation Function remains OPERABLE in MODES 2 and 3 unless all MSIVs are closed. In MODES 4, 5, and 6, there is not enough energy in the primary and secondary sides to pressurize the containment to the Containment Pressure – High High setpoint.

(continued)

45. 059 A2.04 001

Given the following plant conditions:

- Plant is operating in Mode 1 at 100% RTP.
- A Reactor Trip and Safety Injection has occurred.
- No AFW pumps are available.
- RCS Bleed-and-Feed is in progress IAW FRP-H.1, Response to Loss of Secondary Heat Sink.
- Both Condensate Pumps are running.

Which ONE (1) of the following completes the statement below?

To restore feed flow to the S/G(s) IAW FRP-H.1, the operator is required to place __(1)__ Feedwater Isolation Key Switch(es) in the OVRD/RESET position, verify the Feedwater Header Section Valves __(2)__ and start 1 Main Feedwater Pump to feed __(2)__ S/G(s).

A. (1) ONE

(2) OPEN

(3) ONE

B. (1) THREE

(2) OPEN

(3) ONE

C. (1) ONE

(2) CLOSED

(3) ALL

D✓ (1) THREE

(2) CLOSED

(3) ALL

The correct answer is D.

A. Incorrect - Reference: FRP-H.1 Pages 1 through 11. All key operated override switches are placed in OVRD/RESET Position. All must be in OVRD/RESET and the Feedwater Header Section Valves must be closed to allow for starting of the MFP. 1 MFP started and FRV Bypass opened. Candidate may think that only one Feedwater Isolation Key Switch is utilized to over-ride all Feedwater Isolation signals similar to other over-ride switches on the RTGB. The Feedwater Header Section Valves must be closed to allow for starting of the MFP. All S/Gs are fed once feedwater flow is established.

B. Incorrect - The first part of the distractor is correct. The Feedwater Header Section Valves must be closed to allow for starting of the MFP. All S/Gs are fed once feedwater flow is established.

C. Incorrect - All key operated override switches are placed in OVRD/RESET Position. All must be in OVRD/RESET and the Feedwater Header Section Valves must be closed to allow for starting of the MFP. 1 MFP started and FRV Bypass opened. Candidate may think that only one Feedwater Isolation Key Switch is utilized to over-ride all Feedwater Isolation signals similar to other over-ride switches on the RTGB. The second and third part of the distractor are correct.

D. Correct.

Question 45
Tier/Group 2 / 1
K/A Importance Rating - RO 2.9 SRO 3.4

Ability to (a) predict the impacts of the following malfunctions or operations on the MFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Feeding a dry S/G

Reference(s) - Sim/Plant design, FRP-H.1
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-H.1-004
Question Source - ILC-09 NRC EXAM Modified
Question Cognitive Level - F
10 CFR Part 55 Content - 41.5 / 43.5 / 45.3 / 45.13
Comments - K/A match because candidate is given a situation where a plant trip occurred with a loss of secondary heat sink. Bleed and Feed was required due to S/G levels being low. The candidate must know how to manipulate the Feedwater Isolation Switches to start a MFP and the flowpath that will be used to restore S/G levels.

ILC-09 NRC EXAM Modification:
ILC-09 question had the candidate determine if the S/Gs would be fed via the FRV or the FRV Bypass Valve. This question has been modified to have the candidate determine the required position of the Feedwater Header Section Valves. Also, the question has been reformatted to a fill-in the blank.

Reviewed and approved by MAB.

ILC-09 QUESTION

17. WE05 EK2.1 001/FRP-H.1/1 / 1/3.7 / 3.9/////

Given the following:

- Plant is operating in Mode 1 at 100% RTP.
- A Reactor Trip and Safety Injection have occurred.
- Multiple failures have resulted in a loss of all AFW.
- PATH-1 has been implemented and the crew has transitioned to FRP-H.1, Response to Loss of Secondary Heat Sink.
- Both Condensate Pumps are running.

Which ONE (1) of the following describes the required actions to restore feed flow to the S/G(s) IAW FRP-H.1?

Override the Feedwater Isolation to......

A. ONLY ONE S/G and start 1 Main Feedwater Pump to feed ONE S/G with the Feedwater Regulating Valve.

B.✓ ALL S/Gs and start 1 Main Feedwater Pump to feed all S/Gs with the Feedwater Regulating Bypass Valves.

C. ONLY ONE S/G and start 1 Main Feedwater Pump to feed ONE S/G with the Feedwater Regulating Bypass Valve.

D. ALL S/Gs and start 1 Main Feedwater Pump to feed all S/Gs with the Feedwater Regulating Valves.

Answer is B

B. Correct. Reference: FRP-H.1 Pages 1 through 11. All key operated override switches are placed in OVRD/RESET Position. 1 MFP started and bypass opened. The main feedwater regulating valve will not open.

The key operated switches only allow a feed pump to be started and the bypass valve to be opened.

Question 17
Tier 1 / Group 1
K/A Importance Rating - RO 3.7 SRO 3.9

Inadequate heat transfer - Knowledge of the interrelations between EOP and components and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes and automatic and manual features.

Reference(s) - Sim/Plant design, FRP-H.1
Proposed References to be provided to applicants during examination - None
Learning Objective - FRP-H.1-002
Question Source - New
Question History -
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7 / 45.8
Comments -

46. 059 A3.02 001

Which ONE (1) of the following completes the statement below?

At 15% RTP the programmed S/G level is approximately __(1)__ and at 20% RTP the programmed S/G level is approximately __(2)__.

A. (1) 52%

(2) 52%

B.✓ (1) 49%

(2) 52%

C. (1) 39%

(2) 39%

D. (1) 29%

(2) 39%

The correct answer is B.

A. Incorrect. 52% is the programmed level from 20% to 100% RTP.

B. Correct. The programmed levels are 39% to 52% from 0 to 20% power and a constant 52% from 20% to 100% power.

C. Incorrect. If the candidate incorrectly thinks that S/G levels are programmed at 39% level from 0 to 20% power and ramped from 39% to 52% from 20% to 100% power this answer would be correct. The numbers are correct, just misapplied.

D. Incorrect. This value would be correct if programmed level was from 0 to 39% from 0 to 20% RTP.

Question 46
Tier/Group 2/1
K/A Importance Rating - RO 2.9 SRO 3.1

Ability to monitor automatic operation of the MFW, including: Programmed levels of the S/G

Reference(s) - Sim/Plant design, System Description, Logic Diagrams
Proposed References to be provided to applicants during examination - None
Learning Objective - FW 006
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7 / 45.5
Comments -

The auto/manual selector switch on the side of the Bailey positioner at the feedwater regulating valves cannot be used for local pneumatic valve control. If manual is selected, the valve will fail closed.

A wide-range level channel, calibrated for no-load conditions, aids manual level control from hot shutdown to cold shutdown. This channel consists of a recorder, high and low level alarms (only function when steam generator pressure is less than 614 psig), and indicators. Automatic pressure-temperature compensation is not necessary.

Besides the main feedwater regulating valve (FCV-478, -488, or -498), for each steam generator there is a bypass valve (FCV-479, -489, or -499) which is intended to provide manual feedwater flowrate control at low loads. During normal "at power" operation of the plant the bypass valve is closed.

The bypass valve operation is controlled from the RTGB controller station which provides manual positioning of the valve. The opening of the bypass valve is prevented in the presence of either safety injection or high steam generator water level.

The auto/manual selector switch on the side of the Bailey positioner at the feedwater regulating bypass valves can be used for local pneumatic control.

The main feedwater regulating valves and bypasses are operated by utilizing the instrument air system pressure through controllers to properly position the valves.

The main feedwater regulating valves and the bypass regulating valves have OPEN and CLOSED light indications. These position indication lights are located on the RTGB adjacent to their respective controllers.

The main feedwater regulating valves rely on motor operated block valves if needed to isolate them from the main feedwater pump discharge. These valves are controlled from the RTGB and supplied power from: FW-V2-6A for "A" steam generator from MCC-5, FW-V2-6B for "B" steam generator from MCC-6, and FW-V2-6C for "C" steam generator from MCC-6.

5.1.2 Steam Generator Water Level Control

Steam generator level is programmed for operation. The normal no load level is 39% and is programmed from 39% to 52% from 0% to 20% power. From 20% to 100% power the level remains at 52%.

The three-element feedwater control system compares actual steam generator level to the program level derived from turbine first stage pressure (for power level, selected from either PT-446 or PT-447) and any difference between the signals is the level error.

The pressure compensated steam flow signal and the feedwater flow signal are compared

47. 061 K5.01 001

Given the following plant conditions:

"B" MFP is OOS for Maintenance and the following occurs:

- The Reactor was manually Tripped while operating at 20% RTP due to a trip of "A" MFP
- Tave is 546°F and lowering.
- PZR Level is 22% and slowly lowering.
- RCS Pressure is 2045 psig and lowering.
- Steam Generator Blowdown is Isolated.
- S/G levels are as follows:
    - "A" S/G Narrow Range level is 42% and slowly rising.
    - "B" S/G Narrow Range level is 41% and slowly rising.
    - "C" S/G Narrow Range level is 45% and slowly rising.

Which ONE (1) of the following provides the action(s) that are required to be taken <u>next</u> IAW EPP-4, Reactor Trip Response?

A. Initiate Safety Injection

B. Borate to Cold Shutdown Boron

C✓ Reduce Auxiliary Feedwater Flow

D. Close the MSIVs & MSIV Bypasses

The correct answer is C.

A. Incorrect - Safety Injection initiation criteria have not been met. PZR is greater than 10%. PZR is lowering due to the RCS cooldown.

B. Incorrect - EPP-4 will only direct borating to CSD Boron if RCS temperature lowers to less than 530°F.

C. Correct - EPP-4 will direct the operator to reduce total feed flow to stop cooldown since S/Gs are greater than 8%, S/G Blowdown is isolated and Tave is less than 547°F and lowering.

D. Incorrect - Closure of the MSIVs and MSIV Bypasses is only required if the reduction in feed flow does not stop the cooldown.

Question 47
Tier/Group 2 / 1
K/A Importance Rating - RO 3.6 SRO 3.9

Knowledge of the operational implications of the following concepts as the apply to the AFW: Relationship between AFW flow and RCS heat transfer.

Reference(s) - Sim/Plant design, System Description, EPP-4, EPP-Foldout H
Proposed References to be provided to applicants during examination - None
Learning Objective - AFW 010
Question Source - ILC-11-1 NRC Exam
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 45.7
Comments - K/A met because candidate must analyze plant conditions given following a plant trip due to a loss of main feedwater. Based on this analysis the candidate must identify the effect of AFW flow due to RCS temperature lowering and determine the appropriate actions of reducing AFW flow.

CONTINUOUS USE

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL

VOLUME 3

PART 4

END PATH PROCEDURE

EPP-4

REACTOR TRIP RESPONSE

REVISION 28

Purpose and Entry Conditions

(Page 1 of 1)

1. **PURPOSE**

   This procedure provides the necessary instructions to stabilize and control the plant following a Reactor trip without a Safety Injection.

2. **ENTRY CONDITIONS**

   Path-1 when a Reactor trip has occurred and SI is not initiated or required.

- END -

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1	**Verify Moisture Seperator Reheater Steam Valves - CLOSED** • MSR Shutoff Valves • MSR Purge Valves	IF a loss of power prevents isolation of the MSRs, THEN close the MSIVs AND MSIV BYPs. IF ANY Purge OR Shutoff Valve can NOT be closed from the RTGB AND RCS temperature is less than 540°F and lowering, THEN close the MSIVs AND MSIV BYPs. Locally close Open MSR Steam Valves
* 2.	**Determine If Procedure Exit Is Warranted:**	
	a. Check Attack on RNP Site - IN PROGRESS NO	a. Go To Step 3
	b. Check either of the below events - IN PROGRESS • Total Loss Of SW OR • Loss Of Lake Robinson Dam integrity	b. IF a total loss SW OR a loss of Lake Robinson Dam integrity occurs due to hostile action, THEN Go To EPP-28, Loss of Ultimate Heat Sink. Go To Step 3.
	c. Go To EPP-28, Loss Of Ultimate Heat Sink	
* 3.	**Check SI Signal - INITIATED**	IF SI initiation occurs during this procedure, THEN Go To Path-1, Entry Point A. Go To Step 5.
4.	**Go To Path-1, Entry Point A**	
5.	**Perform The Following:** a. Reset SPDS b. Initiate monitoring of Critical Safety Function Status Trees	
6	**Open Foldout H**	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
7.	**Check RCS Temperature - STABLE AT OR TRENDING TO 547°F** NO	IF RCS temperature is NOT stable at OR trending to 547°F, THEN Go To Step 9.
8.	**Go To Step 10**	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9.	**Control RCS Temperature As Follows:**	
	a. Check RCS temperature - LESS THAN 547°F AND LOWERING	a. Go To Step 9.g.
	b. Stop dumping steam	
	c. Verify S/G blowdown isolation valves - CLOSED • FCV-1930A&B • FCV-1931A&B • FCV-1932A&B	
	d. Check S/G levels - ANY GREATER THAN 8% YES	d. Perform the following: • Establish FW bypass flow greater than $0.2x10^6$ pph until level in at least one S/G is greater than 8%. OR • Establish AFW flow greater than 300 gpm until level in at least one S/G is greater than 8%. Go To Step 9.f.
	e. Reduce total feed flow, as necessary, to stop cooldown	
	f. Check RCS cooldown - STOPPED	f. Close MSIVs AND MSIV BYPs. IF RCS Temperature lowers below 530°F, THEN borate the RCS to CSD boron concentration.
	g. Check RCS temperature - GREATER THAN 547°F AND RISING	g. Go To Step 10.
	h. Check steam dump to Condenser - AVAILABLE	h. Dump steam using STEAM LINE PORVs to obtain 547°F. Go To Step 10
	i. Dump steam to Condenser to obtain 547°F	

FOLDOUT H

(Page 1 of 4)

1. SI ACTUATION CRITERIA

IF EITHER condition below occurs, THEN Actuate SI and Go To PATH-1, Entry Point A:

- RCS Subcooling - LESS THAN 35°F [55°F]
- PZR Level - CAN NOT BE MAINTAINED GREATER THAN 10% [32%]

48. 061 K6.02 001

Given the following plant conditions:

- The Plant is in Mode 3.
- "B" MDAFW pump is running.
- A small feedline break occurs between FCV-1425, MDAFW pump "B" FCV, and isolation valve V2-16C, SG C AFW Isolation Valve.
- FCV-1425 is closed and the break flow stops.

The CRS has directed isolation of the leak from all water sources.

Which ONE (1) of the following identifies the SGs available to be fed from "A" MDAFW pump?

A. S/G "A" ONLY

B. S/G "B" ONLY

C✓ S/Gs "A" and "B" ONLY

D. S/Gs "A", "B" and "C"

The correct answer is C.

A. Incorrect. "B" S/G can be fed using "A" MDAFW pump through V2-16B.

B. Incorrect. "A" S/G can be fed using "A" MDAFW pump through V2-20A and V2-16A.

C. Correct.

D. Incorrect. The break location requires that V2-16C and V2-20B be closed. "C" S/G would have to be fed via the SDAFW pump in an emergency condition.

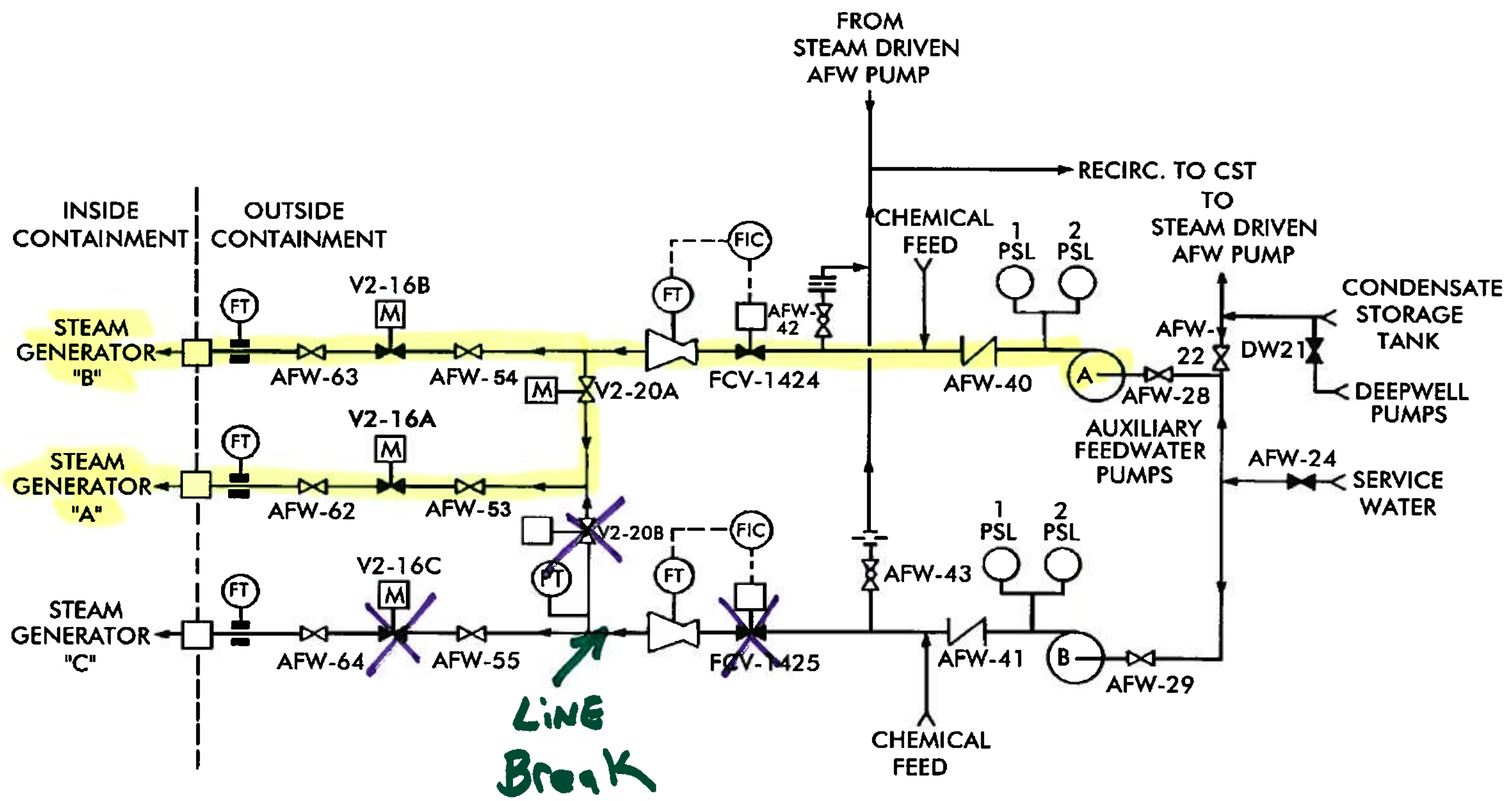
Question 48
Tier/Group 2 / 1
K/A Importance Rating - RO 2.6 SRO 2.7

Knowledge of the effect that a loss or malfunction of the following will have on the AFW Components: Pumps.

Reference(s) - SD-042, Figure 2, Page 39 of 50
Proposed References to be provided to applicants during examination - NONE
Learning Objective - AFW 003
Question Source - BANK (Last used on 2007 NRC Exam.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7
Comments -

MOTOR DRIVEN AUXILIARY FEEDWATER SYSTEM

AFW-FIGURE-2



INFORMATION USE ONLY

49. 062 A2.10 001

Given the following plant conditions:

- Unit operating at 50% RTP.
- "A" Train of CR HVAC is in service.
- Breaker 52/21A, Feed to MCC-5 (NORM POWER) & MCC-16, trips open.
- CRS has directed that MCC-5 be transferred to the DS Bus.

Which ONE (1) of the following completes the statements below?

MCC-16 __(1)__ re-energize when MCC-5 is transferred to the DS Bus.

"A" Train of Control Room HVAC __(2)__ be available.

A. (1) will

(2) will

B. (1) will

(2) will NOT

C.✓ (1) will NOT

(2) will NOT

D. (1) will NOT

(2) will

The correct answer is C.

A. Incorrect - The feeder breaker on 480V Bus E-1 is a double lugged breaker and feeds both MCC-5 and 16. The kirk key switch for MCC-5 transfer is downstream of the cable split which only supplies MCC-5 from the DS Bus when the kirk key switch is transferred. This causes MCC-16 to remain de-energized when the kirk key switch is transferred to the DS Bus. "A" Train of CR HVAC is powered from MCC-16 and will not be available while MCC-5 is powered from the DS Bus.

B. Incorrect - See discussion in "A" above.

C. Correct - "B" Train of CR HVAC will start automatically upon a loss of "A" train.

D. Incorrect - "A" Train will not have power available due to the MCC-16 being de-energized.

Question 49
Tier/Group 2/1
K/A Importance Rating - RO 3.0 SRO 3.3

Ability to (a) predict the impacts of the following malfunctions or operations on the ac distribution system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Effects of switching power supplies on instruments and controls

Reference(s) - Sim/Plant design, System Description, EDP-003
Proposed References to be provided to applicants during examination - None
Learning Objective - VAC 005
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.5 / 43.5 / 45.3 / 45.13
Comments -

units, HVE-14 (Fan Room "B"), HVE-15 (Fan Room "A") and HVE-15A. The discharge of HVE-15 and HVE-15A (only one can be run at a time) is directed to the plant stack.

The discharge duct of HVE-14 contains an isokinetic probe for pulling a sample of exhaust air through a particulate and iodine sampler assembly. This air then returns back to the duct. A high range noble gas monitor (R-30) is placed on the outside of the duct "looking in" through the duct. The discharge ducts of HVE-14 and HVE-15 are monitored by low range gas monitors (R-20 and R-21, respectively). The R-20 monitor alarms if air becomes unsuitable for exhaust. The R-21 alarms and trips fan HVE-15 and also the supply fan HVS-4 if air becomes unsuitable for exhaust. Detailed information on the function and operation of radiation monitors may be found in SD-019, Radiation Monitoring System.

The fan rooms are ventilated through motor operated dampers by HVE-20 (Fan Room "B") and HVE-21 (Fan Room "A").

HVE-14, 15 and 15A are powered from PP No. 22.

2.4.2 Control Room (See Figures - 8, 9, 14, 15 and 16)

The Control Room HVAC System is designed with an air handling unit, an air cleaning unit, and a kitchen/toilet exhaust unit to supply conditioned air to and exhaust spent air from the Control Room envelope. This system is designed to operate in either of three modes depending on external environmental conditions which could affect the habitability of the Control Room. However, under all modes of operation the temperature in the envelope will be controlled between 70°F and 77°F dry-bulb, inclusive.

The air handling unit (AHU) is comprised of a stainless steel unit housing, one average efficiency prefilter bank and two redundant, 100% capacity cooling coils. During all modes of operation, the AHU operates under positive pressure by either of two redundant, 100% capacity centrifugal fans, HVA-1A and HVA-1B. Each of the AHU cooling coils is served by its respective service water cooled condensing unit, WCCU-1A and WCCU-1B. Control Room heating is provided by an electric air duct heater, EDH-5, mounted in the supply duct run located in the Control Room vestibule area.

The air cleaning unit (ACU) is comprised of a stainless steel filtration unit housing, one average efficiency prefilter bank, one pre-HEPA (high efficiency particulate air) filter bank, one permanently installed gasketless carbon adsorber bank of a 2-inch bed depth, and one post-HEPA filter bank. (Pre- and post- are relative to the adsorber bank in the direction of air flow.) The ACU operates under positive pressure by either of two redundant, 100% capacity centrifugal fans, HVE-19A and HVE-19B.

The kitchen/toilet exhaust fan, HVE-16, operates continuously during normal operating conditions. However, during the emergency pressurization and emergency recirculation modes of operation, HVE-16 fan stops and redundant in-line dampers CR-D1A and CR-D1B close.

Outside make-up air enters the Control Room HVAC system through louver L-19 during normal and emergency modes of operation. However, during the emergency recirculation mode of operation, redundant, parallel dampers CR-D2A and CR-D2B are closed, enabling 100% recirculation of Control Room air. AHU and ACU operate during emergency pressurization and emergency recirculation mode of operation. AHU and HVE-16 operate during normal mode of operation.

HVA-1A and HVA-1B are powered from MCC-16 and MCC-18. HVE-19A and WCCU-1A are powered from MCC-16 while HVE-19B and WCCU-1B are powered from MCC-18. "A" Train from MCC-16 (E-1) and "B" Train from MCC-18 (E-2)

The Control Room Envelope (CRE) is designed to maintain a minimum positive pressure of 1/8 in. w.g. with respect to outside atmosphere. If any breach of the CRE would prevent the Control Room from achieving at least 1/8 inch positive pressure, then ITS 3.7.9 LCO should be entered. To ensure the CRE is maintained intact, PLP-033, Attachment 10.45 lists the structures, Systems, and components that could affect it's integrity. The CRE is composed of the following components, if breached/open they could render the CRE OOS:

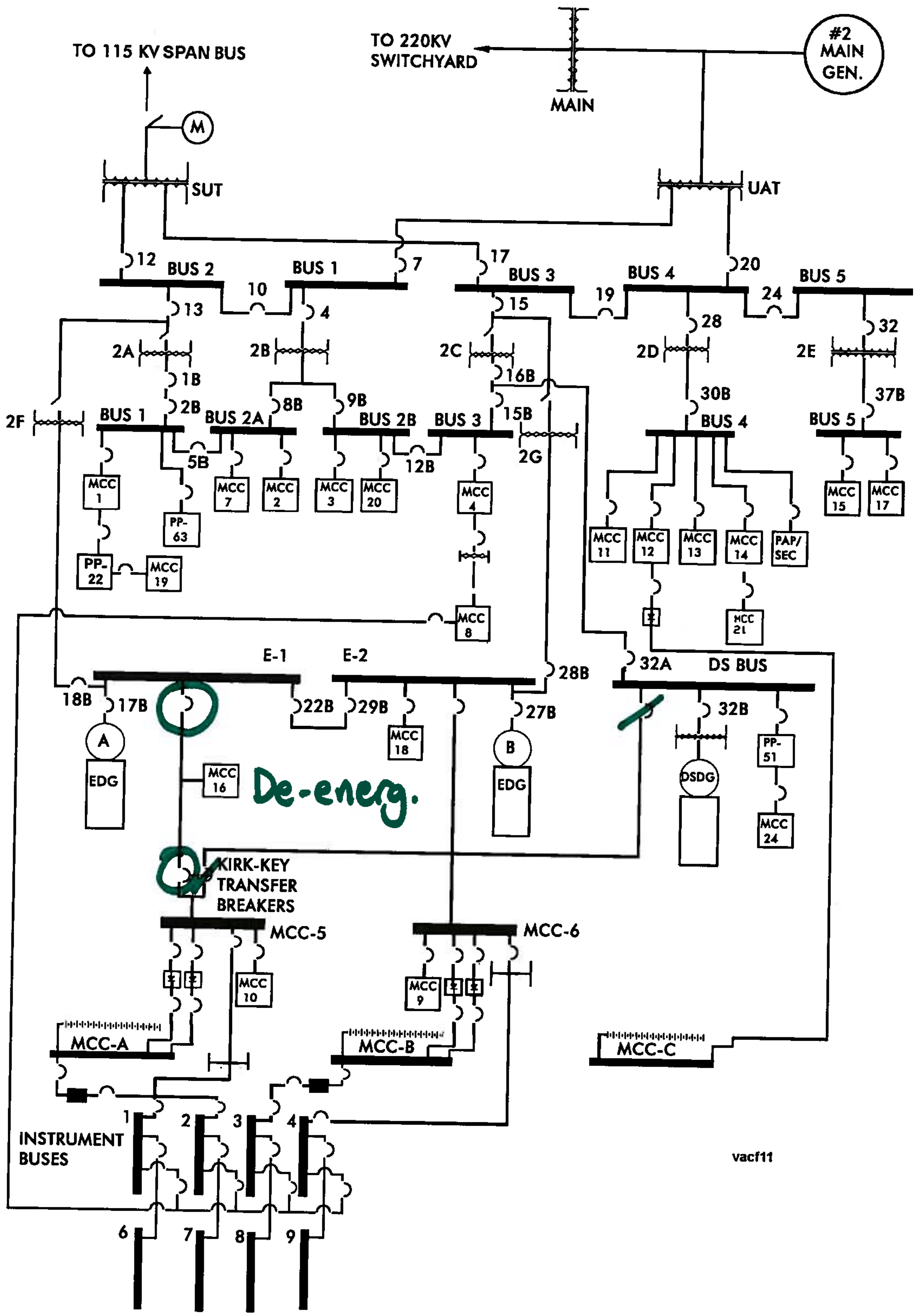
- Security Door-48
- Security Door-49
- Fire Door-17
- Door Seals
- Fan housings and ductwork
- Shaft Seals
- ACU and AHU Doors
- AHU Condensate Drain (Loop Seal)
- Duct Doors and fittings
- Dampers CR-D1A and CR-D1B
- Commode, Lavatory, Water Cooler, and Sink Loop Seals
- Conduit Openings
- Fire Barrier Seals
- Concrete floor, walls and roof

2.4.3 CRDM Power Supply Room (See Figure 3)

Air conditioning of the CRDM Power Supply Room is accomplished with a continuous supply of recirculated air. The system consists of an air-cooled condensing unit and a free-standing air handling unit.

PLANT AC DISTRIBUTION

VAC-FIGURE-11



INFORMATION USE ONLY

17.0 MCC-16

MCC-16

POWER SUPPLY: 480V BUS E-1 (52/21A)   LOCATION: AUX BLDG HALLWAY 2ND LEVEL

CMPT NO.	LOAD TITLE LOAD EDBS TAG NO.	CWD NO.	BKR EDBS NO.
1M	CURRENT LIMITING REACTOR CLRX/MCC-16	1187	N/A
2C	SPARE N/A	N/A	52/MCC-16(2C)
2F	CONTROL ROOM AIR CONDITIONER, HVA-1A HVA-1A	1732	52/MCC-16(2F)
2H	SPARE N/A	N/A	52/MCC-16(2H)
2K	FEED TO LP-42 LP-42	N/A	52/MCC-16(2K)
2M	SPARE N/A	N/A	52/MCC-16(2M)
3B	BLANK N/A	N/A	N/A
3F	DEEPWELL PUMP D DPW-PMP-D	1787	52/MCC-16(3F)
3M	SERVICE WATER BOOSTER PUMP A SWBP-A	845	52/MCC-16(3M)

MCC-5

POWER SUPPLY: 480V BUS E-1 (52/21A) LOCATION: AUX BLDG HALLWAY

CMPT NO.	LOAD TITLE LOAD EDBS TAG NO.	CWD NO.	BKR EDBS NO.
16F	V1-8A, SDAFW PUMP STEAM ISOLATION MS-V1-8A	631C	52/MCC-5(16F)
16J	V6-34B, CV RECIRC COOLER HVH-2 SW OUTLET V6-34B	507	52/MCC-5(16J)
16M	V6-34A, CV RECIRC COOLER HVH-1 SW OUTLET V6-34A	509	52/MCC-5(16M)
17B	MDAFW PUMP ROOM RECIRC FAN, HVH-7B HVH-7B	556	52/MCC-5(17B)
17D	FUEL HANDLING BUILDING UPPER LEVEL EXHAUST GAS, R-21 R-21	87	52/MCC-5(17D)
17FL	SPARE N/A	N/A	N/A
17FR	FEED TO MCC-10 MCC-10	N/A	52/MCC-5(17FR)
17M	45 KVA TRANSFORMER FOR MCC-10 VT/MCC-10	N/A	N/A

50. 063 A1.01 001

Given the following plant conditions:

- A Loss of Offsite Power has occurred.
- BOTH EDGs have failed to auto start.
- EPP-1, Loss of All AC Power, has been implemented.

Which ONE (1) of the following identifies the time limitations of the **design** capacity of the station batteries?

IAW EPP-1, __(1)__ to assure that the station batteries achieve their __(2)__ design time limitations

A. (1) low priority loads will be shed from both DC busses to minimize the discharge rate on both DC buses

(2) 30 minute

B.✔ (1) low priority loads will be shed from both DC busses to minimize the discharge rate on both DC buses

(2) 1 hour

C. (1) Inverter A **OR** Inverter B will be secured to minimize the discharge rate of one DC bus

(2) 30 minute

D. (1) Inverter A **OR** Inverter B will be secured to minimize the discharge rate of one DC bus

(2) 1 hour

The correct answer is B.

A. Incorrect - The first part of distractor is correct. PATH-1 has a continuous action step that requires a battery charger to be restarted within 30 minutes of a power loss. The 30 minutes is to allow for a 30 minute margin to the design limit of 1 hour and ensures that the batteries are not completely discharged.

B. Correct.

C. Incorrect - Securing an Inverter would reduce the discharge rate on one DC bus. However, this will result in a loss of one of the two instrument bus power supplies. EPP-1, Attachment 2, contains CAUTION that states the following: Inverter A AND Inverter B should NOT be shed to ensure power is available to Instrument Buses 2 and 3. PATH-1 has a continuous action step that requires a battery charger to be restarted within 30 minutes of a power loss. The 30 minutes is to allow for a 30 minute margin to the design limit of 1 hour and ensures that the batteries are not completely discharged.

D. Incorrect - Securing an Inverter would reduce the discharge rate on one DC bus. However, this will result in a loss of one of the two instrument bus power supplies. EPP-1, Attachment 2, contains CAUTION that states the following: Inverter A AND Inverter B should NOT be shed to ensure power is available to Instrument Buses 2 and 3. The second part of the distractor is correct.

Question 50
Tier/Group 2/1
K/A Importance Rating - RO 2.5 SRO 3.3

Ability to predict and/or monitor changes in parameters associated with operating the DC electrical system controls including: Battery capacity as it is affected by discharge rate

Reference(s) - Sim/Plant design, System Description, EPP-1, EPP-1BD
Proposed References to be provided to applicants during examination - None
Learning Objective - DC 004
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.5 / 45.7
Comments - K/A match because candidate .

1.0 INTRODUCTION

The DC power system consists of five 125V batteries, each with its own battery charger(s) and DC bus. The five batteries are A, B, C, DS System and DSDG. Two of the batteries, A & B, are safety-related. The battery chargers supply the normal DC loads as well as maintaining each battery fully charged. Each charger has the capacity to supply all normal DC loads and maintain the battery fully charged. For each safety-related station battery, there are two safety-related battery chargers. One battery charger supplies the normal DC loads while the other provides 100% back-up capability.

Each of the two safety-related station batteries is sized to carry its expected shutdown loads following a design basis accident with no battery chargers available for a period of 1 hour without battery terminal voltage falling below minimum allowable voltage. Each of the four safety-related chargers has been sized to charge its partially discharged battery within 24 hours while carrying its normal load.

The DC subsystems associated with the Dedicated Shutdown system and DSDG are described in SD-056, Dedicated Shutdown Diesel Generator

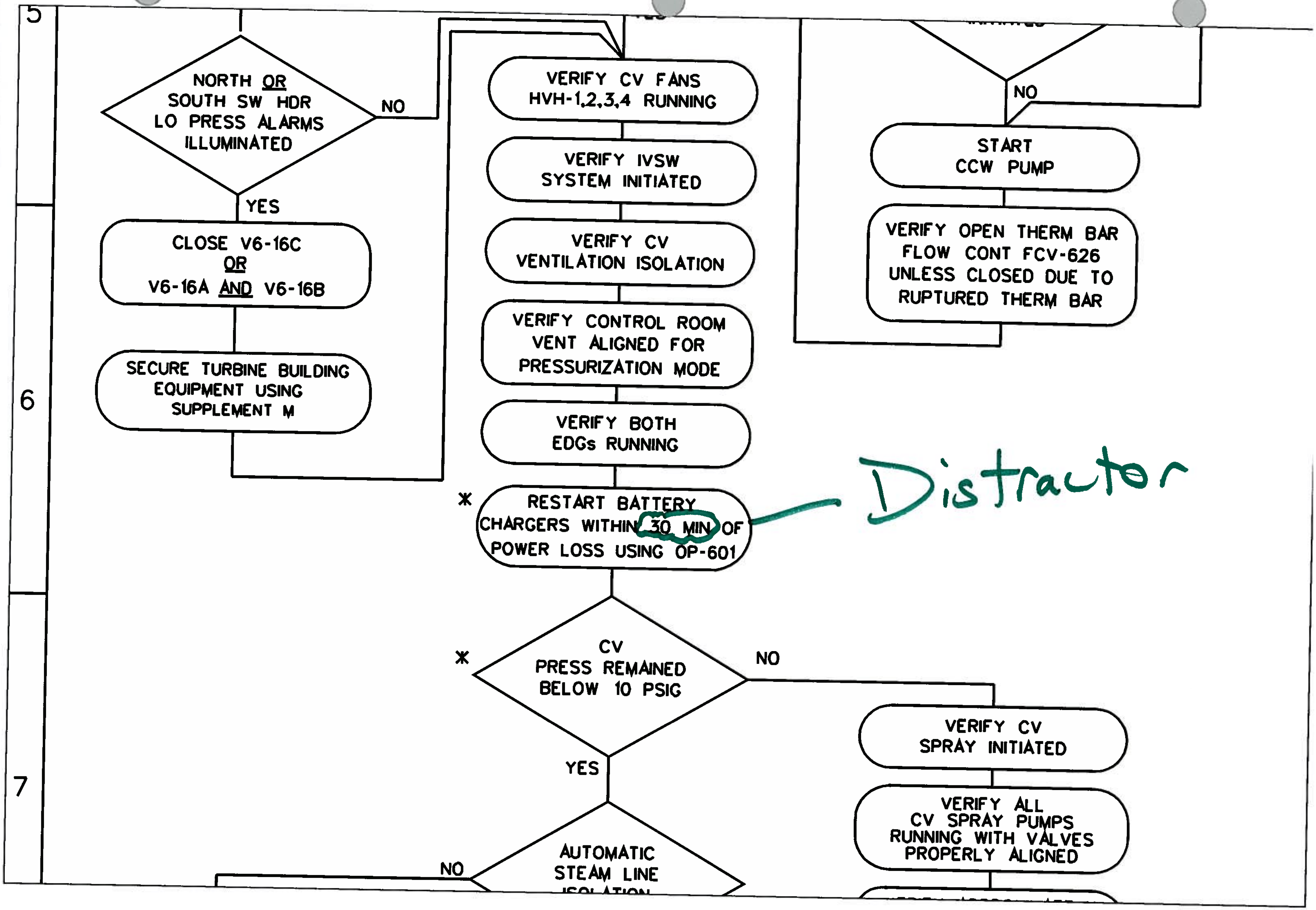
2.0 GENERAL DESCRIPTION

2.1 System Purpose

The purpose of the DC distribution system is to supply control power for nearly all of the electrical system, (an exception is 480VAC Bus 5, which gets control power from a local control power transformer), supply emergency lighting in the event AC power is lost, and to supply electrical power for actuation of solenoid operated valves, reactor protection system relays, and instrument bus inverters A & B.

2.2 System Description (see DC-FIGURE-14)

The 125 volt DC electrical system consists of five independent busses each supplied by a battery and battery charger. Batteries "A" and "B" provide power for vital instruments, for control and for emergency lighting for one hour following a simultaneous Loss of Coolant Accident and a loss of all AC power without battery terminal voltage falling below 110V for "A" battery and 106.8V for "B" battery. Battery "C" provides non-safety related power to the emergency bearing oil pump and the air side seal oil backup pump, and Power Panel "C".



5
NORTH OR SOUTH SW HDR LO PRESS ALARMS ILLUMINATED
NO
YES
CLOSE V6-16C OR V6-16A AND V6-16B
SECURE TURBINE BUILDING EQUIPMENT USING SUPPLEMENT M
VERIFY CV FANS HVH-1,2,3,4 RUNNING
VERIFY IVSW SYSTEM INITIATED
VERIFY CV VENTILATION ISOLATION
VERIFY CONTROL ROOM VENT ALIGNED FOR PRESSURIZATION MODE
VERIFY BOTH EDGs RUNNING
* RESTART BATTERY CHARGERS WITHIN 30 MIN OF POWER LOSS USING OP-601
Distractor
* CV PRESS REMAINED BELOW 10 PSIG
NO
YES
NO
START CCW PUMP
VERIFY OPEN THERM BAR FLOW CONT FCV-626 UNLESS CLOSED DUE TO RUPTURED THERM BAR
VERIFY CV SPRAY INITIATED
VERIFY ALL CV SPRAY PUMPS RUNNING WITH VALVES PROPERLY ALIGNED
AUTOMATIC STEAM LINE
NO
6
7

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
36.	Reduce DC Bus Loads As Follows:	
	a. Check DC Battery A status - ENERGIZED FROM A BATTERY CHARGER	a. Locally shed loads from BOTH Battery A AND B using Attachment 2, Load Shed Listing. Observe the NOTE prior to Step 37 and Go To Step 37.
	b. Locally shed loads from Battery B ONLY using Attachment 2, Load Shed Listing	

CONTINUOUS USE

ATTACHMENT 2

LOAD SHED LISTING

(Page 1 of 4)

Distractor

****

CAUTION

Inverter A AND Inverter B should NOT be shed to ensure power is available to Instrument Buses 2 and 3.

****

NOTE

Flashlights and any handtools needed are located with AOP/EOP/DSP Tool Kits.

1. Shed the following Battery A loads:

   a. 125 VDC MCC-A and Distribution Panel A loads:

      - Breaker 7, Startup Transformer Motor Operated Disconnects
      - Breaker 10, Reactor Trip Breaker "A" & Reactor Trip Bypass Breaker "B"
      - Breaker 12, Rod Drive M-G Set "A"
      - Breaker 13, Main Generator Exciter Field Breaker
      - Breaker 14, Gas Stripper Control Cabinet "A"
      - Breaker 15, Generator Lockout Relay 86P
      - Breaker 22, Turbine Auto Trip

   b. Instrument Bus No.2 loads:

      - Breaker 10, Quenching Valve Control
      - Breaker 13, FIC 632, FIC-155
      - Breaker 15, Turning Gear Automatic Control
      - Breaker 16, Waste Disposal System Panel Misc. Relays

(CONTINUED NEXT PAGE)

RNP DIFFERENCES/REASONS

Supplement G is used for isolating S/Gs.

The following differences have been applied for the S/G level control step:

1. The EPP does not include the adverse containment values as requested by the ERG due to the amount of uncertainties applied to the WR level instrument. The calculation resulted in an unacceptable range of level control. Neither the RNP license basis for SBO, nor the WOG ERG scope for ECA-0.0, include events that would result in adverse containment values, therefore elimination of the adverse values does not alter the ERG intent of the step or procedure.

2. The EPP uses the upper level tap as the analytical value for the upper range of the level control band. The lower range also is slightly lower than that specified by the ERG. Both of these are due to the large amount of uncertanties associated with the WR level which did not allow an adequate level control band. Many of the ERGs use this upper tap as a reference for preventing S/G overfill which is the reason for establishing the level control band.

3. The RNP step has a decision block for power of MCC-5. Once MCC-5 is energized local control of S/G level is no longer required for "A" and "C" S/Gs. "B" is fed to the upper level then isolated locally. The operator is directed to secure feeding and steaming "B" S/G so that it will remain relatively stable. "A" and "C" are steamed in the subsequent steps since the operator will have control of the AFW isolation valves from these S/Gs.

Based on the above, these differences in the control band setpoints and control of level are not a safety significant deviation.

SSD DETERMINATION

This is an SSD per criterion 5, 8, and 10.

36 14 WOG BASIS

PURPOSE: To conserve dc power supply by shedding non-essential dc loads from the dc busses as soon as practical

BASIS:

Following loss of all ac power, the station batteries are the only source of electrical power. The station batteries supply the dc busses and the ac vital instrument busses. Since ac emergency power is not available to charge the station batteries, battery power supply must be conserved to permit monitoring and control of the plant until ac power can be restored.

A plant specific procedure should be prepared to prioritize the shedding of dc loads in order to conserve and prolong the station battery power supply. The plant specific evaluation should consider shedding of equipment loads from the dc busses and of instrumentation from the ac vital busses. The intent of load shedding is to remove all large non-essential loads as soon as practical, consistent with preventing damage to plant equipment. Consideration should be given to the priority of shedding additional loads in case ac power cannot be restored within the projected life of the station batteries. Consideration should also be given to securing a portable diesel powered battery charger to ensure dc power availability.

Since the remaining battery life cannot be monitored from the control room, Step 14 requires personnel to be dispatched to locally monitor the dc power supply. This is intended to provide the operator information on remaining battery life and the need to shed additional dc loads. The plant specific procedure should be structured to ensure communications with the control room operator to ensure his knowledge of dc power status.

RNP DIFFERENCES/REASONS

The EPP directs load shedding using an Attachment. It is expected that Battery Charger A will be restored, as described earlier. The ERG does not make prevision for either Battery Charger being reenergized. The step has been flagged as continuous action due to the time delay in turbine coast-down.

51. 064 K6.07 001

Given the following conditions:

- APP-010-B2, EDG A START AIR LO PRESS, has been received.
- EDG A Air Receiver relief valve DA-11A has lifted and blown down the air receiver pressure to 80 psig prior to reseating.
- At time 1700, EDG A air compressor is currently operating and pressure in EDG A Air Receiver is rising at a rate of 1 psig/min.

Which ONE (1) of the following identifies the EARLIEST time at which the "A" EDG Air Receiver will be pressurized to a value that supports 8 cold starts of the EDG?

A. 1720

B.✓ 1910

C. 1916

D. 1920

Answer is B

A. Incorrect - At 1720 the pressure would be 100 psig. At 100 psig the EDG is assured to start once if called upon.

B. Correct - At 1910 the pressure would be 210 psig. This is ITS LCO 3.8.3 limit and assures that at least 8 cold starts of the EDG can be performed.

C. Incorrect - At 1916 the pressure would be 216 psig which is the AIR START LO PRESS alarm setpoint.

D. Incorrect - At 1920 the pressure would be 220 psig which is the automatic starting pressure setpoint for the EDG Air Compressor when in AUTO.

Question 51
Tier/Group 2/1
K/A Importance Rating - RO 2.7 SRO 2.9

Knowledge of the effect of a loss or malfunction of the following will have on the ED/G system: Air receivers

Reference(s) - Sim/Plant design, OP-604, APP-010, ITS 3.8.4
Proposed References to be provided to applicants during examination - None
Learning Objective - EDG 008
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7 / 45.7
Comments -

ALARM

EDG A START AIR LO PRESS

AUTOMATIC ACTIONS

1. None Applicable

CAUSE

1. Starting Diesel "A"
2. Compressor Control Switch in Off position for an extended period
3. Compressor Supply Breaker Open
4. Failure of Air Compressor Control Circuit
5. Compressor Failure
6. Relief Valve Open
7. Receiver or Piping Rupture

CAUTION
IF the Air Compressor is started in MANUAL and left to run, **THEN** it will continue to run until the relief valve lifts unless returned to automatic.

OBSERVATIONS

1. APP-010-B1, EDG A/B AIR CMPR OVLD

ACTIONS — CK (✓)

1. **IF** required, **THEN DISPATCH** an Operator to investigate the Alarm. ______
2. **IF** annunciator APP-010-B1 is ILLUMINATED, **THEN VERIFY** applicable actions have been completed. ______
3. **IF** pressure is less than 210 psig, **THEN REFER TO** ITS LCO 3.8.3. ______

DEVICE/SETPOINTS

1. PS-4503A / 216 psig Distractor

POSSIBLE PLANT EFFECTS

1. Failure of EDG "A" to start when required

REFERENCES

1. ITS LCO 3.8.3
2. CWD B-190628, Sheet 945, Cable D
3. OP-604, Diesel Generators "A" and "B"

3.8 ELECTRICAL POWER SYSTEMS

3.8.3 Diesel Fuel Oil and Starting Air

LCO 3.8.3 The common stored diesel fuel oil and starting air subsystem for each diesel generator (DG) shall be within limits.

APPLICABILITY: When associated DG is required to be OPERABLE.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more DGs with DG fuel oil level < 19,000 gal and > 14,145 gal in the Unit 2 DG fuel oil storage tank.	A.1 Restore fuel oil level to within limits.	48 hours
B. One or more DGs with DG Fuel oil level < 34,000 gal and > 29,145 gal in the combination of the Unit 1 IC turbine fuel oil storage tanks and the Unit 2 DG fuel oil storage tank.	B.1 Restore fuel oil level to within limits.	48 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One or more DGs with new fuel oil properties not within limits.	C.1	Restore stored fuel oil properties to within limits.	30 days
D. One or more DGs with starting air receiver pressure < 210 psig and ≥ 100 psig.	D.1	Restore starting air receiver pressure to ≥ 210 psig.	48 hours
E. Required Action and associated Completion Time not met. <u>OR</u> Common stored DGs diesel fuel oil or starting air subsystem for each DG not within limits for reasons other than Condition A, B, C, or D.	E.1	Declare associated DG(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	Verify ≥ 19,000 gallons of diesel fuel oil available to the DGs from the Unit 2 DG fuel oil storage tank <u>AND</u> ≥ 34,000 gallons available to the DGs from the combination of the Unit 1 IC turbine fuel oil storage tanks and the Unit 2 DG fuel oil storage tank.	7 days
SR 3.8.3.2	Verify fuel oil properties of stored fuel oil are tested in accordance with, and maintained within the limits of, the Diesel Fuel Oil Testing Program.	In accordance with the Diesel Fuel Oil Testing Program
SR 3.8.3.3	Verify each DG air start receiver pressure is ≥ 210 psig.	31 days
SR 3.8.3.4	Check for and remove accumulated water from each fuel oil storage tank.	31 days

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil and Starting Air

BASES

BACKGROUND

The diesel generators (DG) are provided with a fuel oil storage capacity sufficient to operate one diesel for a period of 7 days while the DG is supplying full load. This onsite fuel oil capacity is sufficient to operate the DGs for longer than the time to replenish the onsite supply from outside sources.

A 275 gallon day tank is located at each of the units. The level in the day tanks is maintained by two electric motor driven transfer pumps taking suction on the 25,000 gallon storage tank. A minimum of 34,000 gallons of fuel oil is maintained on site. This is sufficient to operate one diesel at full load for seven days.

Additional supplies of diesel oil are available in the Hartsville area and from port terminals at Charleston, SC, Wilmington, NC, Fayetteville, NC and Raleigh, NC. Ample trucking facilities exist to assure deliveries to the site within eight hours. Diesel fuel is also available from the internal combustion turbine diesel fuel oil storage tanks (approximately 95,000 gallon total capacity) located at the site and connections are provided for fuel oil transferral to the Unit 2 diesel fuel oil storage tank.

For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. The Diesel Fuel Oil Testing Program provides appropriate testing requirements for DG fuel oil. The fuel oil properties governed by these SRs are the water and sediment content, cloud point, viscosity, and specific gravity (or API gravity).

Each DG has an air start system with adequate capacity for eight successive start attempts on the DG without recharging the air start receiver(s).

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 1), and in the UFSAR, Chapter 15 (Ref. 2), assume Engineered Safety Feature (ESF) systems are OPERABLE. The DGs are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that fuel, Reactor Coolant System and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

Since diesel fuel oil and the air start subsystem support the operation of the standby AC power sources, they satisfy Criterion 3 of the NRC Policy Statement.

LCO

Stored diesel fuel oil is required to have sufficient supply for 7 days of full load operation. It is also required to meet specific standards for quality. This requirement, in conjunction with an ability to obtain replacement supplies within 7 days, supports the availability of DGs required to shut down the reactor and to maintain it in a safe condition for an anticipated operational occurrence (AOO) or a postulated DBA with loss of offsite power. DG day tank fuel requirements, as well as transfer capability from the storage tank to the day tank, are addressed in LCO 3.8.1, "AC Sources – Operating," and LCO 3.8.2, "AC Sources – Shutdown."

The starting air system is required to have a minimum capacity for eight successive DG start attempts without recharging the air start receivers.

APPLICABILITY

The AC sources (LCO 3.8.1 and LCO 3.8.2) are required to ensure the availability of the required power to shut down the reactor and maintain it in a safe shutdown condition after an AOO or a postulated DBA. Since stored diesel fuel oil, and the starting air subsystem support LCO 3.8.1 and LCO 3.8.2, stored diesel fuel oil and starting air are

(continued)

BASES

APPLICABILITY (continued)

required to be within limits when the associated DG is required to be OPERABLE.

ACTIONS

The ACTIONS Table is modified by a Note indicating that separate Condition entry is allowed for each DG. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable DG subsystem. Complying with the Required Actions for one inoperable DG subsystem may allow for continued operation, and subsequent inoperable DG subsystem(s) are governed by separate Condition entry and application of associated Required Actions.

A.1 and B.1

In these Conditions, the 7 day fuel oil supply for a DG is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6 day supply. These circumstances may be caused by events, such as full load operation required after an inadvertent start while at minimum required level, or feed and bleed operations, which may be necessitated by increasing particulate levels or any number of other oil quality degradations. This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of fuel oil to the Unit 2 DG fuel oil tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the DGs inoperable. This period is acceptable based on the remaining capacity (> 6 days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

C.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.2 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties. This period provides sufficient time to test the stored fuel oil to determine that the new fuel oil, when mixed with previously stored fuel oil, remains acceptable, or to restore the stored fuel oil properties. This restoration

(continued)

BASES

ACTIONS

C.1 (continued)

may involve feed and bleed procedures, filtering, or combinations of these procedures. Even if a DG start and load was required during this time interval and the fuel oil properties were outside limits, there is a high likelihood that the DG would still be capable of performing its intended function.

D.1

With starting air receiver pressure < 210 psig, sufficient capacity for eight successive DG start attempts does not exist. However, as long as the receiver pressure is > 100 psig, there is adequate capacity for at least one start attempt, and the DG can be considered OPERABLE while the air receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete restoration to the required pressure prior to declaring the DG inoperable. This period is acceptable based on the remaining air start capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this brief period.

E.1

With a Required Action and associated Completion Time not met, or one or more DG's fuel oil, or starting air subsystem not within limits for reasons other than addressed by Conditions A through D, the associated DGs may be incapable of performing its intended function and must be immediately declared inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil in the storage tanks to support one DG's operation for 7 days at full load. The 7 day period is sufficient time to place the unit in a safe shutdown condition and to bring in replenishment fuel from an offsite location.

(continued)

DIESEL GENERATOR "A" DATA SHEET

CONTINUOUS USE

This revision has been verified to be the latest revision available. ________ Date ______ INIT

PRE START CHECKS			
LUBE OIL SUMP LEVEL SAT / UNSAT (Circle one)	EXPANSION TANK LEVEL SAT / UNSAT (Circle one)	GEN BEARING OIL LEVEL SAT / UNSAT (Circle one)	DAY TANK LEVEL ≥ ½ (SAT) / < ½ (UNSAT) (Circle one)

				Min / Max	After 30 minutes	After 60 minutes
1	PI-4500A	Lube Oil Pressure	psig	20/55		
2	TI-4504A	Lube Oil Temperature	°F	130/225	(3)	(3)
3	PI-4501A	Coolant Discharge Pressure	psig	25/40		
4	TI-4505A	Coolant Water Temperature	°F	105/195		
5	PI-4502A	Fuel Oil Pressure Inlet (black)	psig	Max ΔP 10 (5)		
6	PI-4502A	Fuel Oil Pressure Outlet (orange)	psig			
7	PI-4506A	Scavenging Air Pressure	psig	N/A		
8	PI-4503A	Starting Air Pressure	psig	220/250	(4)	(4)
9	PI-4507A	Crank Case Press	inH_2O	+0.5 max		
10	TI-4513A	Cylinder Temperature #1	°F	(1) (2)		
11	TI-4513A	Cylinder Temperature #2	°F	(1) (2)		
12	TI-4513A	Cylinder Temperature #3	°F	(1) (2)		
13	TI-4513A	Cylinder Temperature #4	°F	(1) (2)		
14	TI-4513A	Cylinder Temperature #5	°F	(1) (2)		
15	TI-4513A	Cylinder Temperature #6	°F	(1) (2)		
16	TI-4513A	Cylinder Temperature #7	°F	(1) (2)		
17	TI-4513A	Cylinder Temperature #8	°F	(1) (2)		
18	TI-4513A	Cylinder Temperature #9	°F	(1) (2)		
19	TI-4513A	Cylinder Temperature #10	°F	(1) (2)		
20	TI-4513A	Cylinder Temperature #11	°F	(1) (2)		
21	TI-4513A	Cylinder Temperature #12	°F	(1) (2)		
22	TI-4513A	Turbo A Inlet Temperature #13	°F	(1) (2)		
23	TI-4513A	Turbo B Inlet Temperature #14	°F	(1) (2)		

EMERGENCY DIESEL GENERATOR DATA SHEET

(1) EE 94-48 allows for cylinder temperatures above 1100°F based on EDG load. The max cylinder temperature is determined using EDG "B" Cylinder Temperature Acceptance Criteria graph.

(2) If EDG temperature variation between cylinders rises to > 300°F, notify Engineering to evaluate cylinder performance.

(3) Send copy of data sheet to Engineering if:

- Lube Oil Temperature exceeds 210°F
- After Cooler Water Temperature exceeds 120°F
- ~~Jacket Water Heat Exchanger Out Temperature exceeds 185°F~~

(4) If pressure is less than 220 psig, then check the compressor is running and raising pressure to greater than 220 psig. (Minimum pressure ≥ 210 psig ITS SR 3.8.3.3)

(5) If fuel oil filter ΔP is greater than 10 psid, take selector valve to opposite filter cartridge and submit a WR to replace filter cartridge. IF ΔP is greater than 10 psid on BOTH filters, take selector valve to mid-position (both filters selected) and contact system engineer.

(6) Contact Engineering if Lube Oil Sump Level is at or below the Add mark. Notify Mechanical Maintenance to add oil if at or below the Add mark.

(7) The Load Indicator reading is taken from where the black arrow points, **NOT** the white line. The white line points to the Load Limit Setter. (ACR 94-01839)

(8) Contact Engineering if Air Compressor Oil Level is at or below the Add mark. Notify Mechanical Maintenance to add oil if at or below the Add mark.

52. 073 G2.2.12 001

Given the following plant conditions:

- OST-924-2, Process Radiation Monitoring System, Section 8.10, Fuel Handling Building Upper Level Monitor Test, is in progress.
- The CKT TEST pushbutton on R-21 has been depressed and held in the depressed position.

Which ONE(1) of the following completes the statement?

Check HVS-4 and __(1)__ **OFF** and those fans are required to be checked __(2)__ when the CKT TEST pushbutton is released.

HVS-4, Fuel Handling Building Supply Air Handling Unit
HVE-15, Spent Fuel Building Exhaust Air Handling Unit
HVE-15A, Spent Fuel Building Exhaust Air Handling Unit

A.✓ (1) HVE-15

(2) ON

B. (1) HVE-15

(2) OFF

C. (1) HVE-15A

(2) ON

D. (1) HVE-15A

(2) OFF

The correct answer is A.

A. Correct

B. Incorrect - The automatic functions provided by the Process Rad. Monitor will be deactivated when the CKT TEST pushbutton is released. This is also specified in the OST to verify that the fans are ON once the CKT TEST pushbutton is released.

C. Incorrect - HVE-15A includes charcoal filters and is placed in service when performing spent fuel activities. HVE-15A provides filtered exhaust for the spent fuel building with HVS-4 providing the supply. R-21 does not have any automatic functions associated with HVE-15A.

D. Incorrect - HVE-15A includes charcoal filters and is placed in service when performing spent fuel activities. HVE-15A provides filtered exhaust for the spent fuel building with HVS-4 providing the supply. R-21 does not have any automatic functions associated with HVE-15A.

Question 52
Tier/Group 2/1
K/A Importance Rating - RO 3.7 SRO 4.1

Process Radiation Monitoring (PRM) System: Knowledge of surveillance procedures.

Reference(s) - Sim/Plant design, OP-924-2, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - RMS 009
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.10 / 45.13
Comments -

8.10. R-21, Fuel Handling Building Upper Level Monitor Test

INIT

1. **VERIFY** Upper Fuel Handling Building Ventilation System in Service for Normal Operation IAW OP-906 with HVS-4 and HVE-15 ON. ____

2. **STATION** operator locally at HVS-4 and HVE-15 to observe fan operation and check fan motors for excessive heating during testing of R-21. ____

NOTE:	Completing an EIR Form IAW OMM-007 is **NOT** required unless the monitor will remain inoperable following testing.

3. **IF** R-21 was **NOT** previously inoperable, **THEN PERFORM** the following: (CR 95-00224)

   a. **DECLARE** R-21 inoperable. ____

   b. **APPLY** the applicable Compensatory Measures from the ODCM Table 3.10-1. ____

   c. **RECORD** time action statement entered. Time ________ ____

NOTE:	APP-010-E7, HVE-14/15 AIR FLOW LOST/OVLD, alarm may take greater than 20 seconds to illuminate.

4. **DEPRESS AND HOLD** the CKT TEST pushbutton. ____

5. **CHECK** the following:

   - CKT TEST light ILLUMINATED ____
   - ALARM/RESET light ILLUMINATED ____
   - Display indicates 288K OR 289K ____
   - APP-036-D8, PROCESS MONITOR HI RAD, ILLUMINATED ____
   - RMS recorder, RR-1, point #25 LED alarm ILLUMINATED ____
   - HVS-4 AND HVE-15 OFF ____
   - APP-010-E7, HVE-14/15 AIR FLOW LOST/OVLD ILLUMINATED ____

NOTE:	The rate meter has three error codes. An error is indicated by a number 1, 2, or 3 in the center digit of the display with the rest of the display blank. A number 1 or 2 indicates a ROM or a RAM error; a number 3 indicates both a ROM and a RAM error.

6. **IF** 288K **OR** 289K is **NOT** displayed **OR** an error code is displayed, **THEN PERFORM** the following:

   a. **RELEASE** CKT TEST pushbutton. ____

   b. **MAINTAIN** R-21 inoperable. ____

   c. **INITIATE** a priority two Work Request for repairs. ____

   d. **DISCONTINUE** this section. ____

7. **RELEASE** CKT TEST pushbutton. ____

8. **CHECK** the following:

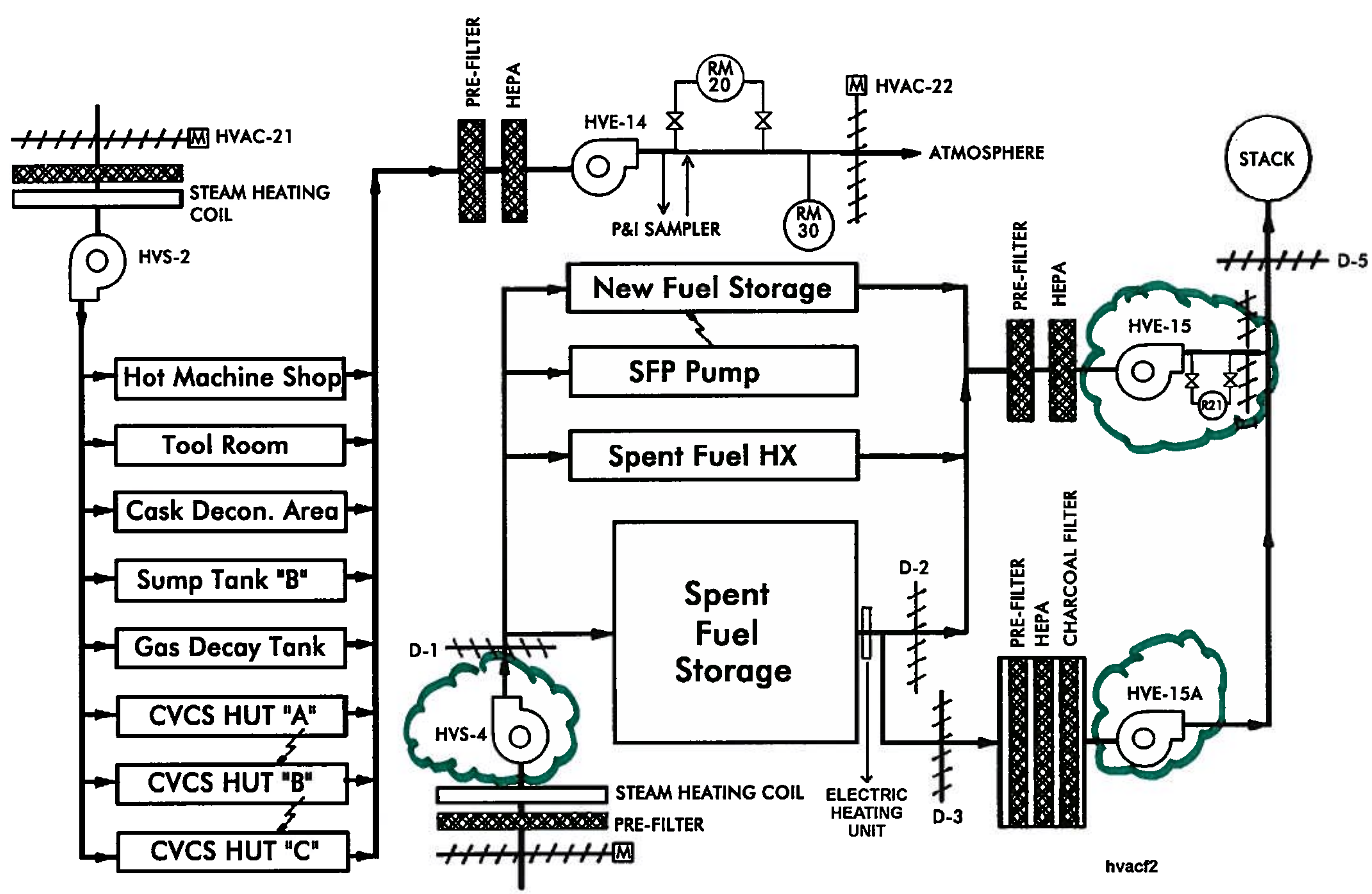
   - CKT TEST light EXTINGUISHED ____
   - ALARM/RESET light EXTINGUISHED ____
   - APP-036-D8, PROCESS MONITOR HI RAD, EXTINGUISHED ____
   - RMS recorder, RR-1, point #25 LED alarm EXTINGUISHED ____
   - HVS-4 AND HVE-15 ON ____
   - APP-010-E7, HVE-14/15 AIR FLOW LOST/OVLD EXTINGUISHED ____

9. **SIMULTANEOUSLY PERFORM** the following:

   - **DEPRESS AND LATCH** the HV OFF pushbutton. ____
   - **START** the stopwatch. ____

FUEL HANDLING BUILDING VENTILATION

HVAC-FIGURE-2



INFORMATION USE ONLY

53. 076 G2.4.18 001

Given the following plant conditions:

- A plant trip and safety injection has occurred due to multiple events.
- The crew is implementing PATH-1.
- "C" and "D" SW Pumps have tripped and cannot be restarted.
- North and South SW Header pressures are 35 psig.

Which ONE(1) of the following completes the statement below?

Based on the conditions above the action required by PATH-1 is to close __(1)__ ONLY and the basis for this action is to ensure __(2)__.

A. (1) V6-16A, SW NORTH HEADER SUPPLY TO TURBINE BUILDING

(2) adequate cooling flow to the EDGs

B✓ (1) V6-16C, SW ISOLATION TO TURBINE BUILDING

(2) adequate cooling flow to the EDGs

C. (1) V6-16A, SW NORTH HEADER SUPPLY TO TURBINE BUILDING

(2) SW Booster Pumps will not trip on low SW pressure

D. (1) V6-16C, SW ISOLATION TO TURBINE BUILDING

(2) SW Booster Pumps will not trip on low SW pressure

The correct answer is B.

A. Incorrect - Only closing V6-16A will not isolate SW to the Turbine Building. V6-16B must also be closed or V6-16C. Candidate may think that since "C" and "D" SWPs tripped that V6-16A is the only valve required to be closed since these pumps supply the North Header. The second part of the distractor is correct.

B. Correct -

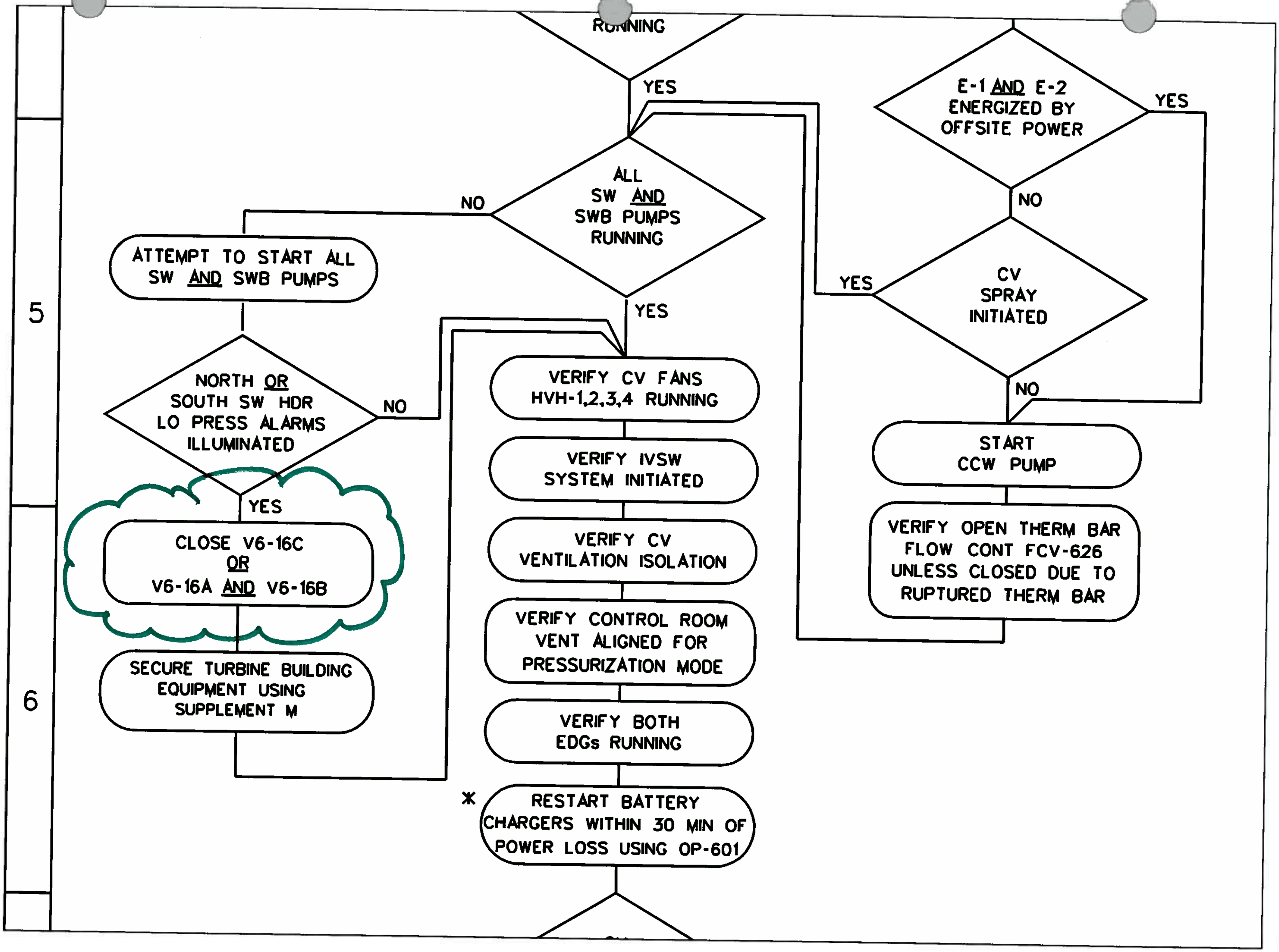
C. Incorrect - Only closing V6-16A will not isolate SW to the Turbine Building. V6-16B must also be closed or V6-16C. Candidate may think that since "C" and "D" SWPs tripped that V6-16A is the only valve required to be closed since these pumps supply the North Header. Under normal and blackout conditions, if SW Booster pump suction pressure drops below 12 psig for 10 seconds the SW Booster pump will trip. However, this is not the bases for isolating the turbine building on low header pressure.

D. Correct. The first part of the distractor is correct. Under normal and blackout conditions, if SW Booster pump suction pressure drops below 12 psig for 10 seconds the SW Booster pump will trip. However, this is not the bases for isolating the turbine building on low header pressure.

Question 53
Tier/Group 2/1
K/A Importance Rating - RO 3.3 SRO 4.0

Service Water System (SWS): Knowledge of the specific bases for EOPs.

Reference(s) - Sim/Plant design, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - SW 007
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.10 / 43.1 / 45.13
Comments -


RUNNING
YES
E-1 AND E-2 ENERGIZED BY OFFSITE POWER
YES
NO
ALL SW AND SWB PUMPS RUNNING
NO
ATTEMPT TO START ALL SW AND SWB PUMPS
YES
CV SPRAY INITIATED
YES
NO
START CCW PUMP
VERIFY OPEN THERM BAR FLOW CONT FCV-626 UNLESS CLOSED DUE TO RUPTURED THERM BAR
NORTH OR SOUTH SW HDR LO PRESS ALARMS ILLUMINATED
NO
YES
CLOSE V6-16C OR V6-16A AND V6-16B
SECURE TURBINE BUILDING EQUIPMENT USING SUPPLEMENT M
VERIFY CV FANS HVH-1,2,3,4 RUNNING
VERIFY IVSW SYSTEM INITIATED
VERIFY CV VENTILATION ISOLATION
VERIFY CONTROL ROOM VENT ALIGNED FOR PRESSURIZATION MODE
VERIFY BOTH EDGs RUNNING
* RESTART BATTERY CHARGERS WITHIN 30 MIN OF POWER LOSS USING OP-601
5
6

GRID	WOG STEP	BASIS/DIFFERENCES

A-5 N/A

RNP STEP

NORTH OR SOUTH SW HDR LO PRESS ALARMS ILLUMINATED

WOG BASIS

N/A, this step is not in the WOG ERG.

RNP DIFFERENCES/REASONS

The SW calculations for the EDGs assume that for certain single failures the Turbine Building is isolated. An automatic isolation signal has been provided to close the Turbine Building isolation valves in the event of a trip with low SW header pressure present. If the low pressure alarms are present these valves should be closed (subsequent step). This step checks these alarms present. If the alarms are not present (successful previous step), then the subsequent Turbine Building isolation is bypassed.

SSD DETERMINATION

This is an SSD per criterion 10.

A-6 N/A

RNP STEP

CLOSE V-6C OR V-6A AND V-6B

WOG BASIS

N/A, this step is not in the WOG ERG.

RNP DIFFERENCES/REASONS

This step was added to the EOP to reflect the need to assure EDG cooling under certain single failure criteria. SW calculations for EDG cooling assume that SW to the Turbine Building is isolated 10 minutes into the event in order to assure adequate cooling flow to the EDGs. The automatic isolation circuitry installed by previous modification is non-Q and non-safety related, therefore cannot be credited with the isolation under accident analysis. The analysis credits this manual step in the EOP.

SSD DETERMINATION

This is an SSD per criterion 4 and 10.

A-6 N/A

RNP STEP

SECURE TURBINE BUILDING EQUIPMENT USING SUPLEMENT M

WOG BASIS

N/A, this step is not in the WOG ERG.

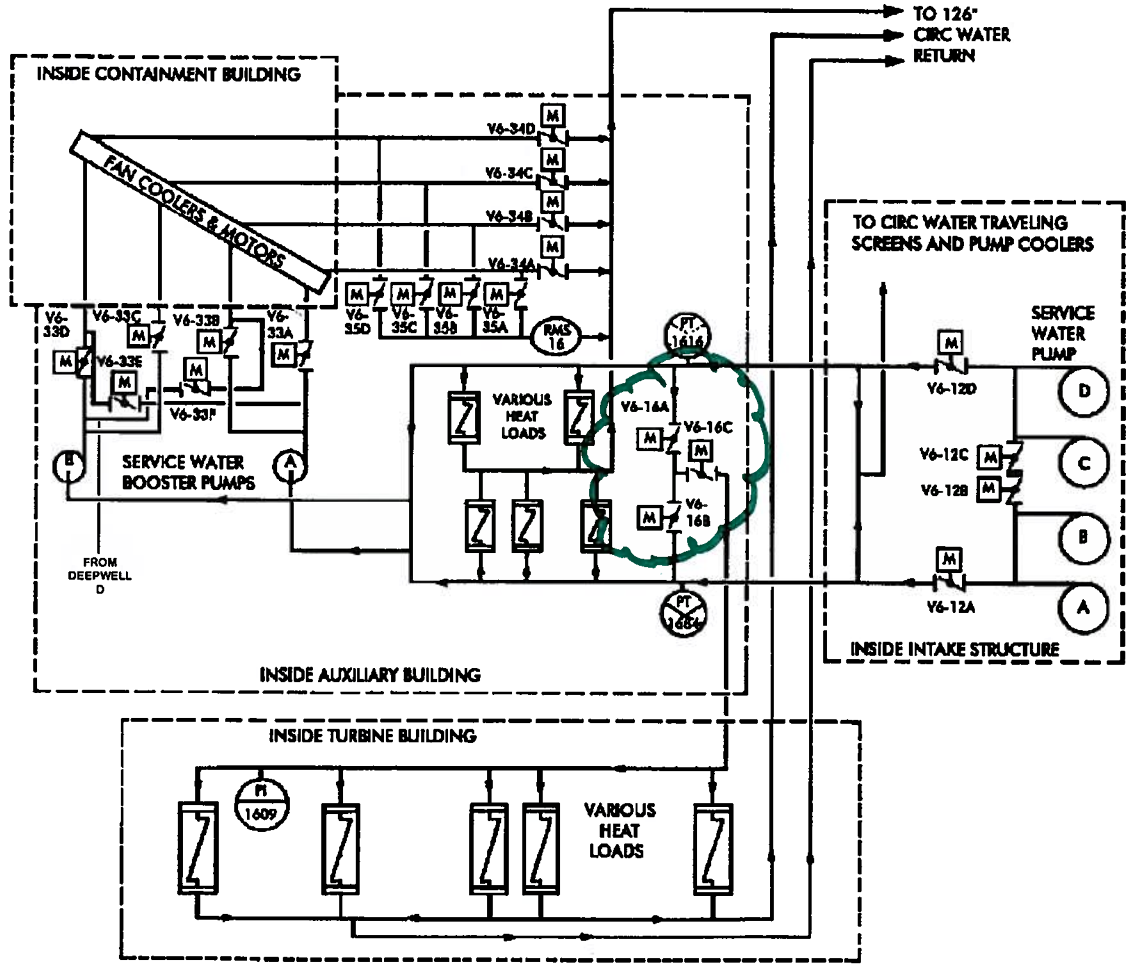
RNP DIFFERENCES/REASONS

This step has been added as part of the actions necessary from the previous step to isolate cooling to the Turbine Building. Since SW has been isolated the components cooled by SW must be secured to prevent damage.

SSD DETERMINATION

This is an SSD per criterion 4 and 10.

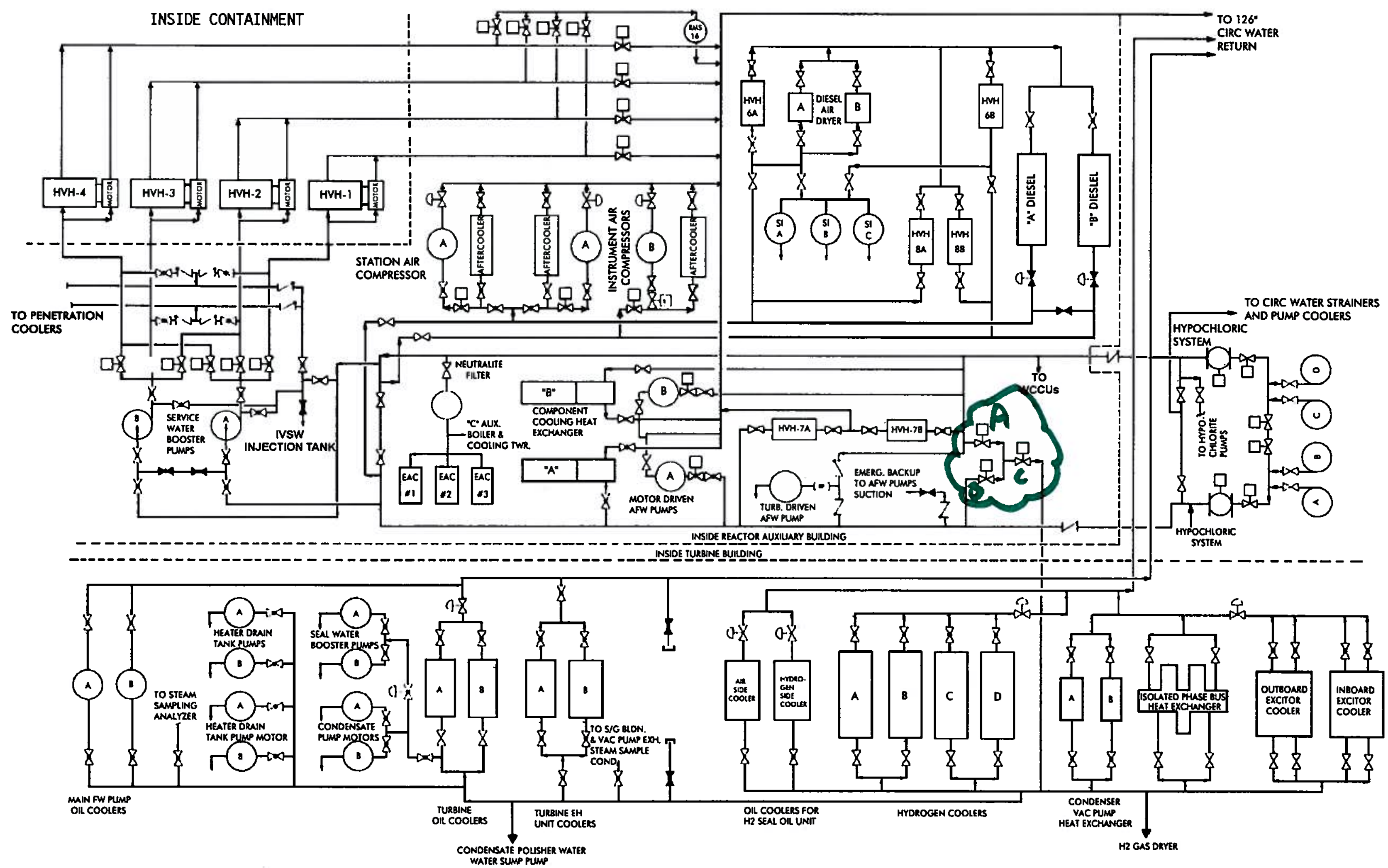
SIMPLIFIED SERVICE WATER SYSTEM
SW-FIGURE-1



swf01

INFORMATION USE ONLY

SERVICE WATER SYSTEM LOADS
SW-FIGURE 2



swf02

3.2 SW North and South Header

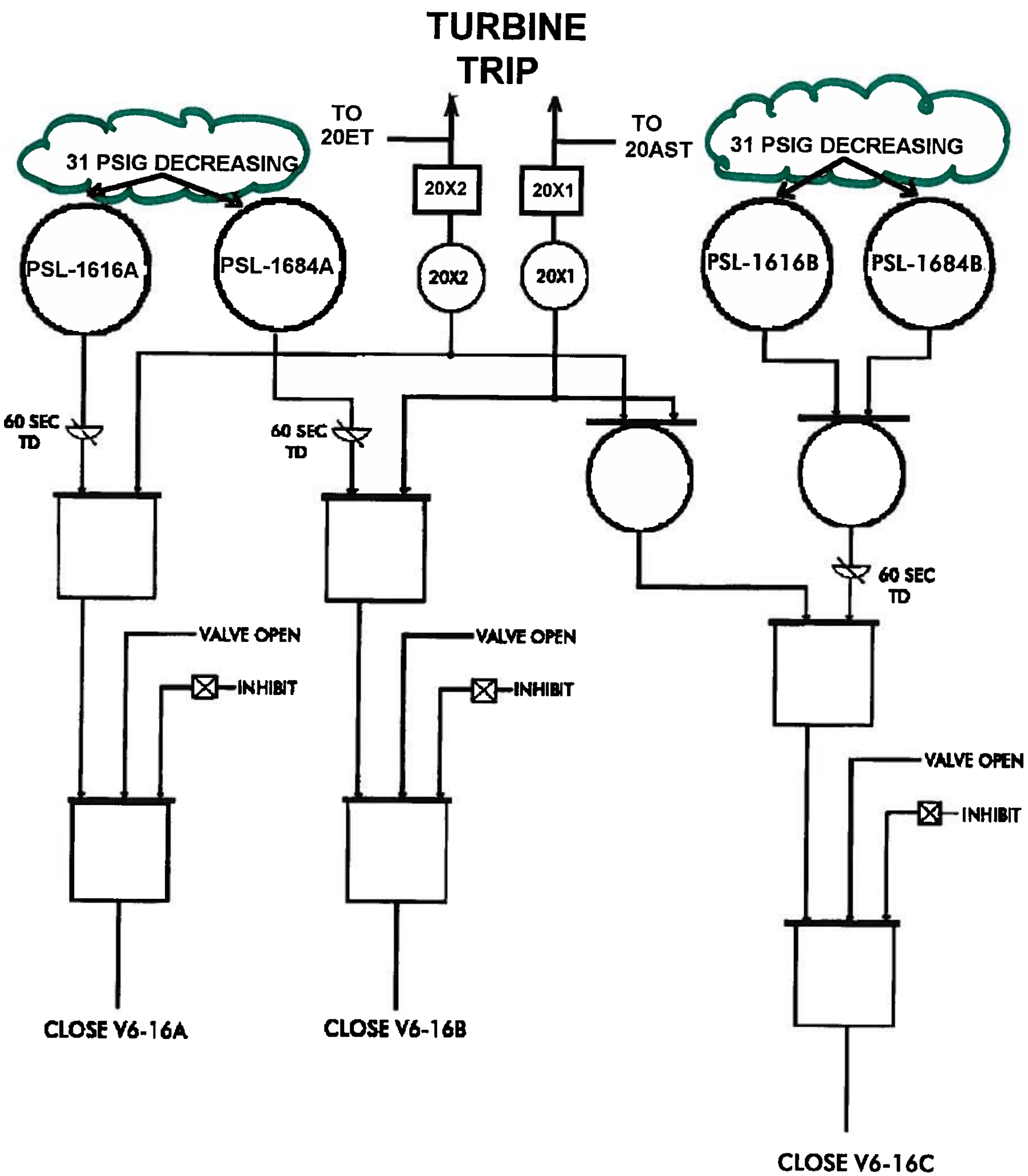
Normally three SW Pumps are running supplying full system needs through two headers, each capable of passing full system flow. Four valves are installed to cross connect SW Pump discharge (V6-12B & C) and to isolate the North or South SW Header (V6-12A & D). These valves are normally open and are controlled at the RTGB. Since the operation of these valves can be lost due to flooding, APP-008 windows D7, D8, E7, and E8 provide high water annunciation for the SW pits. Operators use these alarms in determining if and when these valves should be configured for safe shutdown operation.

Pressure transmitters (PT-1616 and 1684) provide RTGB indication and alarm capability for the North and South headers, respectively. Header pressures should be maintained between 40 to 50 psig with less than four SW pumps operating, and between 40 to 55 psig with four pumps operating. Indicated SW Header pressure on these gauges is approximately three psig less than SW Pump discharge pressure at the pumps.

The SW North and South Headers also supply water to the Turbine Building Header. The North Header supplies through Valve V6-16A and the South Header supplies through Valve V6-16B. In addition, Valve V6-16C is used to completely isolate the North and South Header from the Turbine Building Header. The normal power supply of Valve V6-16C is MCC-10. If MCC-10 loses its power V6-16C motor control will automatically switch to MCC-9 as the power supply. If a sustained low SW Header pressure occurs in coincidence with a Turbine Trip Signal all three valves will automatically close; with an alarm provided on APP-008. (See SW-Figure 4)
The North SW Header can be further isolated by removing the spacer plate downstream of V6-12D and substituting a blank plate. The South Header does not currently have this function. Plant Modification (ESR 96-00707) will install this feature in the South Header at a later date.

During Refueling Outage (RFO) 19, a portion of the North SW Header underground piping was replaced with above ground piping. This replacement was due to several minor leaks in this portion of the SW System. It is believed that a combination of failure of the external pipe coating, lack of cathodic protection, and poor installation techniques contributed to these piping failures. The above ground piping is enclosed in a Class I structure capable of protecting against a loss of function during a design basis tornado. In addition to the pipe replacement, this modification added a flow venturi (FE-1752), and moved the North SW Header Supply Check Valve (SW-541) and pressure instrumentation (PT-1616, PSL-1616A and B) to outside the Auxiliary Building in the Class I enclosure. (ESR 98-00509)

TURBINE BUILDING SW ISOLATION LOGIC (SIMPLIFIED)
SW-FIGURE-4



swf04

INFORMATION USE ONLY

Upon a Blackout signal, all SW Pumps and SW Booster Pumps "A" and "B" will automatically start. (ESR 97-00520) SWBP suction pressure must be > 30 psi for the booster pump to start. Upon an "S" signal (safety injection actuation), all SW Pumps and both SW Booster Pumps "A" and "B" will automatically start regardless of suction pressure.

Electrical power for the four SW Pumps will be supplied from the onsite diesel generators in the event of loss of all offsite power. For this condition, the SW System is designed to supply cooling water to only the required emergency systems. Under the conditions of a concurrent loss-of-coolant accident (LOCA) and loss of offsite power, any two of four pumps using the emergency diesel power are capable of supplying the required cooling capacity.

Following a simultaneous LOCA and loss of offsite power, the cooling water requirements for all four fan cooling units and the other essential loads can be supplied by any two of the four SW Pumps during the injection and long term recirculation phase of the Safety Injection System.

The Emergency Operating Procedures provide instructions for monitoring and verification of required SW System operation during plant accidents and security events.

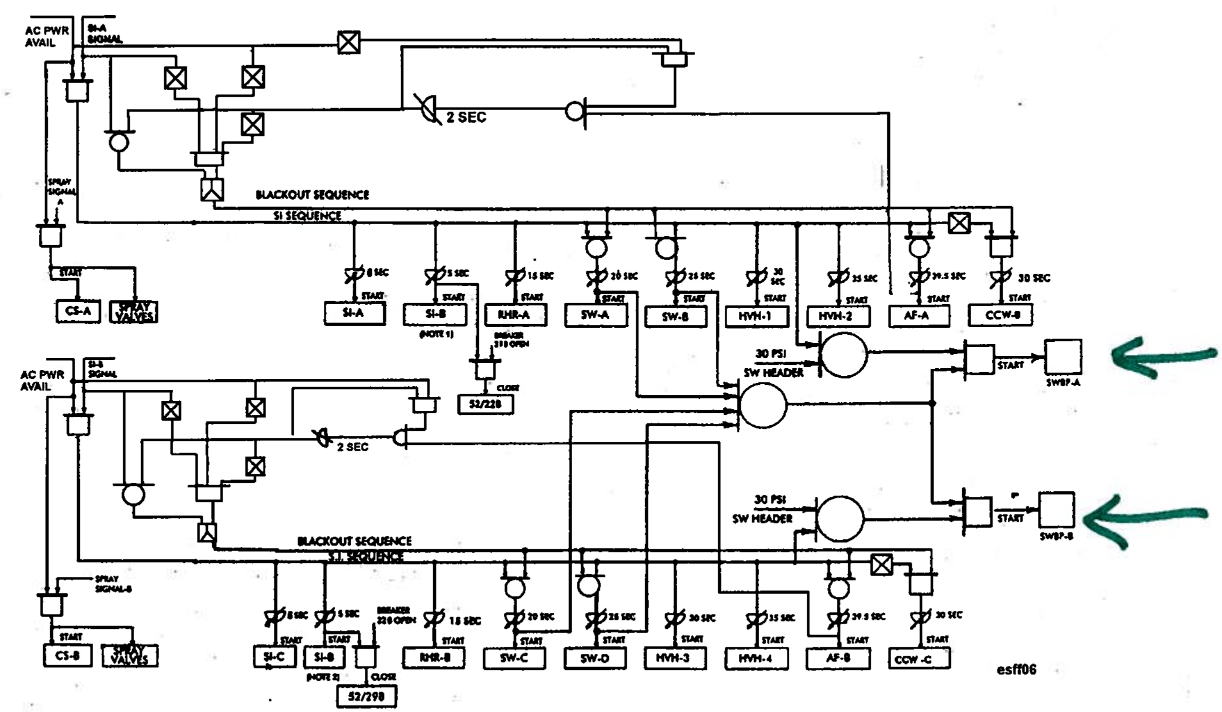
6.4 Probabilistic Safety Assessment

Probabilistic Safety Assessment (PSA) is an analytical technique for estimating in a quantitative manner the risk the plant presents to the health and safety of the public. The technique employs event trees to model postulated accident progression and fault trees to model accident mitigating system. The PSA model estimates the core damage, estimated as an annual frequency.

The SW Pumps, Booster Pumps, North and South Headers, MOVs, alternate cooling valve alignments to specific components, and the alternate supply capability to supply makeup to the Condensate Storage Tank are important components in the PSA in regards to risk reduction. They are relied upon to mitigate accident scenarios by providing the necessary cooling for the RCS and secondary plant.

LOGIC DIAGRAM - SAFEGUARDS SEQUENCING LOGIC

ESF-FIGURE-6



INFORMATION USE ONLY

54. 078 K2.02 001

Given the following plant conditions:

- The unit tripped due to a loss of off-site power.
- "A" EDG output breaker failed to close and cannot be manually closed.
- EPP-25, Energizing Supplemental Plant Equipment using the DSDG, has been completed.

Which ONE(1) of the following identifies the air compressor(s) available to be restarted under these conditions?

A. Instrument Air Compressor "A" ONLY

B. Instrument Air Compressor "B" ONLY

C✓ Instrument Air Compressors "A" AND "B" ONLY

D. Instrument Air Compressors "A" AND "B" and the Primary Air Compressor.

The correct answer is C.

A. Incorrect. "B" IAC is also available since E-2 is energized.

B. Incorrect. "A" IAC is also available since MCC-5 has been energized by the DSDG. This answer would have been correct had EPP-25 not been implemented.

C. Correct.

D. Incorrect. The Primary Air Compressor is powered from 480V Bus 2A. EPP-25 does have steps to perform a backfeed that could re-energize 480V Bus 2A, however, this was not given in the stem of the question.

Question 54
Tier/Group 2/1
K/A Importance Rating - RO 3.3 SRO 3.5

Knowledge of bus power supplies to the following: Emergency air compressor

Reference(s) - Sim/Plant design, System Description, EDPs, EPP-25
Proposed References to be provided to applicants during examination - None
Learning Objective - AIR 005
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7
Comments -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

****

CAUTION

DSDG output is limited to 2000 KW, or 345 amps, due to the bus limitation of 3000 amps between the DSDG Output Transformer and the Dedicated Shutdown Bus.

****

8. Check MCC-5 Status - DEENERGIZED — Go To Step 14.

9. At The DEDICATED SHUTDOWN BUS, Close Breaker, FEED TO MCC-5 (ALT POWER) (CMPT-34C)

> NOTE
>
> Kirk-Key Interlocked Breakers for transferring MCC-5 to the DS Bus are located in the Auxiliary Building Hallway opposite the WASTE DISPOSAL BORON RECYCLE PANEL.

10. Transfer MCC-5 To The DS Bus Using The Kirk-Key Interlocked Breakers

11. Locally Verify The Following Breakers at MCC-5 - CLOSED

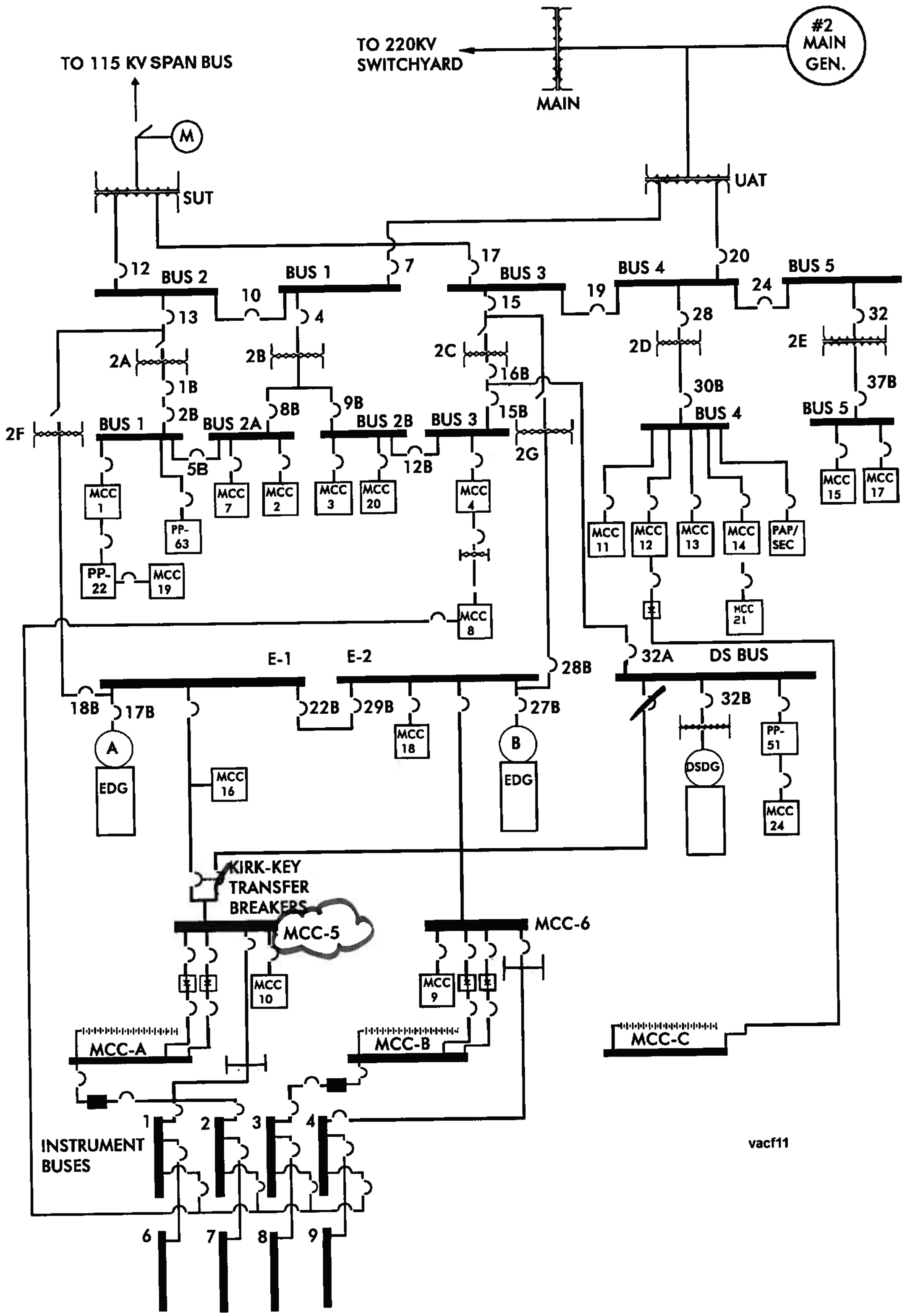
    - BATTERY CHARGER A-1 (CMPT-5B)
    - INSTRUMENT AIR COMPRESSOR A (CMPT-7M)
    - BATTERY CHARGER A (CMPT-11CR)

12. Restore INSTRUMENT AIR COMPRESSOR A As Follows:

    a. Locally place the INSTRUMENT AIR COMPRESSOR A CONTROL PANEL Switch to AUTO

PLANT AC DISTRIBUTION

VAC-FIGURE-11



INFORMATION USE ONLY

administrative barrier to introducing nitrogen into the IA System. This precaution is necessary since the IA System can supply breathing air to supplied-air respirator. This interconnection is to be used in the event of a dedicated shutdown emergency, where IA is not available for steam generator power operated relief valve operation and nitrogen is available to the steam dump nitrogen accumulator.

3.0 COMPONENT DESCRIPTION

3.1 IA "A" & "B" Compressor Package

The "A" & "B" IACs are 200 scfm, Ingersoll Rand, non-lubricated, single stage reciprocating, 100 psig compressors. The water jackets for cylinder cooling are supplied by SW and limits air discharge temperature to 415°F. The aftercoolers are shell and tube heat exchangers with SW on the shell side and will reduce the air outlet temperature to 100°F. Air temperature at the receiver discharge is maintained at about 110°F by controlling the SW flow to the compressor water jackets and the aftercoolers. SW is automatically secured when the compressor is stopped, via a solenoid valve. This prevents condensation buildup in the cylinder. The compressors and receiver are equipped with internal baffles, traps, and relief valves. The compressors are powered from MCC-5 for IAC “A” and MCC-6 for IAC “B”. The compressors discharge into a 150 cubic foot vertical air receiver, located in the Auxiliary Building hallway. The air dryers have a capacity of 200 scfm each, and are of the refrigeration type, which will maintain air dew point of minus 10°F.

NOTE: Design dew point for Refrigerant type dryers is 40 degrees at 100°F with 100% Humidity, can be lower with lower ambient temperature or lower humidity. The power supplies for the Air Dryers are MCC-9 for IA Dryer “A” and MCC-10 for IA Dryer “B”.

3.2 IA”D” Compressor and Dryer Package

IAC "D" will alternate with the PAC to supply the IA System throughout the plant. IAC “D” is an Atlas Copco model ZT90-110, rotary screw type compressor, rated at 110 psig. The oil free rotary compressor is fully integrated in a sound insulated package. The compressor is completely air cooled which eliminates a costly water cooled system. Discharge cooling air is ducted out of the compressor enclosure area. The duct is routed up to the ceiling, penetrating the roof and discharges to the outside. Twin rotors in the compression elements are of asymmetric screw type - fully synchronized and precision engineered. No rotor-to-rotor or rotor-to-casing contact occurs thereby totally eliminating the need for oil lubrication in the rotor chamber. Power supply for the IAC “D” package is from MCC-13. The package includes the compressor, the cooling fan, the dryer rotating motor and the dryer cooling fan. MCC-13, which is located above the condensate polisher control room, is supplied from 480V Bus 4. Freeze protection for the package is provided by FPP-31, circuit 12 which is supplied from PP-29, circuit 12.

"D" IA Dryer is an Atlas Copco model MD200, adsorption type desiccant dryer, rated at 506 scfm (at 14.5 psi & 68°F). The pressure vessel incorporates a rotating drum with permanently impregnated desiccant that is in a honeycomb pattern. This eliminates dusting and removes all the moisture through adsorption. The drum only rotates when the compressor is loaded so that hot regeneration air is available. The maximum speed of the drum is 6 revolutions per hour, driven through a worm gear.

The Dryer operates with continuous regeneration, utilizing air that bypassed the compressor aftercooler. This air is still hot and unsaturated and is used to regenerate the drum by evaporating the moisture adsorbed through the drying process.

The moisture saturated regeneration air is cooled in the regeneration cooler before flowing into the ejector and rejoining the main air stream assuring all the air that is compressed to be used in the IA system. This process eliminates the need for electric heaters and the need to purge during regeneration which results in power savings.

The desiccant dryer is efficient in removing all moisture (93% more water than a refrigerated dryer) and is capable of design dew points of minus 22°F. The lower dew point for compressed air will prevent condensation and buildup of foreign material in air operated valves.

3.3 PAC Package

The PAC and the PAC dryer is also a Atlas Copco unit. Except for the rating, it is identical to IAC "D". The PAC is a Atlas Copco ZT-55 compressor and can provide 284 scfm at 110 psig or roughly 300 scfm at 100 psig. This is more than adequate capacity for normal conditions. The PAC is powered from MCC-17. Discharge cooling air is ducted out of the compressor enclosure area, up to the ceiling, penetrating the roof and discharges to the outside. The compressor has a moisture separator after the second stage and at the dryer that removes condensate from the compressed air. Drain lines will be routed from the drain traps to the floor drain next to "D" IAC. All drain traps where water will collect will be freeze protected. Freeze protection is provided by FPP-26, circuit 15 (which is fed from MCC-2).

HAA

The Atlas Copco MD-100 is a regenerative type desiccant dryer and has a capacity of 327 scfm. It will provide a dew point less than 0 °F under any conditions, which more than meets the 32 °F design requirement. Per the vendor literature no special afterfilter is needed with the desiccant dryer because the drying material does not generate dust. The

Air Dryer is powered from MCC-17.

3.4 SAC Package

The SAC is a Ingersoll Rand, 400 scfm single stage reciprocating, 100 psig, oil lubricated type compressor. The water jackets for cylinder cooling are cooled by SW. The aftercooler is a shell and tube type heat exchanger with SW on the shell side. Cooling water is automatically secured when the compressor is stopped, via a solenoid valve. This prevents condensation buildup in the cylinder. The SAC is powered from 480V Bus 2B. The compressor discharges to a 150 cubic foot, vertical air receiver.

3.5 Carbon Monoxide (CO) Monitor and Breathing Air

The CO monitor samples IA that is used for breathing air. For protection of personnel this air is monitored for CO by AE-1702. A local (Aux. Bldg. Hallway) alarm light and horn will sound if the concentration reaches approximately 10 ppm. This monitor is calibrated by SIC-033.

There is an MSA air distribution manifold which is used by Radiation Control to supply breathing air to workers using air-supplied respirators. The MSA device contains a breathing air manifold with a regulator.

4.0 INSTRUMENTATION

4.1 IAC "A" & "B" Instruments

See Attachment 10.2

4.2 PAC Controls and Indication

See Attachment 10.3

4.3 IAC "D" Instruments

See Attachment 10.4

4.4 SAC Instruments

See Attachment 10.4

4.5 Carbon Monoxide Monitor

55. 103 A4.09 001

Given the following plant conditions:

- Mode 1 at 100% RTP.
- APP-002-B7, CV NAR RANGE HI/LO PRESS illuminates.
- CV Pressure indicates **- 0.4** psig and degrading.

Which ONE (1) of the following identifies the action necessary to clear the alarm IAW OP-921, Containment Air Handling?

A. Stop HVH-1 and HVH-3 to raise CV pressure gradually.

B. Start CV Purge to equalize the CV pressure with atmospheric pressure.

C✓ Open Containment Vacuum Relief Valves V12-12 and V12-13 until pressure is restored.

D. Open Containment Pressure Relief Valves V12-10 and V12-11 until pressure is restored.

The correct answer is C.

A: Incorrect. Stopping HVH-1 and HVH-3 would allow the CV temperature and pressure to rise but is not the method designed to relieve the negative pressure in the CV.

B: Incorrect. OP-921 requires that CV pressure be less than 0.1 psig to start a CV Purge. Although this condition is satisfied, and the CV Purge would equalize the CV pressure with atmospheric pressure, this is not the method designed to correct this condition.

C: Correct. Opening the CV Vacuum Relief valves will correct a negative pressure in the CV.

D: Incorrect. Opening the CV Pressure Relief valves is not the proper method of relieving a negative pressure in the CV. OP-921 allows the use of the CV Vacuum Relief valves to relief a positive pressure in the CV if the CV Pressure Relief valves are inoperable. This makes this choice plausible.

Question 55
Tier/Group 2/1
K/A Importance Rating - RO 3.1 SRO 3.7

Ability to manually operate and/or monitor in the control room: Containment vacuum system.

Reference(s) - Sim/Plant design, OP-921 Section 8.4.3, APP-002
Proposed References to be provided to applicants during examination - None
Learning Objective -CV-007, CVHVAC Objective 3
Question Source - ILC-11-1 NRC EXAM
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7 / 45.4 to 45.8
Comments -

TABLE OF CONTENTS

CONTINUOUS USE

INIT

8.4.2 Containment Vacuum Relief When Containment Integrity is Required

1. Initial Conditions

a. This revision has been verified to be the latest revision available. ________ ____
Date

> **NOTE:** The CV NAR RANGE HI/LO PRESS annunciator (LO setpoint) alarms at -0.4 psig. (APP-002-B7)

b. Electrical Distribution is in service IAW OP-603. ____

c. Instrument and Station Air System is in service IAW OP-905. ____

d. **VERIFY** Containment Ventilation Isolation is **RESET**. ____

e. **VERIFY** the Containment Purge Supply and Exhaust valves **CLOSED**: (ITS LCO 3.6.3)

V12-6 ____

V12-7 ____

V12-8 ____

V12-9 ____

8.4.2 (Continued) INIT VERI

2. Instructions

a. **PLACE** CV VAC RELIEF V12-12 & V12-13 Control Switch to the open position. ____

b. **CHECK**, by position indicating lights, the following are **OPEN**.

V12-12 ____

V12-13 ____

CV Intake Damper ____

c. **WHEN** Containment pressure reaches between -0.025 psig and 0.0 psig on PI-950B, **THEN PERFORM** the following:

1) **PLACE** the CV VAC RELIEF V12-12 & V12-13 Control Switch to the close position. ____

2) **VERIFY**, by position indicating lights, the following are **CLOSED**.

V12-12 ____ ____

V12-13 ____ ____

CV Intake Damper ____

	Initials	Name (Print)	Date
Performed By:	________	________________________	__________
	________	________________________	__________
	________	________________________	__________

Approved By: ________________________________ __________
Shift Manager Date

ALARM

CV NAR RANGE HI/LO PRESS

AUTOMATIC ACTIONS

1. None Applicable

CAUSE

High

1. Instrument Air **OR** Nitrogen Leakage in the CV
2. Secondary leakage in the CV
3. RCS leakage in the CV

Low

1. Cooldown of CV atmosphere following purge **OR** pressure relief.

OBSERVATIONS

1. Containment Vessel Pressure Indicators PI-950B, PI-951, PI-953, PI-955, PI-950A, PI-952, and PI-954.

ACTIONS		CK (✓)
1.	**IF** excessive RCS leakage is indicated, **THEN REFER TO** AOP-016.	______
2.	**IF** excessive Secondary, Instrument Air, **OR** Nitrogen leakage is indicated, **THEN INITIATE** efforts to repair, as appropriate.	______
3.	**IF** Instrument Air pressure can **NOT** be maintained, **THEN REFER TO** AOP-017.	______
4.	**IF** required, **THEN PERFORM** a CV pressure relief using OP-921.	______
5.	**IF** required, **THEN PERFORM** a CV vacuum relief using OP-921.	______
6.	**REFER TO** ITS LCO 3.6.4.	______

DEVICE/SETPOINTS

1. PC-950B / +0.9 psig
2. PC-950B / -0.4 psig

POSSIBLE PLANT EFFECTS

1. TECH SPEC LCO

REFERENCES

1. ITS LCO 3.6.4
2. AOP-017, Loss of Instrument Air
3. AOP-016, Excessive RCS Leakage
4. OP-921, Containment Air Handling
5. Hagan Drawing, H5957D73 (5379-3505)
6. CWD B-190628 Sh 496

56. 001 A3.05 001

Given the following plant conditions:

- The plant is operating at 25% RTP.
- Control Bank C step counters indicate **225 steps**.
- Control Bank D step counters indicate **105 steps.**
- Rod Control is in AUTOMATIC.
- A malfunction in the Automatic Rod Control Circuitry causes the rods to insert.
- The rods are stopped when the Rod Bank Selector Switch is taken to Manual(M).
- The Group Step Counters for Control Bank C and D did not function properly.
- A review of ERFIS identified that Control Bank D Rods inserted **10 inches.**

Which ONE(1) of the following identifies what the Group Step Counters for Control Banks C and D would indicate if operating properly?

	Bank C	Bank D
A.✓	217 steps	89 steps
B.	223 steps	95 steps
C.	215 steps	95 steps
D.	209 steps	89 steps

The correct answer is A.

A. Correct. 10 inches equates to 16 steps. Control Bank D will step in 16 steps to 89 steps. Control Bank C will not begin stepping in until Control Bank D is at 97 steps. Control Bank C will therefore only step in 8 steps to a final position of 217 steps.

B. Incorrect - This distractor incorrectly correlates 10 inches of IRPI to 10 steps on the Group Step Counters. The distractor for Bank C has to correct overlap assuming 10 steps on Bank D.

C. Incorrect - This distractor incorrectly correlates 10 inches of IRPI to 10 steps on the Group Step Counters. The distractor for Bank C does not account for the proper overlap and incorrectly assumes that the Bank C rods will move once Bank D rods begin to insert.

D. Incorrect - The position given for Bank D is correct. The position given for Bank C does not account for proper overlap and incorrectly assumes that the Bank C rods will move once Bank D rods begin to insert.

Question 56
Tier/Group 2/2
K/A Importance Rating - RO 3.5 SRO 3.5

Ability to monitor automatic operation of the Control Rod Drive System, including: Individual vs. group rod position

Reference(s) - Sim/Plant design, System Description, ITS
Proposed References to be provided to applicants during examination - None
Learning Objective -RDCNT 007
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.13
Comments - .

Banks A and B, the Bank Overlap unit directs the Master Cycler to pulse slave cyclers 1 AC and 1 BD simultaneously at Master Cycler count zero and Slave Cyclers 2 AC and 2 BD simultaneously at count three. In addition, the Bank Overlap unit directs Power Cabinet 1 AC to select the Control Bank A - Group 1 mechanism, Power Cabinet 2 AC to select the Control Bank A - Group 2 mechanisms, Power Cabinet 1 BD to select the Control Bank B - Group 1 mechanisms, and Power Cabinet 2 BD to select the Control Bank B - Group 2 mechanisms. During the overlap condition, the Group 1 mechanisms of Control Banks A and B move simultaneously, the Group 2 mechanisms of Control Banks A and B move simultaneously.

The six overlap setpoints (S1, S2, S3, S4, S5, S6) are preset by the six digital thumbwheel switches located in the rod control equipment (logic cabinet). This sequence provides a 97 step overlap between banks.

S1	(Start B with A)	128 Steps
S2	(Stop A)	225 Steps
S3	(Start C with B)	256 Steps
S4	(Stop B)	353 Steps
S5	(Start D with C)	384 Steps
S6	(Stop C)	481 Steps

Selection of individual banks for motion out of the normal programmed sequence is accomplished with the Bank Selector Switch through the Bank Overlap Unit. When an individual bank is selected, the counting feature of the Bank Overlap Unit is locked out. Before the system is put back into overlapped bank operation by selecting MANUAL or AUTOMATIC on the Bank Selector Switch, the banks must be manually returned to the position held before the individual banks were moved.

Individual bank motion is not used for normal operation except for mechanism testing, special physics testing, and recovery of dropped rods.

3.5.5 Failure and Alarm Circuits

The Logic Cabinet circuit detects two types of alarms: urgent and non-urgent. Each of these are further subdivided into two subclasses of circuits: those devoted to detecting internal alarm conditions, and those devoted to detecting external Power Cabinet alarm conditions.

3.5.5.1 Urgent Alarm - Logic Cabinet

A Logic Cabinet urgent alarm performs the following functions:

- Inhibits all rod motion
- Energizes a red light at the Logic Cabinet.

removal of the command signal, all rod motion stops. However, a group still in sequential motion will complete its entire step before halting. Reversal of direction is programmed such that the last group which ceased motion will be the first to move in the new direction. Staggered stepping of the groups within banks is controlled by the Master Cycler.

5.5.8 Bank Overlap

The rod program requires overlapping of control banks. Control Bank A is withdrawn until it reaches a preset position above the center of the core. At this point, Control Bank B starts moving out in synchronism with Bank A. Control Bank A stops when it reaches the top of the core and Bank B continues until it reaches a preset position above the center of the core. At this point, Bank C moves out in synchronism with Bank B. Bank B motion then stops and Bank C sequencing continues until it reaches a preset position above the center of the core where Bank D engagement occurs. Banks C and D are withdrawn together until Bank C reaches the top of the core. Bank D withdrawal then continues as required for control. In the overlap region, Group 1 rods of each of the two overlapped banks are stepped simultaneously; similarly, the Group 2 rods of the two overlapped banks are stepped simultaneously.

5.6 Protection

5.6.1 Control Rod Insertion Monitor

The control rod group insertion limits are calculated as a linear function of power and reactor coolant average temperature. An insertion limit monitor with two setpoints is provided for each control bank. The "Low" alarm alerts the operator of an approach to a reduced shutdown reactivity situation requiring boron addition by following procedures with the CVCS. If the actuation of the "Low-Low" alarm occurs, the operator should take immediate action to add boron to the system. (Refer to RDCNT-Figure-24)

5.6.2 Interlocks

The rod control group used for automatic control is interlocked with measurements of turbine-generator load to prevent automatic control rod withdrawal below 15 percent of nominal power. The manual and automatic controls are further interlocked with measurements of nuclear flux,.T, and rod drop indication to prevent approach to an overpower condition. These are the rod stop interlocks which are explained in the next section.

The operator is able to select any single bank of rods for manual operation. This is accomplished with a multiposition switch so that he may not select more than one bank. He may also select automatic or manual reactor control, in either case, however, the

(P-A) Converter Drawer. The P-A could require an adjustment IAW AOP-001 in the event of a dropped or mis-aligned control rod.

4.2 System Indication (Refer to RPI-Figure-23 & 24)

The following are indicators for monitoring system operation:

- A rod position indicator is located on the RTGB for each full length rod. The indicators are arranged in banks and groups and are calibrated to indicate inches or steps of rod height from 0 to 144 inches or 0 to 225 steps. (indicator actually reads 0 to 250 steps)
- A red rod bottom LED indicator is provided for each full length rod. This light is located directly below the associated indicator, and indicates that the control rod is less than 12.5" (20 steps) from the bottom of the core.

4.2.1 RTGB Rod Position Indication

The original RTGB rod position indicators were analog meters that could not be replaced or calibrated on line. It was necessary to remove an entire bank from the RTGB to access one indicator. Therefore as part of the IRPI upgrade to the Hurst NARPI modules (ESR-99-00392) during RFO-20 IAW, the RTGB indicators were also replaced. The new indicators were designed to fit into the exact same opening in the RTGB as the original indicators.

The RTGB indicators are designed to accept the 0-3.5 VDC input from the Hurst NARPI Modules. These indicators use a bar of LEDs instead of a pointer needle. The LED indicators provide improved readability. The indicators are scaled from 0 to 250 steps. One step is 5/8", so this scale represents 0 to 156.25". The normal range of travel of a control rod is 0 to 143.75" equal to 0 to 230 steps. The 0 to 250 step scale is internal to the indicator. An external scale is mounted on each bank/group of control rods in an inch scale. In this manner, a control room operator will have both scales available to read.

This external scale is ranged from 0 to 150" and will be divided into 20" as a major interval, 10" as a minor interval, and 2.5" as a sub-minor interval. This yields a scale accuracy of 1.25". There are one hundred LED bars over the 250 step scale. This results in an accuracy of the LED bars to 2.5 steps. This results in an overall accuracy of 1.5" on the scale.

The LED indicators are powered from Instrument Bus 7A, Ckt 10. This is a safety related electrical bus. If this power supply is lost, RTGB indicator readout (LED's) will extinguish. However, the Rod Bottom LED will still illuminate if a control rod should drop. The Rod Bottom LED is powered from it's individual NARPI Module.

NOTE: The use of ERFIS is an acceptable alternate method for determining ARPI System Operability IAW Improved Tech Specs if the RTGB RPI indicators are not indicating properly. In cases where both indications (RPI and ERFIS) are tracking closely, and one of the indications is outside the required limits with the other indication still within the limits, ERFIS should be considered the most accurate indication and actions taken should be based on the ERFIS indication. If the ERFIS readout is used to replace the RPI indicators, it shall be continuously displayed on a terminal accessible to the Reactor Operator. (ESR 97-00611)

4.2.2 RTGB Rod Position Indicator Specification

Manufacturer	Weschler-Bowmar
Input Voltage - Indicator	0.075 to -3.67 VDC
Input Voltage – Rod Bottom Light	24 VAC
Power Requirements	35 Watts at 120 VAC
Readability	±1.5"
Accuracy	±0.5%

4.3 Setpoints

Rod Bottom Bistable (Dropped Rod annunciator)	20 steps
Rod Bottom Bypass Bistable	35 steps
Rod deviation (ERFIS printout):	
• Bank position ≥ 200 steps deviation between ~~individual rod position~~ indicator and bank counter	±15 inches
• Bank position < 200 steps deviation between individual rod position and the average of the individual rod positions	±7.5 inches

NOTE: 1 Step = 5/8 inch

4.4 Alarms (RPI-Figure-25)

57. 011 K2.02 001

Which ONE (1) of the following identifies (in the order presented) the normal power supplies for the Pressurizer Heaters?

Control Group _____, Backup Group A _____, Backup Group B _____

1. 480V Bus 1
2. 480V Bus 2A
3. 480V Bus 2B
4. 480V Bus 3

A.✓ 3, 1, 2 2B, 1, 2A

B. 3, 2, 4 2B, 2A, 3

C. 4, 3, 1 3, 2B, 1

D. 2, 1, 3 2A, 1, 2B

The correct answer is A.

A. Correct.

B. Incorrect. First P/S is correct. Bus 2A is the P/S for B/U Group B. Bus 3 does not provide normal power supply but is used if necessary to energize pressurizer heaters through the DS Bus.

C. Incorrect. Bus 3 does not provide normal power supply but is used if necessary to energize pressurizer heaters through the DS Bus. The second and third choices do provide power to PZR heaters, just not to those groups.

D. Incorrect. All three of the busses provide power to pressurizer heaters, they are listed in the incorrect order.

Question 57
Tier/Group 2/2
K/A Importance Rating - RO 3.1 SRO 3.2

Knowledge of bus power supplies to the following: PZR heaters

Reference(s) - Sim/Plant design, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - PZR 005
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7
Comments -

The control bank and both backup groups are operated from the RTGB.

Power Supply:	Control Bank	- 480V BUS 2B
	Backup Group A	- 480V BUS 1
	Backup Group B	- 480V BUS 2A

The capability exists to power 150 kW of PZR heaters from Emergency Bus E1 and another 150 kW of heaters from emergency bus E2. This capability would be used during a loss of offsite power event to ensure proper RCS pressure control capability is maintained. The power supply must be manually transferred to the selected emergency bus following the loss of offsite power to ensure that the PZR temperature remains above the RCS temperature. Once the power supply is transferred, the heaters are controlled from the RTGB. If the PZR heaters are being powered from one of the emergency busses, they will automatically trip upon receipt of a Safety Injection Signal, to ensure the Emergency Diesel Generators are not overloaded by these non-safety related loads. This trip feature is enabled by the PZR Heater "Arm" switch in the E1/E2 room. PZR control group heaters can also be energized from the DS bus in the event of a loss of all AC power.

3.3 PZR Spray Lines

Spray nozzle press drop at max. flow	15.0 psi at 70°F
Continuous spray rate	1 gpm
Pipe Diameter	4 in.
Pipe Schedule	160
Design Pressure	2485 psig
Design Temperature	650°F

The PZR spray system is designed to pass a total flow of 600 gpm, 300 gpm per valve. The driving force of the spray water is a combination of the differential pressure between the hot and cold legs and the velocity head obtained by using a scoop in the reactor coolant piping.

The spray nozzle, which is also protected with a thermal sleeve, is connected to the head of the PZR. It is designed to produce a narrow angle cone spray pattern that prevents cold water impingement on the PZR walls.

The spray water is drawn from cold legs of loops B and C. The two lines tie together downstream of the control valves, form a loop seal, and supply water through a single spray nozzle. The loop seal is provided to prevent the backup of steam into the piping when the spray valves are closed. A small continuous spray flow is provided, by means of the throttle valves (needle valves) which bypass the spray valves, to help ensure that the PZR liquid is in chemical equilibrium with the rest of the reactor coolant system (RCS) and to prevent thermal shock of the spray piping and the auxiliary spray connection.

58. 015 K6.01 001

Given the following plant conditions:

- Plant is at 100% RTP.
- N-42 Power Range Detector A fails LOW.

Which ONE (1) of the following completes the statement below?

The __(1)__ Section Deviation alarm will be received and NI-42C, Delta Flux Meter, will be pegged __(2)__.

A. (1) Upper
(2) HIGH
No

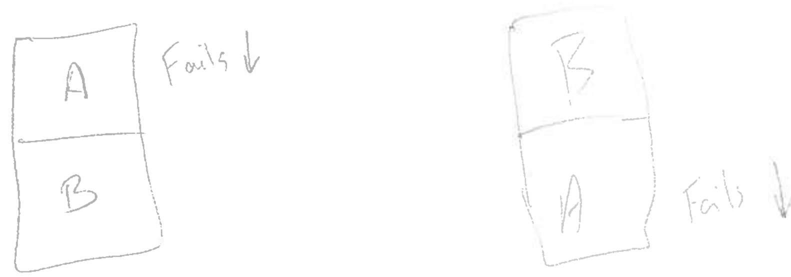
B✓ (1) Upper
(2) LOW
OK

C. (1) Lower
(2) HIGH
OK

D. (1) Lower
(2) LOW
No

Answer is B

Detector A is the upper detector for the power ranges. The failure of the detector low will cause the % power indication on N-42 to deflect lower than the actual power level, since the upper and lower detectors combine through a summator to create the overall % power output on the NI drawer. The delta flux meter is driven from the QTop - QBottom = Delta flux signal. The QTop signal has been lost and will drive the output of the delta flux circuit negative. APP-005-F3, PR UPPER CH HI FLUX DEV will be received and the Misc Drawer will indicate that an upper section deviation has occurred.



Question 58
Tier/Group 2/2
K/A Importance Rating - RO 2.9 SRO 3.2

Knowledge of the effect of a loss or malfunction on the following will have on the NIS: Sensors, detectors, and indicators

Reference(s) - Sim/Plant design, System Description, OWP-011, APP-005, FMP-009
Proposed References to be provided to applicants during examination - None
Learning Objective - NIS SD-010-010
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.7
Comments -

current-type signal from a compensated ionization chamber. The IR provides extended flux coverage from the upper end of the SR to approximately 100 percent power. The signal conditioning equipment furnishes an analog output voltage proportional to the logarithm of the neutron flux spectrum. Each channel covers approximately eight decades of leakage flux. Isolation amplifiers (for startup-rate circuits, remote recording, remote indication, etc.) and bistables (for permissives, rod stop and reactor trip) use this analog voltage to indicate plant status and provide the necessary plant protection functions. All relays associated with plant control or protection is located in the logic or auxiliary relay racks.

2.4.3 PR Instrumentation

PR Outputs (See Figure 5)

Source	Signal To	Type of Signal
Isolation Amplifier NM301 (Detector A)		
	Upper Flux Comparator	0-10Vdc
	ERFIS Computer Input	0-5Vdc
	Remote Meter (Delta Flux) (NI-41C, 42C, 43C, 44C)	0-1mAdc
	Remote Recorder NR41, 42, 43, 44	0-5Vdc
	Spare	0-50mVdc
Isolation Amplifier NM306 (Detector A)		
	ΔT Overpower-Overtemp Compensation (N-41, 42, 43)	0-10Vdc F(ΔI)
Isolation Amplifier NM302 (Detector B)		
	Lower Flux Comparator	0-10Vdc
	ERFIS Computer	0-5Vdc
	Remote Meter (Delta Flux) NI-41C, 42C, 43C, 44C	0-1mAdc
	Remote Recorder NR-41, 42, 43, 44	0-5Vdc
	Spare	0-50mVdc
Isolation Amplifier NM307 (Detector B)		
	ΔT Overpower-Overtemp Compensation (N-41, 42, 43)	0-10Vdc F(ΔI)
Isolation Amplifier NM303 (Total Power)		
	Spare	0-10Vdc
	ERFIS Computer	0-5Vdc

10^{-11} amperes per roentgen per hour when operated uncompensated, and is reduced to approximately 3×10^{-13} amperes/R/hr in compensated operation. The detectors are positioned with their centers at an elevation corresponding to one half of the core height.

The IR Detectors are constructed to have two N_2 filled chambers, one inside the other. Both the inner and outer surfaces of the outside chamber is coated with Boron-10. The inner chamber has no coating and operates in the recombination region. Both neutron and gamma reactions occur in the outer chamber while only gamma reactions occur in the inner chamber. The output of the inner chamber is subtracted from the output of the outer chamber which results in a net output caused by neutron radiation only. The outer chamber operates in the ion chamber region.

Overcompensation of the IR signal can occur if the compensating voltage is set too high causing a reduction of the IR signal out. Undercompensation of the IR signal occurs when the compensation voltage is set too low causing an increase of the IR signal out. Overcompensation causes the IR output signal to be nonconservative.

The detectors are connected to the junction box with high temperature radiation resistant cables that are mineral insulated. The cables are insulated their full length with fiberglass sleeving to prevent grounding to the detector well. The cable is terminated with an amphenol triaxial connector. The connector is sealed with an epoxy to make them moisture tight.

Note: GP-006, NORMAL PLANT SHUTDOWN FROM POWER TO HOT SHUTDOWN, has a precaution concerning these detectors.

"Impurities which may be present in the Intermediate Range detectors can prevent the IR range currents from decreasing to the P-6 reset (10^{-10} amps) in a normal manner. This situation can be identified by observing NI-35, NI-36, NI-51A and NI-52A. If NI-51A and NI-52A are indicating less than 10^2 cps, and NI-35 OR NI-36 is not less than 10^{-10} amps, the PERMISSIVE P-6 DEFEAT pushbuttons should be depressed to energize the Source Range detectors" (Ref. ACR 92-071)

3.1.3 PR Detectors

The remaining four assemblies contain the PR Uncompensated Ionization Chambers, (see Figure 10). Each assembly provides two signal currents corresponding to the neutron flux in the upper (A) and lower (B) detectors of a core quadrant. These detectors have a total neutron sensitive length of five feet and a nominal thermal neutron sensitivity for each section of 1.7×10^{-13} amperes per neutron per square centimeter-second. Gamma sensitivity of each section is approximately 10^{-10} amperes per roentgen per hour.

The PR detectors are a single N_2 filled chamber with all internal surfaces coated with boron to make the detector sensitive to neutrons. Compensation for gamma radiation is not required for two reasons: the neutron produced signal in the PR is approximately a

NI-41, Power Range

1. This revision has been verified to be the latest revision available.

   ______________________ (Print) ______________________________ ________
   Name Signature Date

2. System: NI Work Request No:______________

3. Component: NI-41, Power Range

4. Scope of Work:

   Perform maintenance on Nuclear Instrument NI-41.

5. Testing required on redundant equipment prior to rendering component inoperable:

   N/A

6. Precaution:

   1) To prevent an inadvertent reactor trip or loss of Source Range instrumentation, maintain three Power Range channels in service.

   2) Reference ITS Table 3.3.1-1 Items 2, 5, 6, 17.c and 17.d for applicable required actions.

   3) Removing Instrument Power Fuses satisfies ITS Table 3.3.1-1 requirement for inserting the Lo Power Range Trip. These actions are N/A if power is greater than P-10 or the reactor is subcritical. The fuses must remain removed to satisfy the requirement to insert the trip until either the channel is ready to be tested **OR** the plant is placed in a condition **NOT** requiring the trip.

   4) This OWP has been screened IAW PLP-037 criteria and determined to be outside the bounds of an infrequently performed test.

7. Valve/Breaker/Switch lineup has been completed.

____________________/________
Signature Date

8. **IF** Reactor Power is ≥ 75% and the input to the QPTR monitor is or will be out of service, **THEN** a flux map IAW ITS SR 3.2.4.2. is required within 12 hours and Reactor Engineering must be notified.

____________________/________
Signature Date

9. Clearance Issued (If applicable)

Clearance No:____________________

10. I&C Maintenance lineup complete.

____________________/________
Signature Date

11. Clearance removed and Valve/Breaker/ Switch lineup restored to normal.

____________________/________
Signature Date

12. Power Range NI-41 has been declared operable.

____________________/________
Signature Date

VALVE, BREAKER, SWITCH LINEUP

COMPONENT DESCRIPTION	POSITION FOR MAINTENANCE			RESTORED POSITION	
POWER RANGE CHANNEL NI-41					
		INIT	VERI		INIT
REMOVE NI-41 from ERFIS SCAN: NIN0041A **	REMOVED	____		RESTORED	____
TR-412 ΔT	REC 422 OR REC 432	____			
DROPPED ROD MODE Switch	BYPASS	____		NORMAL	____
NIS ROD DROP BYPASS NI-41 Status Light	ILLUM	____		EXTNG	____
Bistable Switch BS-412B-1 Rack No. 1	TRIPPED	____	*____	NORMAL	____
Bistable Light OP ΔT LOOP 1 TC412B1	ILLUM	____		EXTNG	____
Bistable Switch BS-412B-2 Rack No. 1	TRIPPED	____	*____	NORMAL	____
Bistable Light OP ΔT ROD STOP TC412B2	ILLUM	____		EXTNG	____

* **IF** Bistable Light is illuminated **PRIOR** to tripping Bistable Switch, **THEN** perform an independent verification of Bistable Switch position.

** During I&C calibration, it may be necessary to restore NI to scan. Restoring NI-41 to ERFIS scan for I&C calibration activities may adversely effect CAOC/DELTA Flux and R-24A, B and C. R-24A, B and C should be declared inoperable when the NI is on ERFIS scan and calibration activities are in progress.

VALVE, BREAKER, SWITCH LINEUP

COMPONENT DESCRIPTION	POSITION FOR MAINTENANCE			RESTORED POSITION	
POWER RANGE CHANNEL NI-41					
		INIT	VERI		INIT
Bistable Switch BS-412C-1 Rack No. 1	TRIPPED	____	*____	NORMAL	____
Bistable Light OT△T LOOP 1 TC412C1	ILLUM	____		EXTNG	____
Bistable Switch BS-412C-2 Rack No. 1	TRIPPED	____	*____	NORMAL	____
Bistable Light OT△T ROD STOP TC412C2	ILLUM	____		EXTNG	____
NI-41 OUT OF SERVICE TRIP SWITCH	TRIPPED	____	*____	NORMAL	____
Bistable Light HI POW RANGE HI FLUX NC41R	ILLUM	____		EXTNG	____
ROD STOP BYPASS Switch	BYPASS PR 41	____		OPERATE	____
COMPARATOR CHANNEL DEFEAT Switch	SELECT PR 41	____		NORMAL	____
DETECTOR CURRENT COMPARATOR Drawer:					
UPPER SECTION Switch	SELECT PR 41	____***		NORMAL	____
LOWER SECTION Switch	SELECT PR 41	____***		NORMAL	____
NI-41 INSTRUMENT POWER FUSES **	REMOVED	____	*____	INSTALLED	____
Bistable Light LOW POW RANGE HI FLUX NC41P **	ILLUM	____		EXTNG	____

* **IF** Bistable Light is illuminated **PRIOR** to tripping Bistable Switch or pulling fuses, **THEN** perform an independent verification of Bistable Switch position or fuses.

** This action is N/A if Power is greater than P-10 OR the reactor is in MODES 3 through 6 (ITS Table 3.3.1-1).

*** Only required to be performed if the Power Range Neutron Flux input to QPTR is inoperable.

ALARM

PR UPPER CH HI FLUX DEV/AUTO DEFEAT

AUTOMATIC ACTIONS

1. Comparator Circuit defeated below 50% Power

CAUSE

1. Power decreasing to less than 50%
2. Xenon Oscillation causing a radial flux tilt
3. Dropped Rod **OR** Stuck Rod
4. Rod Misalignment
5. FΔI calibration needed
6. Comparator failed or OOS

OBSERVATIONS

1. RPI's
2. Power Range NI
3. Incore Instrumentation

ACTIONS	CK (✓)
1. **IF** a misaligned **OR** dropped rod is indicated, **THEN REFER TO** AOP-001.	_____
2. **PERFORM** a Quadrant Power Tilt Ratio IAW FMP-007.	_____
3. **IF** a Quadrant Power Tilt is indicated, **THEN REFER TO** FMP-007 **AND NOTIFY** Engineering.	_____
4. **IF** the results of the QPTR is greater than 1.02%, **THEN REFER TO** ITS LCO 3.2.4 for required action.	_____
5. **IF** either the UPPER **OR** LOWER channel alarms are locked in, **THEN REFER TO** FMP-007 **AND** ITS SR 3.2.4.1.	_____

DEVICE/SETPOINTS

1. 2% (1.02 ratio) deviation between any one Upper Channel and average of all four Upper Channels

POSSIBLE PLANT EFFECTS

1. Entry into TECH SPEC LCO Action
2. Power Reduction

REFERENCES

1. ITS LCO 3.2.4 and ITS SR 3.2.4.1
2. AOP-001, Malfunction of Reactor Control System
3. FMP-007, Quadrant Power Tilt
4. CWD B-190628, Sheet 447 Cable AY

8.0 **PROCEDURE**

8.1 Definitions

8.1.1 Axial Flux Difference (AFD)
The Axial Flux Difference (AFD) is defined as the difference in normalized flux signals between the top and bottom halves of a two section excore neutron detector (ITS 1.1). This parameter is synonymous with Delta Flux, Indicated Flux Difference, ΔI, %ΔI, %Δ Flux and Δq. AFD can also be related to core Axial Offset (AO) using the following equation:

AFD = AO * Power Level/Rated Thermal Power.

AFD relates the power in the top of the core to the power in the bottom of the core as seen by the excore NIS Power Range detectors. A separate AFD value is calculated for each NIS Power Range channel. The equations and ERFIS Point IDs used in calculating AFD for each of the four Power Range channels are shown in ATTACHMENT 10.1. It should be noted that the ERFIS AFD is calculated once per minute and is based on 1 minute average values for V(top), V(bottom) and P.

8.1.2 Target Value (TV)
The Target Value, also known as the Target Flux Difference, is the value of AFD determined in conjunction with the measurement of $F_Q^V(Z)$ under equilibrium conditions within 31 EFPD after each refueling and every 31 EFPD thereafter (ITS SR 3.2.3.3). During startup and power ascension following each refueling, the Target Value may be based on design predictions until equilibrium conditions for long term operation are reached. Like AFD, the Target Value is power dependent (examples of the variation of Target Value with power are provided in ATTACHMENT 10.2). A separate Target Value is calculated for each NIS Power Range channel. The Target Value for a Power Range channel is generally the average ERFIS AFD value recorded for that channel during the course of the flux map. The equations and ERFIS Point IDs used in calculating the power dependent Target Value for each of the four Power Range channels are shown in ATTACHMENT 10.1.

ERFIS CAOC SOFTWARE AND AFD RELATED PARAMETERS

EQUATIONS AND ERFIS POINTS USED TO CALCULATE AXIAL FLUX DIFFERENCE (AFD)

$$AFD = \frac{V(top) - V(bottom)}{V(top) + V(bottom)} * K * P$$

where:

- V(top) = Voltage representing the core power as seen by a NIS Power Range channel top detector;
- V(bottom)= Voltage representing the core power as seen by a NIS Power Range channel bottom detector;
- K = Incore/Excore calibration constant determined in accordance with EST-003.
- P = Power Level (%) at the time of the calculation.

Parameter	N41	N42	N43	N44
AFD	NPU0900	NPU0901	NPU0902	NPU0903
V(top)	NIN0051M	NIN0053M	NIN0055M	NIN0057M
V(bottom)	NIN0052M	NIN0054M	NIN0056M	NIN0058M
K	NPK1612	NPK1613	NPK1614	NPK1615
P	NIN0041M	NIN0042M	NIN0043M	NIN0044M

EQUATIONS AND ERFIS POINTS USED TO CALCULATE TARGET VALUES

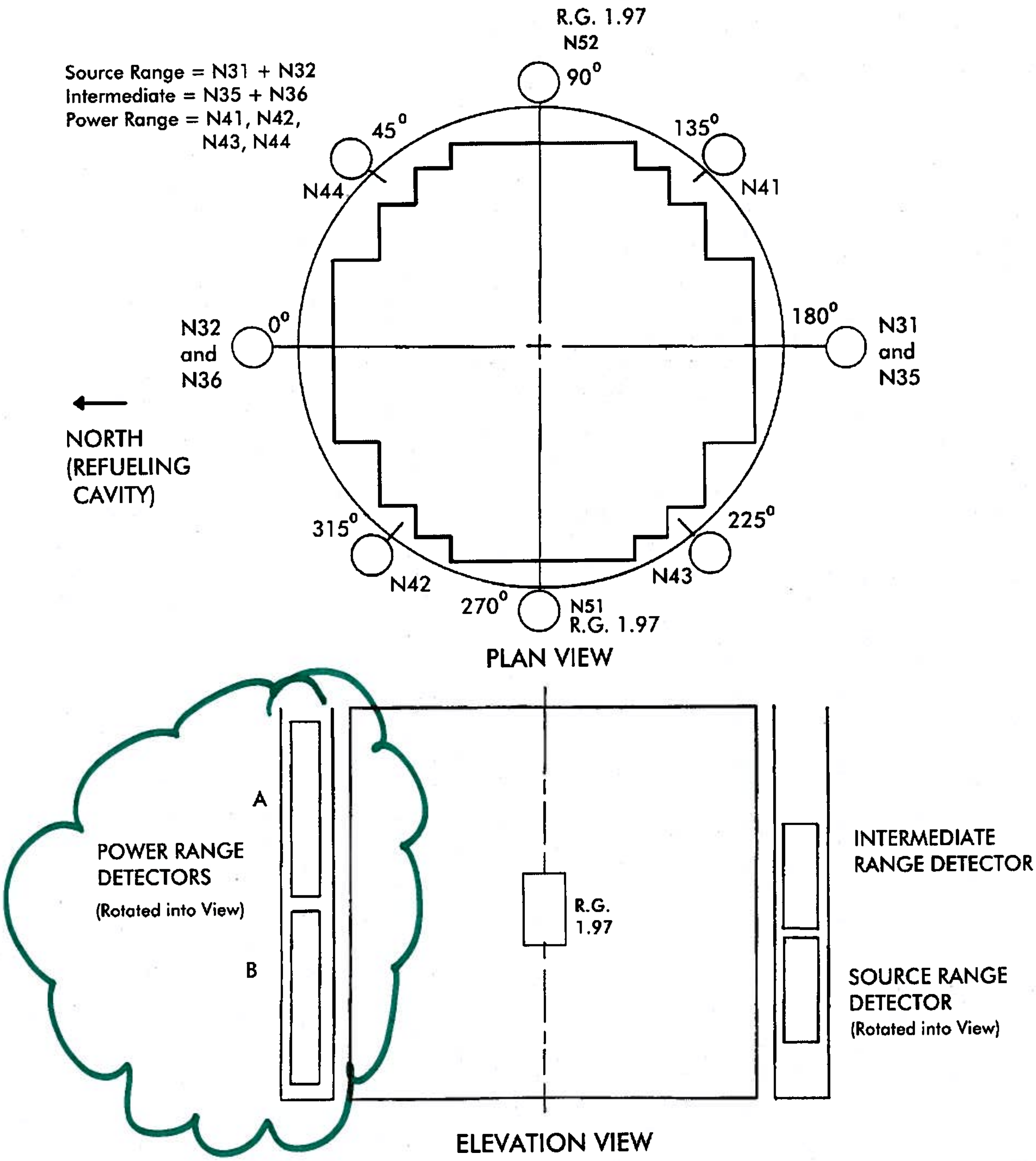
$$\text{Target Value (P)} = \text{Target Value}_{ref} * P/P_{ref}$$

where:

Target Value (P) = Target Value at power P;
Target Value$_{ref}$ = Target Value during flux map;
P = Current power level; and,
P_{ref} = Power level during flux map.

Parameter	N41	N42	N43	N44
Target Value (P)	N/A	N/A	N/A	N/A
Target Value$_{ref}$	NPK1603	NPK1604	NPK1605	NPK1606
P	NIN0041M	NINOO42M	NIN0043M	NIN0044M
P_{ref}	NPK1608	NPK1609	NPK1610	NPK1611

LOCATION OF DETECTORS
NI-FIGURE-1



NIF01

59. 016 K3.09 001

Given the following plant conditions:

- The plant is operating at 100% RTP.

Which ONE(1) of the following completes the statement below?

In order to receive a Safety Injection actuation from High Steam Line Differential Pressure at least __(1)__ S/G pressure transmitter(s) on __(2)__ S/G(s) would have to fail __(3)__.

A. (1) one

(2) each

(3) LOW

one each low

B✓ (1) two

(2) one

(3) LOW

two one low

C. (1) one

(2) each

(3) HIGH

one each high

D. (1) two

(2) one

(3) HIGH

two one high

The correct answer is B.

A. Incorrect - The failure direction is correct. The coincidence is incorrect.

B. Correct

C. Incorrect - Wrong coincidence and the failure direction is reversed.

D. Incorrect - Correct coincidence but the failure direction is reversed.

Question 59
Tier/Group 2/2
K/A Importance Rating - RO 3.5 SRO 3.7

Knowledge of the effect that a loss or malfunction of the NNIS will have on the following: ESFAS

Reference(s) - Sim/Plant design, System Description, Logic Diagrams
Proposed References to be provided to applicants during examination - None
Learning Objective - ESF 004
Question Source - BANK (Not used on an NRC Exam form 2004 to present.)
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7 / 45.6
Comments -

control systems.

4.1.1 Pressurizer Pressure (ESF-Figure-2)

Pressurizer Pressure measurement is one of the inputs used to generate a Safety Injection signal. Three pressure comparators (bistables) provide an input to a 2/3 matrix to generate a Safety Injection signal at 1715 psig lowering pressure. This signal provides protection against the following accidents: an inadvertent opening of a SG safety valve, a steam line break, a spectrum of rod control cluster assembly ejection accidents(rod ejections), inadvertent opening of a pressurizer safety or PORV, and a SG tube rupture.

This measurement is also used to provide:

Low and High pressure reactor trips

An input to the on-line algorithm to calculate the Overtemperature ΔT setpoints; and

An input, via independent transmitters which transmit signals to the Presssurizer Pressure Control System, is provided to achieve channel independence. No components are shared by the protection and control functions; they are either protection grade RPS inputs, located and designed as such, or they are part of the Pressurizer Pressure Control System.

The pressurizer pressure uses two-out-of-three RSPS logic. Since separate pressurizer pressure sensors are used for the control and RSPS channels, no interaction will occur. For more information on the pressurizer pressure detectors and pressurizer pressure control system refer to SD-059, Pressurizer and Pressurizer Relief Tank.

4.1.2 Reactor Coolant Temperature (ESF-Figure-1)

The RCS Low Tavg signal (2 of 3 channels below 543°F) is used to initiate the Safety Injection signal, when coincident with high steam flow; and close the Main Steam Isolation Valves, when coincident with high steam flow (i.e., generate the Steam Line Isolation Signal).

4.1.3 Steam Flow (ESF-Figure-1)

Hi Steam Flow (37.25% flow at no load to 20% load, increases linearly to 109% at full load) detected by at least one sensor on two of three steam lines, coincident with low Tavg (543°F) or low steam line pressure (614 psig), generates a Safety Injection signal and closes all MSIVs. Two flow controllers on each steam line are used to sense high steam line flow. This circuit is designed to detect steam line breaks downstream of the

MSIVs.

4.1.4 Steam Line Pressure (ESF-Figure-1 & 3)

Steam Line Pressure measurement is utilized for steam line break protection. Low steam line pressure (614 psig) in two of three main steam lines or Low Tavg (543°F) in two of three loops, coincident with high steam line flow in two-of-three main steam lines, will initiate the Steam Line Isolation and Safety Injection signals. This is to protect against: a steam line break downstream of the main steam check valves, a feed line break, and/or an inadvertent opening of a SG safety.

In addition, each steam line pressure measurement is compared with a main steam header pressure measurement to determine if a high steam line differential pressure exists. A coincidence of two-of-three steam line differential pressures (100 psid) in any one steam line, that is, steam line pressure lower than main steam header pressure, will initiate a Safety Injection signal.

The steam header pressure is electronically limited to a minimum value of 585 psig. Therefore, this SI signal must be blocked before a plant cooldown is started to prevent SI actuation when S/G pressures drop below 485 psig(approximately 467°F). The steam line differential pressure circuit detects faults upstream of the MSIVs. Since the steam line check valves prevent reverse flow to the faulted S/G, excessive steam line differential pressure does not close the MSIVs.

4.1.5 Containment Pressure (ESF-Figure-4 & 5)

Containment Pressure measurement is utilized to initiate Emergency Core Cooling in response to a Loss of Coolant Accident (LOCA), and to provide containment pressure protection for either a LOCA, a feed line break inside containment, or a Main Steam Line Break inside containment. Nine pressure comparators, with inputs from six pressure transmitters, are used as inputs to ESFAS. Three pressure comparators provide an input for Hi Containment Pressure at 4 psig increasing pressure. Six pressure comparators provide an input for Hi-Hi Containment Pressure at 10 psig.

A coincidence of two of three Hi Containment Pressure (4 psig) will initiate a Safety Injection signal.

A coincidence of two separate two-of-three Hi-Hi Containment Pressure signals (10 psig), i.e., two-of-three twice, will initiate the following signals:

Steam Line Isolation,
Containment Spray Actuation
Containment Isolation Phase "B"
Safety Injection Signal(This SI is not credited and is blocked by the Tavg Block)

4.1.6 Manual Initiation (ESF-Figure-4)

The following RTGB mounted controls are provided for manual actuation capability.

Control	Action
Safety injection Actuation	Two momentary push buttons; pressing of either push button will actuate
Containment Isolation - Phase A Containment Ventilation Isolation	Two momentary push buttons; pressing of either push button will actuate.
Containment Spray - Actuation/Containment Isolation Phase B/Containment Ventilation Isolation	Two momentary push buttons; actuation is affected only if both buttons are pressed simultaneously
CV Spray Reset	One key-operated reset/override switch
Steam Line Isolation	One momentary push button per steam line
Feedwater Isolation Reset	One key-operated reset/override switch provided for each loop

4.1.7 Containment Airborne Radioactivity (ESF-Figure-4)

Containment Air Particulate Radiation Monitor, R-11, and Containment Noble Gas Monitor, R-12, each provide an input to a one out of two matrix which actuates a Containment Ventilation Isolation. Refer to SD-019, Radiation Monitoring System, for more information on R-11 and R-12.

4.1.8 Control Room Area Radiation (ESF-Figure-4)

Control Room Area Radiation Monitor, R-1, provides an input for actuation of the Control Room Ventilation Emergency Pressurization Mode. Refer to SD-019, Radiation Monitoring System, for more information on R-1.

4.2 Safety Injection

4.2.1 Safety Injection (SI or S) Signal (ESF-Figure-4 & 5)

The Safety Injection signal is initiated in a variety of ways. The following contains a list of parameters that will cause an SI actuation:

1. High Steam Line Flow coincident with Low Steam Line Pressure or Low Tavg.
2. High Steam Line Differential Pressure
3. Low Pressurizer Pressure
4. Containment High Pressure

5. Manual
6. Containment Hi-Hi Pressure

4.2.2 Safety Injection (SI or S) Signal Actions

The actions caused by a SI signal are listed below:

1. Reactor Trip
2. Emergency diesel generator startup
3. Feedwater isolation and AFW Start-up (Motor Driven only)
4. Safeguard sequence actuation
5. Phase "A" Containment isolation and IVSW actuation
6. Containment Ventilation isolation
7. Control Room Ventilation shifts to the Emergency Pressurization Mode
8. Close normal dampers for HVH 1-4
9. Align various valves within the SI and RHR systems

4.3 Containment Spray

4.3.1 Containment Spray (P) Signal

The Containment Spray ("P") signal is initiated by a Hi-Hi containment pressure(10 psig) or manual actuation.

4.3.2 Containment Spray Automatic Signal Actions

The actions caused by a Containment Spray Automatic signal are listed below:
1. Spray actuation
2. Phase "B" containment isolation
3. Steam line isolation

4.3.3 Containment Spray Manual Signal Actions

The actions caused by a Containment Spray Manual Signal are listed below:
1. Spray actuation
2. Phase "B" containment isolation
3. C.V. ventilation isolation

4.4 Safety Injection and Containment Spray Setpoints

4.4.1 Safety Injection Signal

1. High steam line flow (1/2 per line and 2/3 lines) differential pressure

corresponding to 37.25% flow at no load to 20% load and increases linearly to 109% at full load. Load is a function of turbine first stage pressure.
Low steam line pressure (2/3 lines) 614 psig

Low T_{avg} - (2/3 loops) 543 °F

2. High steam line differential pressure. (2/3 per line, 1/3 Lines)

   (P_{Header} - P_{Line}) 100 psid

   P_{Header} has a low limit pressure setpoint which prevents this signal from decreasing below 585 psig.

3. Low pressurizer pressure (2/3 pressures)
   Pressurizer pressure 1715 psig

4. Containment high pressure (2/3) 4 psig

5. Manual (1/2) either pushbutton

6. Containment Hi-Hi Pressure (2/3 on both trains) 10 psig

4.4.2 Containment Spray Signal

1. Containment Hi-Hi Pressure (2/3 on both trains) 10 psig

2. Manual (2/2) depressing both pushbuttons is required.

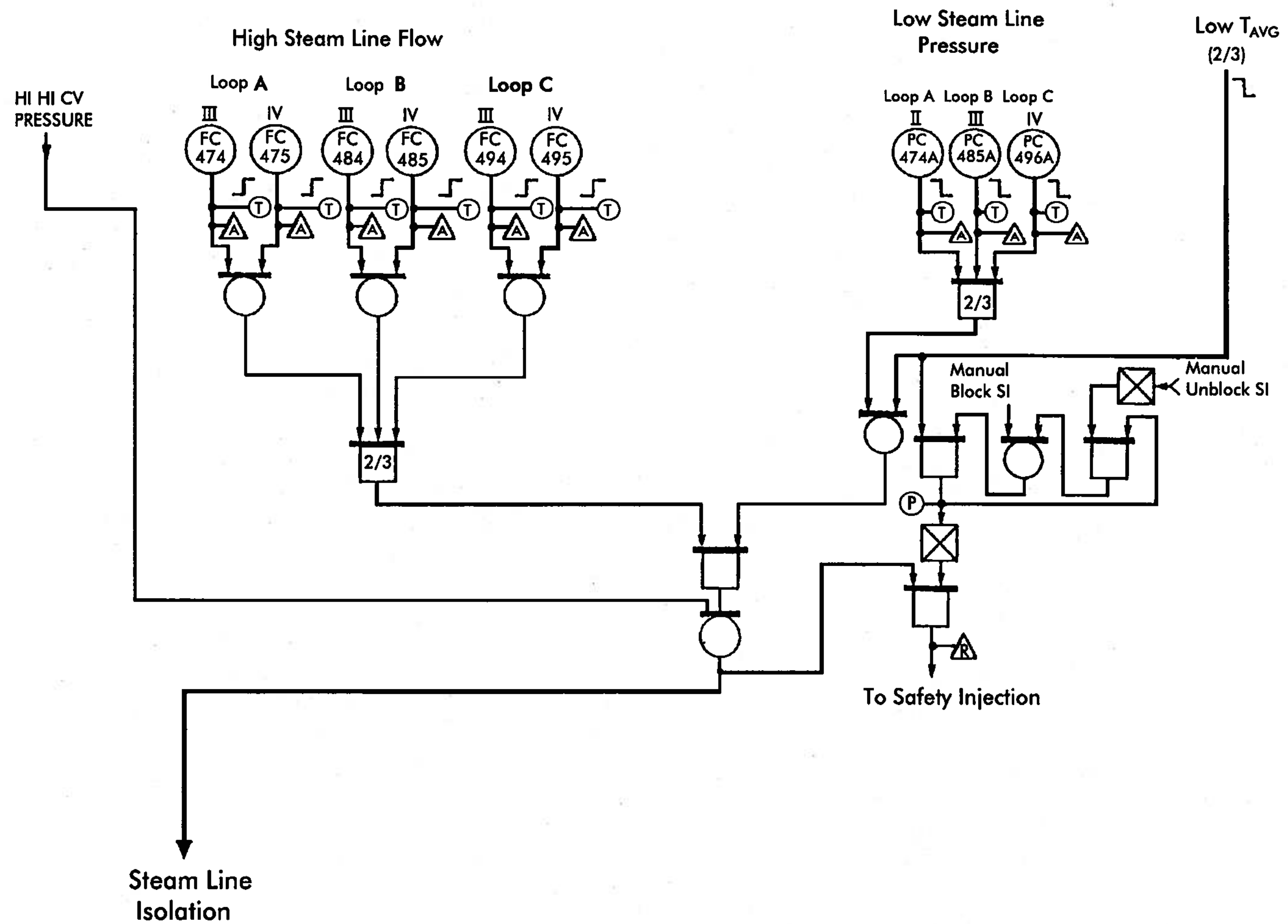
4.5 Alarms

APP-002-A1 LOSS OF DC PWR TO 480V BUS E1 UV CHANNEL
APP-002-A2 SAFEGUARDS LOGIC TEST
APP-002-B1 LOSS OF DC PWR TO 480V BUS E2 UV CHANNEL
APP-002-B2 SAFEGUARD PWR SUPPLY FAILURE
APP-002-C1 FW ISOLATION/CV SPRAY OVRD/RESET
APP-002-C2 CV ISOL PHASE A
APP-002-D1 SPRAY ACTUATION
APP-002-D2 CV ISOL PHASE B
APP-002-F6 AUTO S.I. SIGNAL OVERRIDDEN
APP-004-A1 S/G A STM LINE HI ΔP SFGRD/TRIP
APP-004-B1 S/G B STM LINE HI ΔP SFGRD/TRIP
APP-004-C1 S/G C STM LINE ΔP SFGRD/TRIP
APP-004-D1 PZR LO PRESS SFGRD/TRIP
APP-004-E1 HI STM FLO LO TAVG/LO SLP SFGRD/TRIP
APP-004-E4 CV HI PRESS SFGRD/TRIP
APP-004-E5 MANUAL SI TRIP

HIGH STEAM LINE FLOW

ESF-FIGURE-1

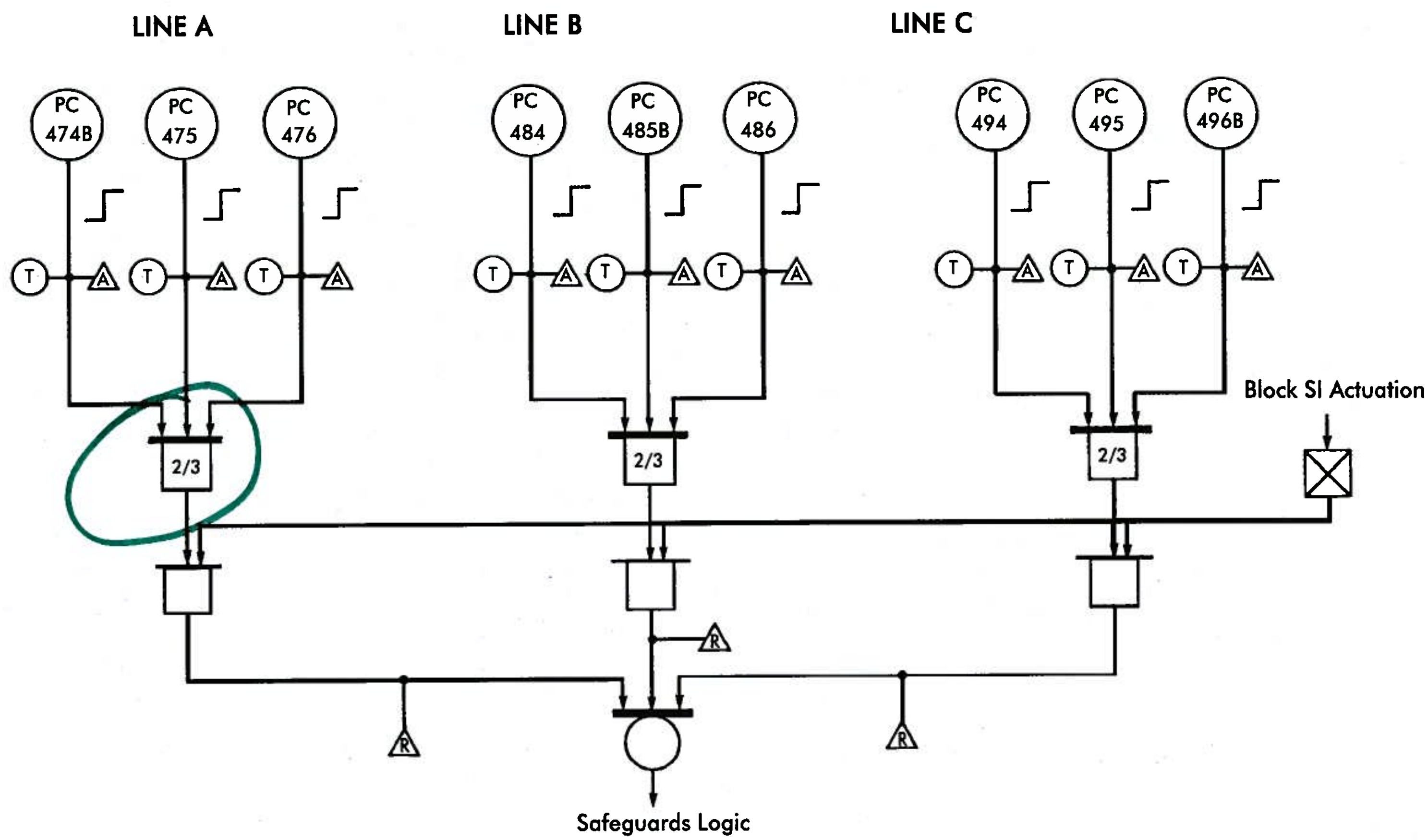
HIGH STEAM LINE FLOW



INFORMATION USE ONLY

HIGH STEAM LINE DIFFERENTIAL PRESSURE
ESF-FIGURE-3

High Steam Line Differential Pressure



INFORMATION USE ONLY

60. 028 A4.02 001

Given the following plant conditions:

- A LOCA has just occurred and CV Pressure indicates 15 psig on ERFIS.

Which ONE(1) of the following completes the statement below?

In addition to ERFIS and AR-100C, CV Conditions Recorder, CV Pressure is indicated in the control room by __(1)__ Wide Range Indicators on the RTGB and __(2)__ Extended Range indicator(s) on the PAM Panel.

A. (1) three

(2) one

B.✓ (1) six

(2) two

C. (1) six

(2) one

D. (1) three

(2) two

The correct answer is B.

A. Incorrect - There are six pressure indicators enclosed in three edge meter panels. Two indications per edge meter panel. There is only one narrow range indicator on the RTGB, however, there are two extended range indicators on the PAM Panel.

B. Correct

C. Incorrect - The first part is correct. There is only one narrow range indicator on the RTGB, however, there are two extended range indicators on the PAM Panel.

D. Incorrect. There are six pressure indicators enclosed in three edge meter panels. Two indications per edge meter panel. The second part of distractor is correct.

Question 60
Tier/Group 2/2
K/A Importance Rating - RO 3.7 SRO 3.9

Ability to manually operate and/or monitor in the control room: Location and interpretation of containment pressure indications

Reference(s) - Sim/Plant design, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - CV 005
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7 / 45.5 to 45.8
Comments -

- Containment Vessel Pressure Relief Valves (V12-10 and V12-11) and Post Accident Hydrogen Venting line "A" isolation (V12-15) interspace and penetration sleeve (S-21, Penetration 41)
- Station Air Supply CV isolation valve interspace between Valves SA-43 and SA-44)
- Containment Vessel Purge Exhaust Valve (V12-8 and V12-9) interspace and penetration sleeve (S-38)
- Containment Vessel Radiation Monitors R-11 and R-12 inlet valves (RMS-1 and RMS-2) and outlet valves (RMS-3 and RMS-4) interspaces and penetration sleeve (S-23)
- Containment Vessel Post Accident Hydrogen Venting line "B" isolation valves (V12 -18 and V12-19) interspace and penetration sleeve (S-46, Penetration 40).

4. Header D
   - Supplies the following penetrations from inside the Containment Vessel

     - Equipment Hatch welds
     - Fuel Transfer Tube Test Channel and Blind Flange/Seal inner space
     - RHR Penetration Sleeve Test Channels (Pen-46 and Pen-47)
     - Penetration Sleeve weld test channels for:
       CV Purge Supply line penetration sleeve (S-37)
       CV Purge Exhaust line penetration sleeve (S-38)
       CV Vacuum Relief line penetration sleeve (S-39)
       CV PAHV line "B" penetration sleeve (S-46)
     - Penetration Sleeve test channels for Mechanical Penetration sleeves (S-1 through S-35) welds at liner to sleeves
     - Penetration Sleeve test channels for Main Steam and Feedwater penetration sleeves (S-40 through S-43) welds at liner to sleeves
     - Penetration Sleeve test channels for north and south electrical penetration sleeves (all sleeves) welds at liner to sleeves

4.0 INSTRUMENTATION

4.1 Containment Vessel Indications

4.1.1 RTGB Indications

Remote containment pressure indication is available on the RTGB by six (6) wide range (-5 to 75 psig) and one (1) narrow range (-. 5 to 1.0 psig) pressure indicators. Two (2) extended range (-5 to 125 psig) indicators are provided on the Core Cooling and Containment Monitor. Also available are pressure readouts on the plant computer.

Remote indication of CV temperature is provided on the RTGB. Temperature readouts are also available on the plant computer.

61. 041 G2.4.11 001

Given the following plant conditions:

- The plant is operating at 100% RTP.
- A 20% Secondary Load Rejection has occurred.
- Steam dump valves did **NOT** actuate.

Which ONE (1) of the following identifies the sequence of actions required to be performed IAW AOP-015, Secondary Load Rejection, to operate the steam dump valves to reduce RCS Tavg?

A. Place PC-464B, Steam Header Press Controller, in Manual and adjust output as necessary.

B. Place the Steam Dump Mode Switch to STEAM PRESS and manually adjust output as necessary.

C✓ Place PC-464B, Steam Header Press Controller, in Manual and adjust output to MINIMUM. Place the Steam Dump Mode Selector Switch to STEAM PRESS and manually adjust output as necessary.

D. Place the Steam Dump Control Switch momentarily to Bypass Tavg Interlock and place the Steam Dump Mode Selector Switch to Reset and then to Steam Pressure Mode and manually adjust output as necessary.

The correct answer is C.

A. Incorrect - The steam dumps will be operated in Manual. However, Steam Dump Mode Selector Switch must be placed in STEAM PRESS before the steam dumps will respond to a manual signal.

B. Incorrect - These actions would cause the steam dumps to open rapidly if a demand signal was present on PC-464B. To prevent the steam dumps from potentially instantly opening due to a large demand signal the controller is adjusted to MINIMUM prior to selecting STEAM PRESS mode.

C. Correct. The output on the controller is verified first to be at zero prior to transferring to steam pressure mode. This will prevent the steam dump from instantly opening due to a large demand signal.

D. Incorrect - These actions will not cause the steam dumps to operate since there will be no output signal on PC-464B. With these actions taken, if the controller is placed in Manual and out put adjusted the steam dumps will operate.

Question 61
Tier/Group 2/2
K/A Importance Rating - RO 4.0 SRO 4.2

Steam Dump System (SDS) and Turbine Bypass Control: Knowledge of abnormal condition procedures.

Reference(s) - Sim/Plant design, AOP-015
Proposed References to be provided to applicants during examination - None
Learning Objective - SD 008
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.10 / 43.5 / 45.13
Comments -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

****

CAUTION

Misoperation of the Steam Dumps while in manual control can lead to excessive S/G swell or overcooling of the RCS.

****

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
* 7.	Check Steam Dump To Condenser - ACTUATED	Perform the following: a. Verify the STEAM DUMP CONTROL Switch is placed to ON. b. Place STEAM HEADER PRESS Controller PC-464B in MAN. c. Manually adjust PC-464B output to minimum. d. Place STEAM DUMP MODE Switch to STEAM PRESS. e. Manually adjust PC-464B output to operate Steam Dump Valves <u>AND</u> reduce T_{avg} to within 5°F of T_{ref}. f. <u>WHEN</u> T_{avg} lowers to within 5°F of T_{ref}, <u>THEN</u> perform the following concurrently: • Verify Control Rod insertion <u>OR</u> borate per OP-301, RCS Boration Quick Checklist, to adjust T_{avg} to within -1.5 to +1.5°F of T_{ref}. <u>AND</u> • Slowly adjust PC-464B output to close the Steam Dump Valves.

62. 071 K1.06 001

Given the following plant conditions:

- Plant is in Mode 3.
- A release is in progress from "A" Waste Gas Decay Tank.
- R-14C, PLANT STACK NOBLE GAS LOW RANGE, **FAIL** light illuminates.

Which ONE (1) of the following completes the statement below?

The condition would cause __(1)__ to alarm and RCV-014, Waste Gas Release Isolation, would __(2)__.

A. (1) APP-036-E7, RAD MONITOR TROUBLE,

(2) remain OPEN

B.✓ (1) APP-036-E7, RAD MONITOR TROUBLE,

(2) CLOSE

C. (1) APP-036-D8, PROCESS MONITOR HI RAD,

(2) remain OPEN

D. (1) APP-036-D8, PROCESS MONITOR HI RAD,

(2) CLOSE

The correct answer is B.

A. Incorrect. A FAIL signal for R-14C will send a signal to automatically close RCV-014 to terminate the release. The FAIL light for R-18, R-11 and R-12 will not cause automatic actions to secure releases via their applicable paths.

B. Correct.

C. Incorrect. No high radiation condition exists, therefore the HI RAD alarm would not be illuminated. This alarm could be received from temporary spikes or malfunctions, which is why the alarm is verified in APP-036 action steps. The FAIL light for R-18, R-11 and R-12 will not cause automatic actions to secure releases via their applicable paths.

D. Incorrect - No high radiation condition exists, therefore the HI RAD alarm would not be illuminated. This alarm could be received from temporary spikes or malfunctions, which is why the alarm is verified in APP-036 action steps. Second half of distractor is correct.

Question 62
Tier/Group 2/2
K/A Importance Rating - RO 3.1 SRO 3.1

Knowledge of the physical connections and/or cause-effect relationships between the Waste Gas Disposal System and the following systems: ARM and PRM systems

Reference(s) - Sim/Plant design, APP-036
Proposed References to be provided to applicants during examination - None
Learning Objective - RMS 009
Question Source - BANK (Has not been used on NRC Exam from 2004 to present.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.2 TO 41.9 / 45.7 TO 45.8
Comments -

ALARM

RAD MONITOR TROUBLE *** WILL REFLASH ***

AUTOMATIC ACTIONS

1. **IF** the R-14C FAIL alarm is ILLUMINATED, **THEN** R-14C closes RCV-014, WASTE GAS DECAY SYSTEM ISOLATION VALVE, to stop any gas release in progress.

CAUSE

1. For all channels (R-1 through R-9; R-11; R-12; R-15; R-16; R-17; R-18; R-20; R-21; R-30; R-31A, B, C; R-32A, B; R-33):
   - Loss of Counts
   - Loss of Power
2. For Channel R-14C, D, E:
   - Loss of Counts
   - Loss of Power
   - Low Sample Flow
   - Low F-14 Flow
   - Low Battery
3. For PLANT VENT EFFLUENT MONITORING EQUIPMENT FAIL:
   - F-14 Kurz Power Failure
   - Heat Trace Trouble
   - Stack Flow Trouble
4. For R-19A, B, C:
   - Loss of Counts
   - Loss of Power
   - Low Skid Flow
   - High Temperature
   - Check Source Counts **NOT** within limits

OBSERVATIONS

1. FAIL light for associated RMS channel illuminated.
2. Plant Vent Effluent Monitoring Equipment FAIL light for R-14C/D/E illuminated.

ACTIONS CK (✓)

NOTE: R-14C/D/E do **NOT** have to be declared out of service if only the Plant Vent Effluent Monitoring Equipment FAIL light is illuminated unless further investigation by E&C determines the channel(s) are inoperable.

1 **IF** the Plant Vent Effluent Monitoring Equipment FAIL light for R-14C/D/E illuminates, **THEN NOTIFY** E&C to investigate cause of alarm. ____

2 **IF** a channel FAIL light has illuminated, **THEN PERFORM** the following:

1) Attempt to **RESET** the alarm. ____

2) **IF** the FAIL light extinguishes, **THEN** channel is operable **AND** no further actions are required. ____

3) **IF** the FAIL light will **NOT** extinguish, **THEN DECLARE** the channel inoperable until the results of the subsequent E&C status check is known. ____

3 **IF** any channel has failed, **THEN REVIEW** TECH SPECS **AND** ODCM to determine the appropriate actions for any release in progress through affected channels with an illuminated FAIL light. ____

- ODCM Table 2.6-1 for liquid releases
- ODCM Table 3.10-1 for gaseous releases

4 **DECLARE** any channel with an illuminated FAIL light inoperable until the cause for the FAIL light is determined. It may be necessary to keep the affected channel energized if a continued release is allowed IAW applicable TECH SPECS **AND** ODCM. ____

5 **IF** R-18 FAIL light is ILLUMINATED, **THEN SECURE** any release in progress via this pathway. ____

6 **IF** R-11 **OR** R-12 FAIL lights are illuminated, **AND** a Containment Purge is in progress, **THEN PERFORM** the following:

1) **IF** the plant is in Modes 1 through 4, **THEN SECURE** any Containment Purge in progress. Containment Purge is **NOT** allowed in Modes 1 through 4 unless R-11 **AND** R-12 are in service (ITS LCO 3.3.6)(ACR 94-00833). ____

2) **IF** movement of <u>recently</u> irradiated fuel is in progress, **THEN STOP** movement of that fuel. ____

7 **IF** R-1 is inoperable, **AND** the plant is in Modes 1 through 4 **OR** movement of fuel assemblies is in progress, **THEN VERIFY** Control Room Ventilation System is in the Pressurization Mode. (ITS LCO 3.3.7) ____

8 **NOTIFY** E&C of monitor(s) status. ____

9 Releases may be continued IAW applicable TECH SPECS **AND** ODCM. ____

10 **IF** desired, **THEN REMOVE** the affected channel from service using OWP-014. ____

ACTIONS (Continued) CK (✓)

11 **IF** R-31A/B/C is inoperable, **THEN PERFORM** the following: [TRM 3.10 (Table 3.10-1 Item 2)]

1) **RESTORE** to operability within 7 days. ____

2) **IF** unable to restore R-31A/B/C to operable status within 7 days, **THEN PERFORM** the following:

a) **INITIATE** an NCR ____

b) **IDENTIFY** any compensatory action required while channel is inoperable ____

12 **IF** R-14D&E is inoperable, **THEN PERFORM** the following: [TRM 3.10 (Table 3.10-1 Item 3&4)]

1) **RESTORE** to operability within 7 days. ____

2) **IF** unable to restore R-14D&E to operable status within 7 days, **THEN PERFORM** the following:

a) **INITIATE** an NCR ____

b) **IDENTIFY** any compensatory action required within seven days ____

DEVICE/SETPOINTS

1. Refer to OMM-014

POSSIBLE PLANT EFFECTS

1. Entry to TECH SPEC LCO

REFERENCES

1. ITS LCO 3.3.6, 3.3.7, 3.4.15, ODCM 2.6 and 3.10, TRM 3.10 (Table 3.10-1 Item 2,3 & 4)
2. ACR 94-00833, No CV Purge with R-11 and R-12 OOS
3. ACR 94-01308, R-18 FAIL Condition
4. CWD B-190628, Sheets 82-85, 87, 279, 350, 361, 525, 530, 535, 637, 1058, 1693-1695, 1724, 1727, 1728, 1734, 1735, 1740, 1741, 1741A
5. OMM-014, Radiation Monitoring Setpoints
6. ESR 95-00227
7. OWP-014, Radiation Monitoring System (RMS)
8. CR 97523, R-14C Failure Due To Low Counts
9. EC 52464, Replace R-14 Plant Vent Monitor

ALARM

PROCESS MONITOR HI RAD *** WILL REFLASH ***

AUTOMATIC ACTIONS/CAUSES

CHANNEL	AUTO ACTION	CAUSE
R-11 R-12	1) HVE-1A **AND** HVE-1B stop. 2) V12-6 closes 3) V12-7 closes 4) V12-8 closes 5) V12-9 closes 6) V12-10 closes 7) V12-11 closes 8) V12-12 closes 9) V12-13 closes	RCS leak R-11 spike may be caused by closure of OCBs 52/8 and 52/9 Cycling LCV-115A in any of the 3 different switch positions may cause this alarm
R-14C	RCV-014 closes.	WGDT leak or Safety lift
R-15	None	Primary to Secondary leak
R-18	RCV-018 closes.	WDS Effluent leakage
ALL	V1-31 closes.	Primary to Secondary leak
R-19A	1) FCV-1930A **AND** B close. 2) FCV-1933A **AND** B close. 3) FCV-4204A closes.	
R-19B	1) FCV-1931A **AND** B close. 2) FCV-1934A **AND** B close. 3) FCV-4204B closes	
R-19C	1) FCV-1932A **AND** B close. 2) FCV-1935A **AND** B close. 3) FCV-4204C closes.	
R-21	HVE-15 stops.	Fuel Handling accident. Low level in SFP.

OBSERVATIONS

1. Reading on affected channel(s)

ACTIONS — CK (✓)

1. **IF** the cause of the alarm is known to be the movement of radioactive material **OR** is an expected alarm due to actions under operator control, **THEN** no further actions for this APP are required. _____

2. **OBSERVE** affected radiation monitor for radiation levels **AND** evidence of short term spiking. _____

3. **IF** a valid alarm is on R-11 **OR** R-12 **AND** the associated Automatic Actions did **NOT** occur, **THEN DEPRESS AND LATCH** the HV OFF pushbutton for R-11 **OR** R-12 **AND CHECK** that the Automatic Actions occurred for CV Ventilation Isolation. _____

4. **IF** short term spiking is evidenced, **THEN** allow the indicated level to lower prior to performing step 5. _____

ACTIONS (continued) CK (✓)

5. **PERFORM** the following to determine if the alarm is valid:

1) **IF** the alarm is on R-14, **THEN PERFORM** the following:

a. **IF** other plant indications show evidence that a release from the stack could be occurring, **THEN** assume the alarm is valid. _____

b. **IF** there are no indications that a plant release could be occurring, **THEN CONTACT** E&C to verify the alarm is valid. _____

2) **IF** the alarm is on R-15, **THEN PERFORM** the following:

a. **OBSERVE** trends on monitor R-24A, B, & C. _____

b. **IF** readings from the R-24 monitors indicate primary to secondary leakage, **THEN REFER** to AOP-035. _____

c. **IF** a SGTR is in progress, **THEN REFER** to the EOP Network. _____

3) **IF** the alarm is on R-19, **THEN PERFORM** the following:

a. **IF** there are other indications that primary to secondary leakage is occurring, **THEN** assume the alarm is valid. _____

b. **IF** there are no other indications that primary to secondary leakage is occurring, **THEN CONTACT** E&C to verify the alarm is valid. _____

4) Momentarily **DEPRESS** the ALARM/RESET pushbutton. _____

5) **IF** the alarm returns, **THEN REFER** To AOP-005. _____

6) **IF** the alarm fails to return, **THEN INITIATE** action to determine the reason for the alarm. _____

– Troubleshoot and repair channel

– Investigate area for transient radioactive material

6. **IF** the affected radiation monitor is determined to be inoperable, **THEN PERFORM** applicable Required Actions **OR** Compensatory Measures from the list below: _____

– ITS LCO 3.3.6 – R-11 and R-12

– ITS LCO 3.4.15 – R-11 and R-12

– ODCM 2.6 – R-16, R-18, R-19 (A, B, & C)

– ODCM 3.10. – R-14C, R-11 and R-12, R-20 and R-21

– R-15 (None)

DEVICE/SETPOINTS

1. Refer to OMM-014, Radiation Monitor Setpoints.

REFERENCES

1. AOP-005, Radiation Monitoring System
2. AOP-35, Steam Generator Tube Leak
3. OMM-014, Radiation Monitor Setpoints
4. CWD B-190628, 83C
5. ODCM 2.6 and 3.10
6. ITS Table 3.3.6-1 Item 3, LCO 3.4.15,

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R-4, Charging Pump Room, is in alarm.

Which ONE(1) of the following completes the statement below regarding the radiation sources measured by R-4, Charging Pump Room, and the units indicated?

R-4, Charging Pump Room, Area Radiation Monitor measures __(1)__ and AOP-005, Radiation Monitoring System, requires that HVE-5A __(2)__ HVE-5B be started.

HVE-5A/B, Aux Bldg Charcoal Exh Fans

A. (1) both gamma and beta and reads out in counts per minute (CPM)

(2) AND

B. (1) gamma ONLY and reads out in counts per minute (CPM)

(2) OR

C. (1) both gamma and beta reads out in mr/hr

(2) AND

D✓ (1) gamma ONLY and reads out in mr/hr

(2) OR

The correct answer is D.

A. Incorrect - R-4 utilizes a detector that is a halogen quenched GM tube to measure gamma fields. The tube is placed in a phenolic tube holder, which is used as a beta shield. The instrument reads out in mr/hr. Several process monitors read out in CPM.

B. Incorrect - The first part of the distractor is correct. R-4 reads out in mr/hr. Several process monitors read out in CPM.

C. Incorrect - R-4 utilizes a detector that is a halogen quenched GM tube to measure gamma fields. The tube is placed in a phenolic tube holder, which is used as a beta shield. The second part of the distractor is correct.

D. Correct.

Question 63
Tier/Group 2/2
K/A Importance Rating - RO 2.7 SRO 3.0

Knowledge of the operational implications of the following concepts as they apply to the ARM system: Radiation theory, including sources, types, units, and effects

Reference(s) - Sim/Plant design, System Description, AOP-005
Proposed References to be provided to applicants during examination - None
Learning Objective - RMS 002
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.6 / 45.4
Comments -

Accident Channels are defined as detector/drawer arrangements, either area or process, that are designed to provide indication during and after an accident when radiation levels and/or environmental specifications of the other area and process channels may be exceeded. The other Area and Process channels will however, continue to provide indication during and after an accident until the above mentioned limitations are exceeded.

1. The area RMS (system # 7005)
   Defined as a detector/drawer arrangement in which the detector is exposed or subject to general area radiation.

2. The process RMS (system # 7005).
   Defined as a detector/drawer arrangement in which the detector is housed in a shielded assembly where only a specific radiation source is monitored.

2.3.1 Area RMS (FIGURE 2)

This system consists of twelve channels that monitor radiation levels in various areas of the plant. Two of these channels (R-32A and R-32B) are designated as accident channels.

Channel	Area Monitored
R-1	Control Room
R-2	CV Low Range Monitor
R-3	PASS Panel Area
R-4	Charging Pump Room
R-5	Spent Fuel Building
R-6	Sampling Room
R-7	CV In-core Instrumentation Room
R-8	Drumming Station
R-9	Letdown Line Area
R-32A	CV High Range
R-32B	CV High Range
R-33	Monitor Building Area

A typical area channel consists of a detector and a ratemeter. This monitoring system utilizes fixed-position, gamma-sensitive G-M tube detectors (except R-32A and R-32B which use Ion Chambers). The radiation level is indicated locally near the detector (except R-32A and R-32B) and in the Control Room on the ratemeter digital display (R-32A and R-32B have an analog display). Radiation levels are recorded by a multi-point recorder RR-1. High-radiation levels and Trouble alarms are annunciated on the RTGB and on the rate-meters. Also, high radiation levels are annunciated near the detector locations (except R-32A and R-32B have no local alarm). Channel R-1 is the only area

e. Pressing and holding the CKT TEST pushbutton (white light) will perform a function check of the ratemeter. During this test the microprocessor executes a detailed routine that checks the read-only memory (ROM), random access memory (RAM) and the processor. Display readings will depend on the ratemeter/detector calibration. A display of only 1 or 2 in the center digit position indicates a ROM or a RAM error; a number 3 indicates both a ROM and a RAM error. In addition, as soon as the switch is pressed, the ALARM/RESET lamp and RTGB will annunciate; and any auto functions will activate. When the pushbutton is released the ALARM/RESET lamp and any auto functions will deactivate.

f. PWR ON (power on) indicator (white light).

NOTE: The ratemeter drawer must be retracted from the RMS console to access the following hardware.

g. POWER ON switch.

h. HIGH Alarm Setpoints thumbwheels.

i. H.V. (Vx2) dial, channel operating voltage. Recommended operating voltage for both the TA62 and TA-63 detectors is 550V (dial setting of 275).

j. The STATISTICS % switch. Reference Attachment 10.1, Ratemeter Data Filtering Techniques, for function.

2. All of the NRC Area Radiation Monitoring Channels have an associated "TA" series detector, manufactured by NRC, mounted in "free space" to monitor radiation levels in various areas. These detectors have the NRC non-blocking oscillator circuit for maintaining full-scale readings at over full-scale radiation intensities. The different area detector models/types are as follows: (theory of GM tubes is described in Section 6.1)

a. TA-62A(V6) Gamma Detector (R-1, R-3, R-4, R-5, R-6 and R-8)
This detector uses a halogen quenched geiger muller (GM) tube to measure gamma fields in the surrounding air. The GM tube is placed in a phenolic tube holder, which is used as a beta shield, and then inserted into an aluminum housing. The pulses received by the GM tube are processed and then transmitted to the ratemeter where it is digitally displayed in mr/hr. The range of this detector is .1 mr/hr - 10 R/hr.

b. TA-62A(V7) Gamma Detector (R-2 and R-7)

6. Pressing and holding the CHANNEL TEST pushbutton when the ratemeter Selector Switch is in the TEST position will immediately light the ALERT, HIGH, and CHANNEL TEST lamps (the high and alert alarm relays will also activate). When the CHANNEL TEST pushbutton is released the SAFE/RESET light may or may not stay on (depends on ratemeter model/power supply and timing of the channel test sequence). The HIGH and ALERT alarm lights should have to be reset.

3.1.3 Area Radiation Monitors Individual Channels

1. R-1; Control Room
    a. Uses a TA-62A(V6) detector
    b. A HIGH alarm will switch Control Room ventilation into the emergency pressurization operating mode (flow through the HEPA filters and carbon absorber bank).
2. R-2; CV Low Range Monitor - Uses a TA-62A(V7) detector.
3. R-3; PASS Panel Area - Uses a TA-62A(V6) detector.
4. R-4; Charging Pump Room - Uses a TA-62A(V6) detector.
5. R-5; Spent Fuel Building - Uses a TA-62A(V6) detector.
6. R-6; Sampling Room - Uses a TA-62A(V6) detector.
7. R-7; CV In-core Instrumentation Room - Uses a TA-62A(V7) detector.
8. R-8; Drumming Station - Uses a TA-62A(V6) detector.
9. R-9; Letdown Line Area - Uses a TA-63A(V5) detector.
10. R-32A and R-32B; CV High Range
    a. Uses fixed position gamma sensitive ion chamber detectors.
    b. Detectors and cables are EQ qualified for the CV.
11. R-33; Monitor Building Area - Uses a TA-63A(V5) detector.

3.2 Process Radiation Monitors

AREA MONITORS

RMS-FIGURE-2

CHANNEL	AREA MONITORED
R-1	CONTROL ROOM
R-2	CONTAINMENT
R-3	PASS PANEL AREA
R-4	CHARGING PUMP ROOM
R-5	SPENT FUEL BUILDING
R-6	SAMPLING ROOM
R-7	INCORE INSTRUMENTATION AREA
R-8	DRUMMING STATION
R-9	FAILED FUEL MONITOR
R-32A&B	HIGH RANGE (Accident)
R-33	R-14 BUILDING MONITOR

INFORMATION USE ONLY

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

1. Perform The Following:

   a. Make PA Announcement For Procedure Entry

   b. Use Non-Performed Attachment(s) Listed Below For Radiation Monitor(s) In Alarm:

RADIATION CHANNEL	**AREA MONITOR**	**ATTACHMENT NUMBER**
R-1	CONTROL ROOM	1
R-2	CV AREA	2
R-3	PASS PANEL AREA	3
R-4	CHARGING PUMP ROOM	4
R-5	SPENT FUEL PIT AREA	5
R-6	SAMPLING ROOM	6
R-7	INCORE INSTRUMENT ROOM	7
R-8	DRUMMING STATION	8
R-9	LETDOWN LINE AREA	9
R-32A R-32B	CV HIGH RANGE	10
R-33	MONITOR BLDG AREA MONITOR	11

(CONTINUED NEXT PAGE)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

ATTACHMENT 4

AREA MONITOR R-4 - CHARGING PUMP ROOM

(Page 1 of 2)

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
1.	Place VLC Switch To EMERG Position	
2.	Place And Hold EVACUATION ALARM Switch To LOCAL Position For 15 SECONDS	
3.	Announce The Following Over Plant PA System: "ATTENTION ALL PERSONNEL. ATTENTION ALL PERSONNEL. A HIGH RADIATION ALARM HAS BEEN RECEIVED ON CHARGING PUMP ROOM AREA MONITOR, R-4. ALL NON-ESSENTIAL PERSONNEL EVACUATE THE CHARGING PUMP ROOM UNTIL FURTHER NOTICE"	
4.	Repeat PA Announcement	
5.	Place VLC Switch To NORM Position	
6.	Contact RC Personnel To Perform A Survey, As Necessary, To Determine Magnitude Of Radiation Source	
7.	Check Reason For Alarm - KNOWN	With assistance from RC personnel, visually inspect Charging Pump Room for radioactive leaks.
8.	Check Charging Pump Room - LEAK IDENTIFIED	Go To the main body, Step 1.b, of this procedure.
9.	Start One Of The Following AUX BUILDING CHARCOAL EXH FANs: • HVE-5A • HVE-5B	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

ATTACHMENT 4

AREA MONITOR R-4 - CHARGING PUMP ROOM

(Page 2 of 2)

10. Coordinate With RC Personnel To Control The Leak And Limit Spread Of Contamination

11. Go To The Main Body, Step 1.b, Of This Procedure

- END -

exhaust unit HVE-13. Air supplied by HVAC-1 is heated/cooled as needed and recirculated without any direct make-up or exhaust air. The men's and ladies' restrooms are ventilated by individual exhaust fans and heated by electric unit heaters, EUH-F and G. C-1 is located on the roof of the tool room adjacent to the CV access area.

2.4.8 Reactor Auxiliary Building Main Supply (HVS-1) and Exhaust (HVE-2A, HVE-2B) (See Figures 3 and 4)

The main air supply unit for the Reactor Auxiliary Building is supply unit HVS-1. HVS-1 supplies treated outdoor air during the summer and partly return/partly outdoor air during the winter.

Heating steam to coils in HVS-1 (Reactor Auxiliary Building) is supplied from the Auxiliary Steam System, and condensate is returned to the same system. Supply water to the cell type air washers is supplied from the Service Water System.

The inter-area air transfer in system HVS-1 is accomplished by maintaining a pressure differential between the supply air outlets and exhaust intakes so that the direction of air flow is always from areas of lower contamination to areas of higher contamination. Part of the air supplied by HVS-1 is collected and returned to the unit during winter. This is accomplished by a return air system that includes fan HVE-7. The total amount of air handled by HVE-7 includes air from the Electrical Equipment Area, Relay Room No. 1, CCW Surge Tank Area, and the H&V Equipment Room. The rest of the air supplied by HVS-1 is exhausted by two sets of exhaust units: HVE-5A, 5B and HVE-2A, 2B. HVE-5A and 5B exhaust to HVE-2A and 2B through a charcoal filtering unit and are not used during normal operations. HVE-2A and 2B discharge to the plant stack.

2.4.9 RHR Pump Room (HVH-8A, HVH-8B), SI (HVH-6A, HVH-6B), and AFW Pump Rooms (HVH-7A, HVH-7B) (See Figure 4)

These rooms are cooled by recirculating the air through cooling units located in the rooms. The RHR Pump Room is cooled by cooling units HVH-8A and 8B. The SI Pump Room is cooled by cooling units HVH-6A and HVH-6B. The AFW Pump Room is cooled by cooling units HVH-7A and HVH-7B. The actual cooling is accomplished by circulating the room air, and water from the Service Water System through a heat exchanger cooled by SW.

2.4.10 CCW Surge Tank Room - Electric Unit Heater EUH-1

This heater provides local heating to the Component Cooling Surge Tank Room.

2.4.11 Miscellaneous Rooms - Steam Unit Heaters SUH-1 through SUH-13

The air supply unit HVS-1 contains prefilters, steam heating coils, cell type air washer, centrifugal fan with drive and motor, and is housed within a room. The air intake of the unit is connected to dampered outdoor air louvers, and the supply air is discharged into an air distribution system which consists of ductwork, ductwork auxiliaries and air distribution terminals.

3.8.2 Exhaust Units HVE-5A and HVE-5B

Manufacturer - Motor	Westinghouse
Manufacturer - Fan	American Standard Ind. Division
Air flow rate per fan	5,750 cfm
Power requirements - per fan	5 hp
HEPA filters - number per unit	6
Carbon filters - number per unit	18

These units consist of high efficiency particulate air (HEPA) filters, activated carbon adsorbers in one sheet metal enclosure, and two 100 percent capacity axial flow fans each with drive and motor. The discharge of these units is connected to the intake of exhaust units HVE-2A and HVE-2B.

3.8.3 Exhaust Units HVE-2A and HVE-2B.

Manufacturer	Westinghouse
Air flow rate per fan	54,150 cfm
Power requirements - per fan	75 hp
Prefilters - number per unit	48
HEPA filters - number per unit	48

These exhaust air units HVE-2A and HVE-2B (standby) consist of air intake terminals, ductwork, ductwork auxiliaries, prefilters, and HEPA filters. The discharge from these units is directed to the plant stack.

3.9 RHR, SI and AFW Pump Rooms

3.9.1 HVH-8A and HVH-8B (RHR Pump Room)

Manufacturer – Motor	Westinghouse
Manufacturer - Fan	H. K. Porter Co., Inc.
Air flow rate per unit	8,200 cfm
Cooling capacity per unit - Total	71,316 Btu/hr

is actuated. On flow failure, an air flow switch (in the discharge of each fan) starts the standby fan after a 20 second time delay, de-energizes the controls of the fan that failed, annunciates low flow, and sounds an alarm for standby fan running.

A pitot tube sensing velocity pressure, located in the common discharge duct, modulates (through a differential pressure controller) the filter dampers to maintain constant air flow.

Booster fans HVE-5A and 5B for carbon and absolute filters are interlocked with HVE-2A and 2B fans. Manual starting of HVE-5A and 5B closes the normal flow damper automatically, opens the filter damper and starts the fan with indicating lights located on the RTGB. The damper positions are shown on the RTGB with indicating lights.

If the motor of HVE-5A electrically trips, the standby fan, HVE-5B will start automatically. An air flow switch in the filter duct also starts the standby fan on flow failure after a 20 second time delay, de-energizes the controls of the fan that failed, annunciates low flow, and sounds an alarm for standby running.

A pitot tube sensing velocity pressure located in the inlet duct to the filters, modulates the filter damper through a differential pressure controller to maintain constant air flow through the filters. The filter damper opens automatically when either exhaust fan HVE-5A or 5B is energized.

Fresh air intake louver and fan discharge dampers open and controls are energized when HVS-1 fan is energized. A modulating controller, set at 50°F, controls the air temperature leaving the steam coil by throttling the steam valve to each coil section. A thermostat in the return air readjusts the modulating controller to maintain a minimum return air temperature of 50°F. A thermostat located in the discharge of HVS-1 annunciates and sounds an alarm on the RTGB when discharge temperature is below 35°F.

Exhaust fan HVE-7 is energized when supply fan HVS-1 is energized. When the outdoor temperature is below 60°F, the EAC is not placed in service, the return air damper to HVS-1 opens, and the exhaust damper of HVE-7 closes. When the outdoor temperature is above 60°F, EAC-3 may be placed in service, the return air damper closes, and the exhaust damper opens.

Electric duct heaters EDH-2 and 3 are energized through a room thermostat when supply fan HVS-1 is energized.

4.9 RHR, SI, and AFW Pump Rooms

Cooler Unit Fans HVH-6A, -6B, -7A, -7B, -8A, and -8B, will start under the conditions specified in Section 6.1.9. Indicating lights on the RTGB show units off or running.

If a Diesel Generator is started, its ventilation system is automatically started. Fans may be started manually from the RTGB as required by plant conditions. For cooling of Diesel Room "A", HVS-6 and exhaust fan HVE-18 are started as required by plant conditions. For cooling of Diesel Room "B", HVS-5 and exhaust fan HVE-17 are started as required by plant conditions.

6.1.7 Containment Vessel Access Area Supply and Exhaust

During normal operation, HVAC-1 will operate according to thermostat setting and HVE-13 will be operating continuously.

6.1.8 Reactor Auxiliary Building Main Supply and Exhaust

EDH-2 is thermostatically controlled. It operates whenever heating is required. HVE-7 operates continuously during normal plant operation. HVE-7 exhaust louver and HVS-1 return louver are opened and closed, respectively, and solenoid valve SW-787 is open if the outside air temperature is above 60°F.

HVE-5A and HVE-5B are not operating during normal plant operation. These units can be started for the Recirc Phase of Safety Injection or as required by plant conditions to reduce possible airborne activity. When they are placed in service, the bypass damper shuts and air is redirected through the charcoal and absolute filters. HVE-5A or HVE-5B may be started anytime HVE-2A or HVE-2B is running.

If HVE-2A/2B or HVE-5A/5B has an electrical trip, its respective standby fan starts for the tripped fan. If HVE-2A/2B or HVE-5A/5B has a low flow, its respective standby fan starts and trips out the running fan.

6.1.9 RHR, SI, and AFW Pump Rooms

When a SI, CS, RHR, or MDAFW pump is started, only the room cooler fan in the same train will start or with no pump running, any room cooler fan can be started by placing the fan's two-position selector switch at the respective MCC in the RUN position.

6.1.9.1 HVH-6A and HVH-6B

SI/CS Cooler Fan HVH-6A will start automatically if any of the following occurs:

1. Containment Spray Pump "A" starts.
2. Safety Injection Pump "A" starts.
3. Safety Injection Pump "B", when powered from E-1 Bus compartment 22B, starts.

SI/CS Cooler Fan HVH-6B will start automatically if any of the following occurs:

ATTACHMENT 10.2
Page 5 of 13

HVAC INSTRUMENT SETPOINTS

ITEM and LOCATION	DESCRIPTION	FUNCTION	SET POINT
SV-A4, HVE-2B	Solenoid Valve	Open for discharge damper	N/A
HVE-2A, HVE-2B	Differential Pressure Regulator	Energize pneumatic relay and outdoor air damper operator	N/A
HVE-2A, HVE-2B	Pneumatic Relay	Modulate fan discharge dampers	N/A
FS-4734, HVE-2A	Airflow Switch	Start standby fan, annunciate "Low Flow" and sound alarm	N/A
FS-4735, HVE-2B	Airflow Switch	Start standby fan, annunciate "Low Flow" and sound alarm	N/A
HVE-5A, HVE-5B	Differential Pressure Regulator	Energize pneumatic relay and inlet damper operators	N/A
HVE-5A, HVE-5B	Pneumatic Relay	Modulate fan inlet dampers and energize SV-A1 and SV-A2	N/A
SV-A1, HVE-5A	Solenoid Valve	Interlock with HVE-5B	N/A
SV-A2, HVE-5B	Solenoid Valve	Interlock with HVE-5A	N/A
FS-4732, HVE-5A	Airflow Switch	Start standby fan, annunciate "Low Flow" and sound alarm	N/A
FS-4733, HVE-5B	Airflow Switch	Start standby fan, annunciate "Low Flow" and sound alarm	N/A
SV-A7, HVE-8	Solenoid Valve	Open fan discharge damper	N/A
TS-A30, EUH-1	Thermostat	Start/stop unit heater fan	50°F ± 3°F
HVS-2	Temperature Sensor	Energize controller	70°F ± 3°F
HVS-2	Controller	Modulate steam control valve	N/A
HVS-2	Temperature Sensor	Energize controller	50°F ± 3°F
SV-A10, HVS-2	Solenoid Valve	Open outdoor air damper	N/A

INFORMATION USE ONLY

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Given the following plant conditions:

- The plant is operating at 100% RTP.
- A loss of Instrument Air has occurred with pressure currently at 75 psig.
- The crew is implementing AOP-017, Loss of Instrument Air.

Which ONE(1) of the following identifies the preferred flowpath when Station Air is required to be cross-connected with Instrument Air IAW AOP-017?

Flow is from the Station Air Compressor ----->

A.✓ Station Air coalescing filter -----> Instrument Air Header

B. bypass the Station Air coalescing filter -----> Instrument Air Dryers A/B -----> Instrument Air Header

C. Station Air coalescing filter -----> Instrument Air Dryers A/B -----> Instrument Air Header

D. bypass the Station Air coalescing filter -----> Instrument Air Header

The correct answer is A.

A. Correct

B. Incorrect - AOP-017 does give an option to bypass the coalescing filter if the inlet and/or outlet to the filter cannot be opened. This is not preferred since SA has high oil and moisture content. Normal instrument air flow goes through the air dryers. A flowpath does not exist for SA to go through the air dryers. In AOP-017, an option does exist to bypass the IA dryers if necessary to provide IA from the IA compressors.

C. Incorrect - A flowpath does not exist for SA to go through the air dryers. Normal instrument air flow does go through air dryers to remove moisture.

D. Incorrect - This flowpath is an option if the inlet and/or outlet to the filter cannot be opened. This is not preferred since SA has high oil and moisture content.

Question 64
Tier/Group 2/2
K/A Importance Rating - RO 2.9 SRO 3.2

Knowledge of SAS design feature(s) and/or interlock(s) which provide for the following:
Cross-connect with IAS

Reference(s) - Sim/Plant design, System Description, AOP-017
Proposed References to be provided to applicants during examination - None
Learning Objective - AIR 009
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.7
Comments -

Compressor is used as backup to feed the Condensate Polisher Air System. The IA System is sometimes referred to as "oil-free." An "oil-free compressor" is the same as a "non-lubricated compressor." Both terms are used interchangeably and simply refer to the fact that oil is not injected into the cylinders. However, all compressors need oil and contain oil in the crank case to provide lubrication to the journal bearings and other components. Non-lubricated or oil-free machines are designed to keep oil out of the cylinders. The term "oil-free" (or "non-lubricated") IA is defined as a system containing not more than 1 ppm oil.

The SA System has one 400 scfm oil lubricated air compressor with aftercooler, one 150 cubic foot air receiver, controls and accessories but no air dryer.

Since SA differs from IA only in its higher oil and moisture contents, SA is used as a backup for IA by passing the SA receiver discharge through a coalescing filter. The SA compressor is oil-lubricated and is not intended to be used for breathing air. When cross connected to IA, the use of breathing air is stopped to prevent potential harm to users. To a lesser extent, it is also stopped due to a reduction in air pressure.

Normally IAC "D" and the PAC will alternate to supply all the plant compressed air. "D" IAC capacity is rated at 526 acfm* at 110 psig (492 to 552 scfm depending on outside temperature). The PAC is rated at 300 scfm at 100 psig (284 scfm at 110 psig).

NOTE: scfm - Standard Cubic Feet/minute based on 70°F at sea level
acfm - Actual Cubic Feet/minute, corrected for pressure and temperature

For IAC "D", ambient air enters through a dry type inlet filter and silencer. Inlet air is regulated by the Air Intake Valve (To load and unload). The first compression occurs in the LP stage element. The air then flows through an air cooled Intercooler. A water separator removes any water condensed in the cooler. The air is compressed again in the HP element before the air is discharged into a pulsation damper-silencer, through a check valve and into a precooler then into an aftercooler, again with a water separator. Outlet air carrying higher pressure (about 100 psig) and higher temperature is then admitted to a 506 scfm air dryer before it discharges to a 427 cubic foot receiver. The air drying system is of the adsorption desiccant type. "D" IA Dryer capacity is rated at 506 scfm (at 14.5 psi & 68°F). The compressor and the dryer are designed to operate together. From the air receiver, air is distributed to various IA headers.

The 300 scfm PAC maintains system pressure around 100 psig. The flowpath through the compressor/dryer is essentially the same as IAC "D". Outlet air is admitted to a 327 scfm absorption desiccant type dryer before it discharges to a 427 cubic foot air receiver. A cooling fan removes the heat added by compression. Air can then be distributed from

6.2.1 Normally, the IA system should be aligned with:

- Both IAC "A" & "B" should be in **AUTO**
  NOTE: During weekly checks of plant equipment, the Primary Air Compressor and Instrument Air Compressor D will normally be swapped to provide for an even run time between the two compressors.
- PAC **OR** IAC "D" will be **in service**
- SAC should be **ON**

6.2.2 Ensure oil gauge glass level is NORMAL on each compressor prior to STARTING.

6.2.3 Set TCVs (TCV-1628 and TCV-1629-A & B) to maintain an outlet SW temperature of 90°F. This setting is adequate to ensure proper cooling and prevent condensation in the cylinder passages.

6.2.4 The nitrogen bottle high pressure gauge at the HVS-5, 6, and HVE-17, 18 control panel, should be maintained at not less than 1500 psig during normal plant operation. The nitrogen regulator has been adjusted to supply 50 psig if the IA pressure falls below this value.

6.2.5 The compressed air bottle high pressure gauge for the charging pumps and LCV-115B should be maintained at not less than 1350 psig during normal plant operation. The air regulator has been adjusted to supply 45 psig if the IA header pressure falls below this value.

6.3 Abnormal Operation

6.3.1 There are some air operated valves that use air as a force to both open and close the valve, but have a trip valve that will cause the valve to go to a failed position when air pressure decreases to a predetermined pressure. LCV-1530A and LCV-1530B have these trip valves (fail position at 60 psig).

6.3.2 Cross Connecting the Air Systems

The Station and IA Systems are designed to be cross connected. The SA can be lined up to supply IA through SA-220, through the coalescing filter and SA-221 (the preferred path). SA-5 is in a cross connect line without a filter and should not be used unless the filter is unavailable and no other source of IA is available. The IA Dryers are bypassed when SA is cross connected with IA.

INFORMATION USE ONLY

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

NOTE

IA-3821 is located on IA Dryer D.

8. Dispatch Operator(s) To Perform The Following:

   a. Verify Station Air Compressor Available For Service As Follows:

      - Verify SA-1, STATION AIR TO RECEIVER - OPEN

        AND

      - Verify Station Air Compressor Function Switch - ON

      RNO: a. Go To Step 8.d.

   b. Verify the following SA TO IA CROSS CONNECT BYPASS FILTER ISOLATION Valves - OPEN:

      - SA-220
      - SA-221

      RNO: b. Open SA-5, STATION AIR TO INST AIR CROSS CONNECT.

   c. Verify the STATION AIR COMP - RUNNING

   d. Verify IA-18, AIR DRYER "A" & "B" BYPASS - OPEN

   e. Verify the following Compressors - RUNNING

      - INST AIR COMP A
      - INST AIR COMP B

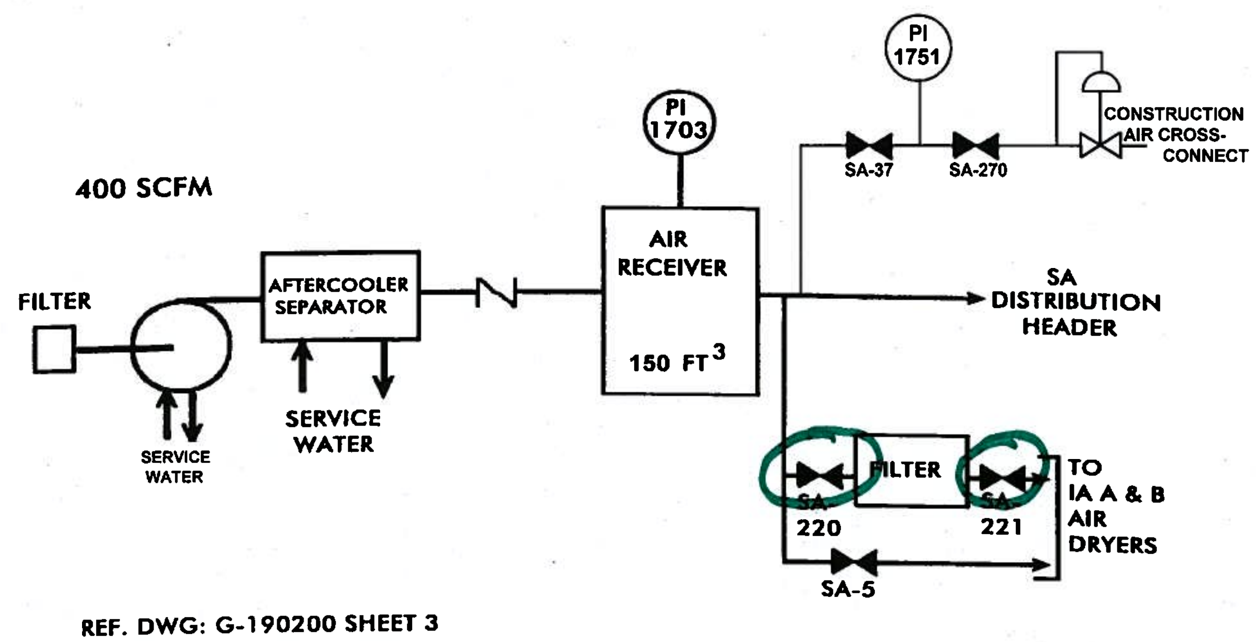
   f. Check FCV-1740, AIR DRYER HIGH DP FLOW CONTROL Valve - OPEN

      RNO: f. Open IA-3665, AIR DRYER "A" & "B" BYPASS.

   g. Open IA-3821, INSTRUMENT AIR DRYER "D" BYPASS

STATION AIR COMPRESSOR PACKAGE

AIR-FIGURE-4



INFORMATION USE ONLY

65. 086 A1.05 001

Given the following plant conditions:

- During clearance restoration on a drained section of Fire Water piping an isolation valve is opened too quickly and Fire Water pressure drops to 97 psig.

Based on the conditions given, which ONE (1) of the following identifies the Fire Water Pumps currently running?

Fire Water Booster (Jockey) Pump ...

A. ONLY

B.✓ AND Motor Driven Fire Pump ONLY

C. AND Engine Driven Fire Pump ONLY

D. Motor Driven Fire Pump AND Engine Driven Fire Pump

The correct answer is B.

A. Incorrect. The Fire Water Booster Pump is always running maintaining a constant fire water header pressure. The Booster pump provides a discharge head of 125 psig at a rated flow of 75 gpm. The setpoint for the MDFP is 100 psig (95 to 105 psig).

B. Correct.

C. Incorrect. The setpoint for the EDFP is 90 psig (85 to 95 psig). Candidate could have gotten setpoints confused. Also, the Booster pump is always running and does not stop when other pumps are running.

D. Incorrect. The setpoint for the EDFP is 90 psig (85 to 95 psig), therefore a start signal for the EDFP will not be generated.

Question 65
Tier/Group 2/2
K/A Importance Rating - RO 2.9 SRO 3.1

Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with Fire Protection System operating the controls including: FPS lineups

Reference(s) - Sim/Plant design, System Description, OST-603
Proposed References to be provided to applicants during examination - None
Learning Objective - FPW 006
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.5 / 45.5
Comments -

2.2 Design Basis

The fire water system is capable of maintaining pressure in the fire main loop at 70 psig or higher with the largest deluge system in operation with an additional 1000 gpm available for fire hose operations.

2.3 System Flow Paths (Figure 7)

Utilizing Lake Robinson as a source of supply, three (3) fire pumps deliver water through a twelve (12) inch feed to a ten (10) inch fire main loop surrounding Unit-2. Refer to Drawing HBR2-8255 for the schematic layout of the fire pumps.

2.4 System Description

2.4.1 Fire Water Distribution System

The fire main loop is part of the distribution system. The loop supplies fire hydrants, deluge systems, sprinkler systems, a dry standpipe system and hose stations.

In an emergency, water can be supplied to the Unit-2 fire main loop from the Unit-1 fire pump and/or ash sluice pumps. The Ash Sluice pumps (normally isolated) take suction from the discharge canal. The canal has a weir that ensures some water will be available even if the dam were to fail and lake level was lost. Also, an automatic starting, 2000 gpm (at 103 psig) electric fire pump at the Unit-1 intake may be used to supply the system. The Unit-1 fire pump takes suction from the lake and is located at the Unit-1 intake.

The fire water pumps are located in the Unit-2 Intake Structure and include one (1) booster pump and two (2) redundant fire pumps each rated at 2500 gpm. The booster pump maintains fire water system pressure at approximately 125 psi, under non-use conditions. One fire pump is driven by an electric motor and the other by a diesel engine. Both start automatically upon decreasing fire water header pressure.

The diesel engine is arranged so that engine overheating or loss of oil pressure will not cause the engine to shut down, but will provide a local alarm and a pump failure alarm in the Control Room. Once started, the engine will run until manually stopped, it trips on overspeed, runs out of fuel or it fails.

Fuel oil sufficient for at least eight (8) hours of operation is supplied by a 450 gallon fuel tank located outside of the intake structure. Normal usage is approximately 10 gal. per hour when the pump is running.

Upon a reduction of pressure in the fire main loop, pressure switches initiate a sequential starting of the fire pumps. The Motor Driven Fire Pump starts at 100 psig (95 psig - 105 psig). Should the fire main pressure drop to 90 psig (85 psig - 95 psig), the Engine Driven Fire Pump will automatically start. Each pump discharges through a swing check valve and gate valve to the fire water header. The swing check valves prevent reverse flow through the non-running fire pumps.

?

Pressure relief valves set at 135 psig provide protection for each fire pump by discharging excess water back into Lake Robinson. Air release valves adjacent to the relief valves are connected to high points and vent air from the discharge piping in an effort to reduce water hammer. Hose manifolds are provided as a means of testing fire pump capacity and can also be used as fire hydrants.

The three (3) fire pumps can be manually operated at their respective local control panels. Remote operation and indications for the Motor Driven Fire Pump (MDFP) are provided in the Control Room on the Containment Fire Protection Panel (CFPP). The Fire Alarm Console (FAC) in the Control Room provides alarms only. Operations, indications and alarms for the Engine Driven Fire Pump (EDFP) and its control system occur locally on its controller. The Fire Alarm Console (FAC) in the Control Room provides alarms only. The booster pump is only operated at its local control panel. There are no local or remote indication or alarms other than pressure gauge indications.

Post indicator gate valves (P.I.V.'s) are strategically located within the fire main loop. The normally open valves permit isolation of a section of the fire main loop without loss of fire service to other than the isolated section. A section of the fire main loop may be defined by its boundary valves.

Attachment 3 lists the systems, hydrants and hose stations which would be rendered inoperable by the isolation of various sections of the fire main loop. Attachment 3 also lists back-up sources of fire water for the affected systems, hydrants and hose stations.

5.0 CONTROLS AND PROTECTION

5.1 Booster Pump

The pump runs continuously and is not connected to any instrumentation or controlling devices other than its motor controller. The local control panel is equipped with a two (2) position selector switch (ON/OFF), normally in the ON position.

5.2 Motor Driven Fire Pump

The local control switch at the intake is equipped with a three (3) position rotary snap switch (OFF, AUTO, ON). The selector switch is normally in the AUTO position. This allows for automatic starting of the fire pump by the pressure switch. Manual starting is accomplished by moving a rotary snap switch on either the local controller or on the Containment Fire Protection Panel in the Control Room to the ON position.

5.3 Engine Driven Fire Pump

The controller for the diesel engine driven fire pump is located in a separate structure west of the Intake Structure. Input power is supplied from Lighting Panel 35 Circuit 8. The controller electrical output for battery charging is 24 volts DC. The control system consists of the controller, battery charger, batteries, and associated alarms as shown in Figure 6. The controller performs the following functions:

1. In AUTO, starts the engine upon a low fire main loop pressure of 90 psig (85 psig to 95 psig). An approximate two (2) second time delay is provided so a pressure spike will not start the diesel fire pump.
2. Maintains battery charging via the two (2) battery chargers.
3. Provides for normal and emergency battery starting power.
4. Provides for local starting and stopping.
5. Accommodates MANUAL testing.
6. Monitors the following eight indications and alarms:

    A. BATTERY 1 FAILURE
    B. BATTERY 2 FAILURE
    C. LOW OIL PRESSURE
    D. HIGH WATER TEMP

Supervision of pre-action sprinkler systems and the dry standpipe is provided by pressurizing the riser with air between 15 and 50 psig depending on the system. A water seal is placed on the valve. The sprinkler riser is then pressurized by the instrument air system through a pressure regulator. Should a sprinkler open, loss of header air pressure results in a Low Air alarm from the system's pressure switch. The resulting alarms are also listed in Attachment 10.2.

In Containment, the instrument air system supplies all three (3) Reactor Coolant Pump Pre-Action sprinkler systems (Fire Detection Zones 25A, B, and C) from the "D" Header. The Electrical Penetration Area Pre-Action System (Fire Detection Zone 24) is supplied from the Auxiliary Building Instrument Air System header.

The air compressor for the Turbine Lube Oil Deluge System supplies the Rate-of-Rise detection systems with supervisory air at 1 to 1½ psig in the HAD system only.

6.0 SYSTEM OPERATION

6.1 Normal Operation

6.1.1 Fire Water System

Normal operation of the fire water system consists of the booster pump maintaining system pressure above the starting pressure of the MDFP, under non-use conditions and the following in the indicated operational state:

- Electric and diesel fire pump controllers, energized and in the automatic (AUTO) mode.
- Post indicator valves in fire main loop open.
- Water supply (header) valves open.
- Pre-action and deluge controlling gate valves open.
- All pre-action, deluge, dry standpipe, wet-pipe, and dry-pipe sprinkler system valves and trim properly set to operate.
- The Fire Detection and Actuation System (FDAS) control panels energized and alarms cleared.

- Deluge sprinkler systems
- Dry standpipe system
- Hose station
- Fire hydrants
- Wet-Pipe Sprinkler System
- Dry-Pipe Sprinkler System

With the local control switch in AUTO, starting of the MDFP is caused by a drop in fire water header pressure to 100 psig (95 psig to 105 psig) which closes the contact on pressure switch PSL-7054. The closed contact energizes the breaker closing coil in 480 Volt Bus 3, Compartment 14C, which is a Westinghouse DB-50 breaker. With the closing coil energized, the MDFP will start. The pump will continue to operate until manually shutdown.

When the MDFP cannot maintain system pressure or fails to start, the Engine Driven Fire Pump (EDFP) starts automatically at 90 psig (85 psig to 95 psig). The pressure switch closes at 90 psig (85 psig to 95 psig) and following a short time delay, the controller for the EDFP will start the pump using the batteries. Once started the engine will continue to run until manually stopped at the control panel by pushing the STOP button, or turning the switch to the "OFF" position. Except for overspeed trip the pump engine will run until failure or fuel depletion.

If the switch is in the AUTO position, the EDFP is reset for automatic operation by pushing the STOP button. If in any other mode of operation,stop the EDFP by moving the control switch to the OFF position, allow starting conditions to return to normal, and move the control switch to the AUTO position.

6.2.2 Deluge Sprinkler System

As illustrated in Attachment 7.1 automatic operation of the turbine lube oil deluge system is accomplished by using Heat Activated Devices, (HAD's). Heat from a fire increases air pressure in the HAD's. This increase in pressure is conveyed through tubing to the release device where it is used to automatically trip the deluge valve and allows water to be discharged through the open spray nozzles.

Automatic operation of the deluge systems for the three main transformers, startup transformer, aux. transformer and H2 seal oil skid is accomplished by using solenoid valves to open the deluge valves. When a fire is sensed by the linear heat detector installed around any of the five transformers or H2 seal oil skid, it sends a discrete signal to the associated solenoid release module. The release module energizes the solenoid to open it which

6.3 Abnormal Operation

6.3.1 Manual Operation - Fire Pumps

Manual actuation is provided for all automatic features of the Fire Water System. The booster pump is manually started at its local controller by placing the selector switch in the ON position. Manual starting of the Engine Driven Fire Pump is done locally at the EDFP controller by moving the selector switch to the MANUAL 1 or MANUAL 2 position and pushing the START button.

Manual starting of the Motor Driven Fire Pump (MDFP) can be accomplished locally by the local control switch located within the Service Water enclosure. This switch is spring return to AUTO from the ON position, and maintained in the OFF position. With the switch in the AUTO position, the pump will start automatically if fire main header pressure drops below 100 psig (95 to 105 psig). With the local control switch in the OFF position, the MDFP will not start even if fire main header pressure drops below 100 psig (95 to 105 psig). This feature will allow time for clearances to be hung for maintenance activities without concerns of the MDFP starting on low pressure. Thus, the OFF position is considered to be a maintenance position.

The Motor Driven Fire Pump can also be stopped and started from the Containment Fire Protection Panel in the Control Room. This is a spring loaded switch which when turned ON and OFF returns to the center position. This switch is designed so the MDFP can be stopped and the switch held in OFF position for five seconds and it locks out the electric motor so the pump will not start even if the system pressure is less than the auto start pressure. However, if the system pressure rises above the automatic start pressure (95 to 105 psi) and then drops below the auto start pressure the pump will automatically start.

6.3.2 Manual Operation - Deluge Systems

Manual operation of the deluge systems can be accomplished both locally and remotely (turbine lube oil deluge system only). Local (Manual) operation of the deluge systems is accomplished at the deluge valve by pulling down on the manual pull handle. This releases the weight which trips the deluge valve clapper open.

ATTACHMENT 10.2
Page 3 of 3

INSTRUMENTATION

Water Flow Alarm Instrumentation

System	Inst. No.	Location	Setpoint
Reactor Coolant Pump Bay "B" (Fire Detection Zone 25B)	PS-7009	At "B" Control Stand in CV (Panel IR-03)	30 psig
Reactor Coolant Pump Bay "C" (Fire Detection Zone 25C)	PS-7012	At "C" Control Stand in CV (Panel IR-04)	30 psig
CCW Pump Room (partial)	PS-7068	Turbine Bldg. Ground Floor	Field set

Fire Water Pump Instrumentation

System	Inst. No.	Location	Setpoint
MDFP Automatic Start	PSL-7054	SW Pump Bldg. at Intake	100 psig
EDFP Automatic Start	PSL-7056	EDFP Controller House at Intake	90 psig

INFORMATION USE ONLY

6.0 SPECIAL TOOLS AND EQUIPMENT

NOTE:	Use of a vibration instrument that is different from what is identified in OMM-015 requires Engineering concurrence to insure the instrument meets the accuracy requirements and is properly configured for this test.

		ID Number	INIT
6.1	Digital Strobotach or Equivalent	________________	____
6.2	Vibration Data Collection Instrument (N/A this step if vibration data is not required)	________________	____
6.3	Plastic seals or equivalent for sealing open FP-46		____
6.4	**IF** the Plan of the Week requires the quarterly performance vibration data to be obtained, **THEN VERIFY** the Vibration Data Collection Instrument is properly configured for this test in accordance with OMM-015 **OR** as recommended by Engineering.		____

7.0 ACCEPTANCE CRITERIA

7.1 The Motor Driven Fire Pump auto starts between 95 psig and 105 psig **AND** operates satisfactorily with no abnormal noise or vibration for a minimum of 10 minutes.

7.2 Both the audible and visual annunciations for starting and securing the MDFP are verified on the Fire Alarm Console.

7.3 The Engine Driven Fire Pump auto starts between 85 psig and 95 psig **AND** operates satisfactorily with all Engine parameters in the normal band for a minimum of 30 minutes.

7.4 Both the audible and visual annunciations for starting and securing the EDFP are verified on the Fire Alarm Console.

7.5 Quarterly MDFP vibration data is being obtained for trending purposes only and does not affect the acceptance criteria.

7.6 The diesel fuel tank level is greater than 250 gallons.

7.7 The reviewing and approving authorities may accept this test in accordance with provisions set forth in OMM-015, Operations Surveillance Testing.

66. G2.1.15 001

Which ONE (1) of the following statements identifies the administrative requirements of Standing Instructions IAW OPS-NGGC-1000, Fleet Conduct of Operations?

A. A Master Standing Instruction Book - Control Room is **NOT** required if a Standing Instruction Database has been developed.

B. Standing Instructions may be used to temporarily alter Reference-Use procedures until the procedure can be formally revised.

C✓ All active Standing Instructions issued since last standing watch must be reviewed.

D. Standing Instructions for Operational Issues are not required to have an expiration date.

The correct answer is C.

A. Incorrect. The Master Standing Instruction Book - Control Room is required even if a database has been created.

B. Incorrect - Standing instructions shall NOT contain instructions that cause departure nor deviation from approved procedures. For these circumstances, a temporary or permanent revision to the appropriate procedure must be initiated.

C. Correct. Only have to review the SIs that were approved since you last stood watch. Periodically review all SIs.

D. Incorrect. Operational Issues SIs have a maximum life of 92 days. SIs used for items to inform the shift of procedural changes have a maximum life of 35 days.

Question 66
Tier 3
K/A Importance Rating - RO 2.7 SRO 3.4

Knowledge of administrative requirements for temporary management directives, such as standing orders, night orders, Operations memos, etc.

Reference(s) - Sim/Plant design, OPS-NGGC-1000
Proposed References to be provided to applicants during examination - None
Learning Objective - Admin Self Study
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 45.12
Comments -

9.17.4 Operator Challenge Program (continued)

c. Quarterly, the Operator Challenge Coordinator or designee shall periodically review the open Operator Challenges to monitor the aggregate impact per attachment 12. (Reference SOER 94-1, Rec. #3)

d. The MSO will meet with the management of the following departments: Maintenance, System Engineering, Design Engineering, and Nuclear Projects. They will meet as needed to discuss Operator Workaround progress and priorities. This meeting should be held at a minimum quarterly.

9.17.5. Standing Instructions (Reference SOER 96-2, Rec. #4)

NOTE:	A site specific Standing Instruction database may be used in lieu of the Attachments 8, 9 and 10 provided all of the requirements of this procedure are met. Maintaining the Master Standing Instruction Book - Control Room is required.

1. General Information

a. Standing Instructions are maintained in the Master Standing Instruction Book - Control Room. In addition, they may also be kept in an electronic database if desired.

b. If necessary, Standing Instructions contained in the Master Standing Instruction Book can be duplicated for simulator training exercises by printing a copy.

c. If at any time, a site specific Standing Instruction database is inoperable and an Attachment 8 Standing Instruction Form is generated manually or a Standing Instruction is cancelled, the database can **NOT** be returned to service until all instructions are validated to be current.

d. The SM, or designee, shall be responsible for all Standing Instruction preparations, approvals, cancellations, and ensuring any site specific Standing Instruction database in use is current.

e. Standing Instructions requested by organizations other than Operations will be submitted in accordance with Attachment 10, Standing Instruction Request Form.

9.17.5.1 **Standing Instructions** (continued)

f. Operations personnel may use a site specific Standing Instruction database, or Attachment 8, Standing Instruction Form, if the site specific Standing Instruction database is not available.

g. Standing Instructions shall **NOT** contain instructions that cause departure nor deviation from approved procedures. For these circumstances, initiate either a temporary or permanent revision to the appropriate procedures. [NOCS 000426]

h. Standing Instructions shall **NOT** be used in lieu of a procedure. The Standing Instructions may be used to notify Operations personnel of additional requirements; however, procedural controls must be established to ensure compliance. [NOCS 000426]

i. Standing Instructions should **NOT** include instructions or information of long-term significance.

j. Standing Instructions should be used for the following types of information:

(1) Guidance in dealing with various types of plant problems to assure consistency between shifts.

(2) Descriptions of significant plant problems or events (including root cause when possible). These would include such items as significant incidents, reportable events, unit trips, etc.

(3) Emergency technical specification changes which have **NOT** been formally issued but granted by phone.

k. The Standing Instruction number format is XX-YYY, where XX is the last two digits of the current year, and YYY are sequential numbers, starting each January with 001.

l. A Prompting Action is an identifying number of any action item which prompted issuance of the Standing Instruction.

m. A Canceling Action is an identifying number of any action item (i.e., an action item prompting a procedure change) which, when complete, will allow cancellation of the Standing Instruction.

9.17.5.1 **Standing Instructions** (continued)

n. Standing Instructions issued solely for information purposes will have an expiration date assigned as necessary to ensure prompt removal when information is no longer needed. The Prompting Action and Canceling Action fields should be marked N/A for these Standing Instructions.

o. All Operations shift personnel will review Standing Instructions as follows:

(1) Any instruction issued since last standing watch.

(2) All instructions periodically to maintain familiarity.

p. Perform one of the following to request a Standing Instruction:

(1) Complete Attachment 8 Standing Instruction Form.

(2) Complete the request using a site specific Standing Instruction database

2. Standing Instruction Approval

a. Review the instruction request and all documentation submitted for accuracy.

NOTE:	An example of a Closure Contact name would be the individual responsible for the status and cancellation notification of the Standing Instruction. The Closure Contact could be the System Engineer, Shift Manager, etc.

b. Enter a Closure Contact name, if required.

c. Enter an expiration date as follows:

(1) Less than or equal to 92 days from the date of issuance is assigned for operational issues.

(2) 35 days for items issued to inform the shift of procedural changes.

(3) Enter the Prompting Action (N/A if no action required).

(4) Enter the Canceling Action (N/A if no action required).

9.17.5.2 Standing Instructions (continued)

NOTE:	If a site specific Standing Instruction database is used it will automatically assign the next sequential serial number. This number must be validated by comparing it to the Attachment 8 in the Master Standing Instruction Book.

d. Acquire the next sequential serial number from the Master Standing Instruction Book log.

e. Ensure the correct serial number field is entered in the Attachment 8.

f. Ensure the following information is entered correctly in the Attachment 8:

(1) Expiration Date

(2) Serial Number

(3) Prompting Action

(4) Canceling Action

(5) Closure Contact

(6) Expiration Date

(7) Instructions

g. Ensure the “Approved” and “Date” field is entered.

h. Complete the update of Attachment 9 in the Master Standing Instruction Book for the new instruction.

i. Return to initiator (a copy of the Standing Instruction should be included if applicable).

j. Send a Copy of Standing Instruction to the Superintendent, Radiation Protection if Standing Instruction has potential for changing Station Dose Rates (Reference SOER 01-1, Rec. #2).

67. G2.1.17 001

Which ONE (1) of the following completes the statement below?

IAW OMM-001-7 ,Notifications, when plant alarms are out-of-service AND it is necessary to make emergency notifications, the announcements are required to be repeated _______________.

A. TWO (2) times

B.✓ THREE (3) times

C. until acknowledged by ALL watchstanders

D. until acknowledged by the TSC and EOF facility leads

The correct answer is B.

A. Incorrect - The Emergency Preparedness procedures require that plant announcements for declarations be made twice. However, OMM-001-7 requires that the announcements be made three times if the alarms are OOS.

B. Correct.

C. Incorrect - An acknowledgement from ALL watchstanders would ensure that they received and understood the announcement. This is part of normal three-way communication. However, this acknowledgement is not procedurally required.

D. Incorrect - An acknowledgement from both the TSC and EOF would ensure that they received and understood the announcement. This is part of normal three-way communication. However, this acknowledgement is not procedurally required.

Question 67
Tier 3
K/A Importance Rating - RO 3.9 SRO 4.0

Ability to make accurate, clear, and concise verbal reports.

Reference(s) - Sim/Plant design, OMM-001-7
Proposed References to be provided to applicants during examination - None
Learning Objective - Admin Self Study
Question Source - BANK (Last used on the 2007 NRC Exam.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 45.12 / 45.13
Comments -

9.6 **On-Call Duty Manager Notifications**

3. Events requiring the On-Call Duty Manager to notify the Site Communications Specialist (SCS):

NOTE:	NEI has requested prompt notification of "Events of Public Interest", and recommends that the notification to NEI be made by the site's public affairs organization rather than control room personnel or the emergency response organization. The SCS is listed in the RNP On-Call List.

Events Of Public Interest, which include, but are not limited to the following: (NCR 228613)

- Classified notice of unusual event
- Unintended release of chemical or other materials
- Fire at the site
- Activist group protest
- Radiation exposure to an individual in excess of regulatory limits
- Accidents involving transport of radioactive material to or from the plant site
- An event near site that mistakenly could be attributed to the plant

9.7 **Normal Working Hours Notifications**

On-Call Duty Manager should be notified of the following events during normal working hours or at the beginning of dayshift, based on significance, at the SM discretion:

- Call out of personnel to support emergent work activities inside the Protected Area
- Unanticipated loss of any Progress Energy base-load generating unit
- Any AOP entry
- Any Departure From Established Procedure IAW PRO-NGGC-0200

9.8 **Suspicious Activities**

Reports of suspicious activities (aircraft, vehicular, waterborne, personnel, etc.) must be evaluated, and if deemed sufficiently suspicious or threatening in nature, notify the Manager-Nuclear Plant Security or his designee.

9.9 **NRC Operations Center Notification**

When notifications to the NRC Operations Center are required , such notifications are to be made as soon as possible. If the Emergency Notification System is inoperative, then the licensee shall make the required notifications via commercial telephone service, other dedicated telephone system, or any other method which will ensure that a report is made as soon as practical to the NRC Operations Center.

9.10 **Plant Alarms Out Of Service**

When plant alarms are Out-of-Service AND it is necessary to make emergency announcements, the announcements should be repeated three times, (CR 95-02443)

68. G2.1.27 001

Which ONE (1) of the following identifies the primary design function / purpose of the Inadequate Core Cooling Monitor?

A. Large Break LOCA

B.✓ Small Break LOCA

C. Steam Line Break

D. Loss of Heat Sink

The correct answer is B.

A. Incorrect - The ICCM is capable of surviving a large-break LOCA transient so that it can be used for post-accident monitoring and recovery. However, instrumentation associated with the Reactor Protection System identifies a large-break LOCA and initiated emergency core cooling systems before the control room operator can respond to the ICCM.

B. Correct

C. Incorrect - Parameters are utilized from the ICCM during the mitigation of a Steam Line Break, such as CETC temperatures. However, ICCM is designed primarily for a Small Break LOCA.

D. Incorrect. Parameters are utilized from the ICCM during the mitigation of a Loss of Heat Sink, such as CETC temperatures. However, ICCM is designed primarily for a Small Break LOCA.

Question 68
Tier 3
K/A Importance Rating - RO 3.7 SRO 3.9

Knowledge of system purpose and/or function.

Reference(s) - Sim/Plant design, System Description
Proposed References to be provided to applicants during examination - None
Learning Objective - ICCM 001
Question Source - BANK (Not used on an NRC Exam from 2004 to present.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.7
Comments -

1.0 INTRODUCTION

As a result of the 1979 accident at Three Mile Island Unit 2 (TMI-2), the Nuclear Regulatory Commission (NRC) recommended the installation of instrumentation "to provide unambiguous, easy-to-read indication of inadequate core cooling." During the accident at TMI-2, both a low water level condition in the reactor vessel and inadequate core cooling existed, but neither was recognized for a long period of time. The failure was the result of a combination of factors including an insufficient range of existing instrumentation, inadequate emergency procedures, inadequate operator training, unfavorable instrument location (scattered information), and insufficient instrumentation.

In 1980 the NRC issued NUREG-0737, which required the installation of inadequate core cooling instrumentation that will provide the control room operator with unambiguous indication of the approach to inadequate core cooling in small-break loss of coolant accidents (LOCAs).

Inadequate Core Cooling Monitor (ICCM) instrumentation is applicable primarily to the slow transient, small-break LOCA and recovery. Neither the ICCM instrumentation as a whole nor the reactor vessel water level instrumentation is required to follow the fast transients resulting from a large-break LOCA. Instrumentation associated with the Reactor Protection System identifies a large-break LOCA and initiates emergency core cooling systems before the control room operator can respond to the ICCM. However, it is important that the ICCM instrumentation be capable of surviving a large-break LOCA transient so that it can be used for post-accident monitoring and recovery (RG 1.97).

Reliable operation of the ICCM, especially the Reactor Vessel Level Instrumentation System (RLVIS), during normal reactor operation is necessary so that the control room operators will be confident of the indications.

1.1 System Purpose

The ICCM System assists the operator in detecting the following conditions:

- Approach to inadequate core cooling
- Presence of gas bubble or void in the reactor vessel
- Formation of voids in the reactor coolant system (RCS) during forced coolant flow

69. G2.2.6 001

Given the following conditions:

- The crew has discovered an error in an AOP. The AOP identified the proper title of a pressure indicator, but describes the indicator as PI-2098 instead of the correct number PI-2089.
- A temporary procedure change has been initiated to correct the error.

Which ONE (1) of the following statements applies to the temporary procedure change process IAW PRO-NGGC-0204, PROCEDURE REVIEW AND APPROVAL?

A.✓ The expiration date of the temporary change shall not exceed 21 days from the approval date.

B. The procedure owner must approve the temporary change prior to use in the field.

C. The change must be processed as a Normal Revision since it is an Intent Change.

D. The expiration date of the temporary change shall not exceed four months from the interim approval date.

The correct answer is A.

A. Correct

B. Incorrect - A temporary change has to be approved by Management personnel, but it does NOT require the Procedure Owner to approve it before use by the shift operators.

C. Incorrect - A change of intent can NOT be processed as a temporary change. Whether the change is to an AOP has NO bearing on whether the change can be processed as a temporary change.

D. Incorrect - Four months is the expiration date for temporary procedure revisions for ALL other Progress Energy sites.

Question 69
Tier 3
K/A Importance Rating - RO 3.0 SRO 3.6

Knowledge of the process for making changes to procedures.

Reference(s) - Sim/Plant design, PRO-NGGC-0204
Proposed References to be provided to applicants during examination - None
Learning Objective - Admin Self Study
Question Source - BANK (Used on the 2008 NRC Exam.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 43.3 / 45.13
Comments - Discussed with P. Capehart on 6/15/11: Discussed concern that RNP does not utilize temporary procedure changes. All procedure changes are performed utilizing the normal process and procedure writers are called out to make necessary changes if conditions warrant. It was agreed to prepare a question to the K/A and if difficulty in preparing plausible distracters becomes evident then this K/A will be re-addressed.

3.0 DEFINITIONS (Continued)

30. **Technical Review (PRRT):** A review of the technical and administrative accuracy of a procedure revision performed by one or more persons knowledgeable and competent in the subject of the procedure. The objective of this review is to ensure consistency is maintained between the procedure, source information, standards, applicable requirements, commitments, policies, and other procedures. **[R2, R5, R18, R19]**

31. **Temporary Procedure Change:** A change to the current revision of a procedure that is not a change of intent and is necessary to support timely continuation of work when the procedure cannot be performed as written. There are two reasons for Temporary Procedure Changes: **[R2, R3]**

    - Plant conditions are different from the expected conditions for which the procedure was written and are expected to return to normal.

    <u>OR</u>

    - Errors or omissions exist in the procedure.

32. **Validation Review (PRRV):** A review performed to confirm the actions specified in a procedure can be performed by qualified individuals to achieve the expected results. Performance, Simulator, Walkthrough, Comparison, or Table Top are methods of validation review. **[R13, R15, R16]**

4.9 **Impact Reviewer**

1. Review the procedure changes for impacts to unit processes and programs.

4.10 **NGG Action Team**

1. Assist the procedure sponsor in obtaining input, reviews, and resolving PRRs and review comments.

4.11 **Validation Reviewer**

1. Ensure the actions specified in the procedure can be performed by qualified individuals to achieve the expected results.

4.12 **Approval Authority**

1. Ensure the adequacy of procedures.
2. Ensure procedures and changes are consistent with organizational standards and expectations.

4.13 **Trainer**

1. Ensure required training is complete for personnel qualified to perform a task prior to completing the TRN assignment.

4.14 **Temporary Procedure Change Initiator**

1. Ensure proper routing and delivery of forms of the Temporary Procedure Change Package.

4.15 **Temporary Procedure Change Interim Approver**

1. Ensure Temporary Procedure Changes are not a Change of Intent.
2. The interim approval authorities are:
   - [CR3] Work Control Center Supervisor or his designee **[R2]**
   - [BNP, HNP] Interim Approval Authority determined using Enclosure 5, [BNP, HNP] Temporary Procedure Change Interim Approvers **[R2]**
   - [RNP] Member of management

   AND

   - Shift Manager or a designee with a SRO License on the affected unit. **[R2]**

4.16 **Field Editorial Correction Approver**

1. Ensure Field Editorial Corrections meet the definition of an editorial correction.
2. The Approver of a Field Editorial Correction shall be a procedure Sponsor, Supervisor, or the Nuclear Shift Manager or higher level of Management.

NOTE:	The normal revision process is preferable to the Temporary Procedure Change process.
NOTE:	Enclosure 4, Temporary Procedure Change Flowchart shows the Temporary Procedure Change Process.

9.5 **Temporary Procedure Changes**

9.5.1 **[Initiator] Temporary Procedure Change Preparation**

1. The Temporary Procedure Change process shall not be used to make changes to NGGC procedures.
2. During working hours, consult the Sponsor or Approval Authority to validate the appropriateness of the Temporary Procedure Change vice a Normal Procedure Revision, Editorial Revision, or Field Editorial Correction.
3. Consult with Supervisor to ensure a Temporary Procedure Change is necessary and appropriate.
4. If the change is an Editorial Correction, go to Section 9.6, Field Editorial Corrections.
5. Obtain a copy of the title page of the current procedure and pages requiring change.
6. Mark-up the changes electronically or manually.
   - Show deletions and additions such that the user can readily see what the step was originally as well as the new wording.
7. Increase the revision level to the next alpha designator on the title page and affected pages. (example: Rev. 20A)
8. Include each affected page as part of the Temporary Procedure Change package.
9. If the Temporary Procedure Change is needed due to a procedure deficiency that meets the Priority 1 (P1), Technical Deficiency criteria:
   - Procedure cannot be performed as written
   - Conflict between procedures
   - Involves a Personnel Safety, Nuclear Safety, Reactivity issue, or Regulatory Requirement
   - Has potential for direct impact on generation
   - Poses significant technical or functional challenges

   then initiate an NCR in accordance with CAP-NGGC-0200, Condition Identification and Screening Process.

NOTE:	Attachment 8, Temporary Procedure Change Form, and the marked up pages become the Temporary Procedure Change Package.

10. Complete the top portion of Attachment 8, Temporary Procedure Change Form.
    a. Describe the changes and the reasons for the changes on Attachment 8, Temporary Procedure Change Form.
    b. Identify the Change type.
        - Changes used to modify procedures due to off-normal conditions are categorized as "Temp Change No Permanent to Follow".
        - Changes used to correct deficiencies such as errors or omissions in a timely manner are categorized as "Temp Change Permanent to Follow".
    c. Enter the expiration date of the change on Attachment 8, Temporary Procedure Change Form.
        - Expiration dates shall be no less than seven days from origination date and not on a Friday, Saturday, Sunday or a holiday.
        - [BNP, CR3, HNP] The expiration date shall not exceed four months from the interim approval date. Distractor
        - [RNP] The expiration date shall not exceed 21 days from the approval date. **[R2]**
11. [Supervisor] Review the Temporary Procedure Change Package.
12. [Supervisor] Ensure the change is not a Change of Intent: Distractor
    - Changes the purpose of the procedure or a procedure section
    - Adds, alters, or deletes a sequence of activities or method as described in the FSAR/UFSAR
    - Has the potential to cause a structure, system, or component to be used in a manner outside the design basis or limit the ability of a structure, system, or component to perform a safety function
    - Deletes, moves or circumvents a QC Hold Point
    - Implements a modification.
    - Conflicts with the remainder of procedure. (example: expected condition for subsequent step)
    - Places the plant in a Technical Specification Action Statement or reduces Defense in Depth
    - Alters or lessens administrative controls necessary to assure safe plant operation such as the Security Plan, Fire Protection Plan, Emergency Plan, QA Program, or Environmental Protection Plan
    - Deletes an independent verification
    - Changes the Prerequisites or Initial Conditions in a non-conservative manner

9.5 Temporary Procedure Changes (Continued)

- Changes acceptance criteria, setpoints, or values used to make a conclusion of acceptability
- Changes a value used to protect plant equipment or provide a limit to equipment operation. (for example; vendor requirement, design calculations, Technical Specifications, FSAR, defined operating ranges, or requirements specified in other procedures)

13. [Initiator and Supervisor] Sign and date on Attachment 8, Temporary Procedure Change Form.
14. [BNP, HNP] Refer to Enclosure 5, [BNP, HNP] Temporary Procedure Change Interim Approvers, and identify Termporary Change Interim Approvers.
15. [Initiator] Deliver Temporary Procedure Change Package to the Interim Approvers.

9.5 Temporary Procedure Changes (Continued)

9.5.2 [Interim Approver] Temporary Procedure Change Approval

1. Review the Temporary Procedure Change Package.
2. Verify the change is not a Change of Intent:
   - Changes the purpose of the procedure or a procedure section
   - Adds, alters, or deletes a sequence of activities or method as described in the FSAR/UFSAR
   - Has the potential to cause a structure, system, or component to be used in a manner outside the design basis or limit the ability of a structure, system, or component to perform a safety function
   - Deletes, moves or circumvents a QC Hold Point
   - Implements a modification.
   - Conflicts with the remainder of procedure. (example: expected condition for subsequent step)
   - Places the plant in a Technical Specification Action Statement, or reduces Defense in Depth
   - Alters or lessens administrative controls necessary to assure safe plant operation such as the Security Plan, Fire Protection Plan, Emergency Plan, QA Program, or Environmental Protection Plan
   - Deletes an independent verification
   - Changes the Prerequisites or Initial Conditions in a non-conservative manner
   - Changes acceptance criteria, setpoints, or values used to make a conclusion of acceptability
   - Changes a value used to protect plant equipment or provide a limit to equipment operation. (for example; vendor requirement, design calculations, Technical Specifications, FSAR, defined operating ranges, or requirements specified in other procedures)
3. Ensure the Temporary Procedure Change will not affect the procedure commitments.
4. Ensure the Temporary Procedure Change will not introduce any potential human performance issues.
5. Ensure the Expiration Date is appropriate for the expected use of the Temporary Procedure Change per the affected site requirements.
6. Sign and date Attachment 8, Temporary Procedure Change Form. **[R2]**
7. If the Temporary Procedure Change will not be implemented, return the Temporary Procedure Change Package to the Initiator.
8. [Initiator] Deliver a copy of Temporary Procedure Change Package to the work crew to begin/continue work.
9. [HNP] [Initiator] Place a copy of Temporary Procedure Change Package in the Main Control Room and the Service Building.

9.6 Field Editorial Corrections

1. [Initiator/Approver] Determine if the proposed change meets the criteria of an editorial correction.

    - Corrections of typographical errors such as:
        - Misspelled words
        - Punctuation
        - Capitalization
        - Redundant words or phrases
        - Omitted symbols
        - Misplaced decimals that are neither setpoint values nor tolerances
        - Incorrect units of measure
        - Obvious step or section number errors where no change in sequence of the task is involved
        - Page number errors
    - Sentence structure
    - Missing or additional sign-offs signatures, or date lines
    - Corrections to the title page including the procedure title, List of Effective Pages, and Table of Contents, except when assigning or lowering Level of Use or Case.
    - Grammatical errors
    - Corrections to Attachment or Enclosure titles.
    - Corrections to match existing titles of plant organizations, position titles, department/section/unit names in the FSAR/UFSAR when there is no change in the authority, responsibility or reporting relationships
    - Corrections to titles of plant organizations, position titles, department/section/unit names, not specified in the FSAR/UFSAR when there is no change in the authority, responsibility or reporting relationships
    - Corrections to addresses, telephone numbers, or computer system replacements
    - Corrections to page layouts or word processing features including section titles/subtitles of a document without changing the text or graphics (does not apply to EOPs)
    - Clarifying or adding information where the information clearly does not direct performance of a step or imply that performance of a step is required.

9.6 Field Editorial Corrections (Continued)

- Corrections to references including additions, deletions or title changes throughout the procedure
- Correction or extension of an expiration date on the title page for Special Procedures as long as there are no additional changes that are not editorial in nature
- Correction to a part number that has changed or due to part number consolidation
- Correction to equipment nomenclature or locations to be consistent with approved drawings, documents, labels, or procedure content
- Incorporating a Temporary Procedure Change when no other changes, other than Editorial Corrections as defined in this section, are incorporated
- Incorporating new, updating existing, and/or removing job aid links

2. [Initiator] Mark the field correction in the current procedure working copy as follows:
   a. Place a single line through the incorrect information
   b. Enter the correct information near the line-out.
   c. Initial and date the line-out
3. [Approver] Ensure the Editorial Field Correction meets the criteria of an Editorial Correction.
4. [Approver] Sign and date the Editorial Field Correction in the right margin of affected pages.
5. [Approver] Return approved Editorial Field Correction to the Initiator for continuation of work.
6. [Initiator] Prior to the end of shift write a PRR documenting the Editorial Field Correction.

70. G2.2.7 001

Operations has been scheduled to perform a new Special Test that has been designated as an Infrequently performed test or evolution IAW OPS-NGGC-1315, Conduct of Infrequently Performed Tests or Evolutions (IPTE).

Which ONE(1) of the following completes the statement below?

The __(1)__ will designate the IPTE Manager and the __(2)__ will conduct the pre-job brief for the Special Test.

A. (1) Operations Manager (Line Manager)

(2) IPTE Manager

B. (1) Operations Manager (Line Manager)

(2) Lead Test Performer

C. (1) Plant General Manager

(2) IPTE Manager

D. ✓ (1) Plant General Manager

(2) Lead Test Performer

The correct answer is D.

A. Incorrect - The Operations Manager will make a recommendation to the PGM on who should be the IPTE Manager. The PGM will designate on Attachment 1 of OPS-NGGC-1315 the assignment of the IPTE Manager. The IPTE Manager has overall responsibility to ensure that a brief is performed but the Lead Test Performer will conduct the briefing.

B. Incorrect - The Operations Manager will make a recommendation to the PGM on who should be the IPTE Manager. The PGM will designate on Attachment 1 of OPS-NGGC-1315 the assignment of the IPTE Manager. The second part of the distractor is correct.

C. Incorrect - The first part of the distractor is correct. The IPTE Manager has overall responsibility to ensure that a brief is performed but the Lead Test Performer will conduct the briefing.

D. Correct.

Question 70
Tier 3
K/A Importance Rating - RO 2.9 SRO 3.6

Knowledge of the process for conducting special or infrequent tests.

Reference(s) - Sim/Plant design, OPS-NGGC-1315
Proposed References to be provided to applicants during examination - None
Learning Objective - Admin Self Study
Question Source - NEW
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 43.3 / 45.13
Comments -

3.0 DEFINITIONS

1. **Infrequently Performed Tests or Evolutions (IPTE)**: An activity that has the potential to significantly degrade the plant's level of nuclear safety and warrant additional management oversight and controls including: **[R1 Rec. #1a]**

   - Evolutions not specifically covered by existing normal or abnormal operating procedures.
   - Evolutions that are seldom performed even though covered by existing normal or abnormal procedures. (e.g. Unit Startup, Activities involving potential significant impact to the Reactor Core.)
   - Special infrequently performed surveillance testing that involves complicated sequencing or placing the plant in unusual configurations. (e.g. Integrated ECCS testing, ECCS check valve testing)
   - Evolutions that require the use of special test procedures in conjunction with existing procedures.
   - Enclosure 1, IPTE Examples provides specific examples

2. **IPTE Manager:** A member of the plant staff or other individual designated by the Plant General Manager, to provide oversight of a specific evolution. Specific required attributes include: **[R5, Rec. #1c]**

   - A senior level member of management, i.e., in a role senior to the Shift Manager
   - Is **NOT** involved in performance of the assigned evolution. Specifically, this individual does not replace any individual involved in the test or evolution nor supervises the evolution.
   - Shall possess the requisite knowledge, skills and experience to provide meaningful oversight of the evolution
   - Shall **NOT** be the on-duty Shift Manager
   - Shall provide continuous oversight, i.e., from beginning to end, of the evolution.

3. **Lead Test Performer:** An individual assigned by the Section Manager responsible for the evolution to supervise the entire test/evolution. This could be anyone with an in-depth knowledge of the test/evolution. Lead Test Performer is meant to be a generic title; it could be the Test Director, SVI Coordinator, etc. The Lead Test Performer shall **NOT** be considered an "oversight" role.

5. Lead Test Performer:

   a. Maintains control **AND** supervises the entire test/evolution **AND** does **NOT** delegate this authority.

   b. Conducts briefings concerning the conduct of the IPTE including pre-job briefs.

6. Department Managers:

   a. Shall use Attachment 1, IPTE Determination and Approval, to determine if the activity qualifies as an infrequently performed test or evolution.

5.0 PREREQUISITES

None

6.0 PRECAUTIONS, LIMITATIONS AND NOTES

None

7.0 SPECIAL TOOLS AND EQUIPMENT

None

8.0 ACCEPTANCE CRITERIA

None

71. G2.3.13 001

Given the following plant conditions:

- RCS cooldown is in progress IAW GP-007, Plant Cooldown from Hot Shutdown to Cold Shutdown.
- The RCS Filter radiation levels are 1100 mrem/hr at 30 cm from the filter housing.
- You have been assigned by the WCC SRO to hang a clearance on the filter for replacement.

Which ONE (1) of the following identifies the radiation area classification and the minimum approval authority for room entry?

	Classification	Approval for Entry
A.✓	Locked High Radiation Area	Radiation Control Supervision
B.	High Radiation Area	Radiation Control Supervision
C.	Locked High Radiation Area	Nuclear Shift Manager
D.	High Radiation Area	Nuclear Shift Manager

A. Correct. Reference AP-031.

B. Incorrect. HRA is >100 mR in 1 hour. Correct approval authority.

C. Incorrect. Classification correct. Wrong approval authority. The Shift Manager is given the authority to approve several infrequent actions, however AP-031 specifies that RC supervision must approve entry into a LHRA.

D. Incorrect. Classification and approval authority wrong.

Question 71
Tier 3
K/A Importance Rating - RO 3.4 SRO 3.7

Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc.

Reference(s) - Sim/Plant design, HPS-NGGC-0003, AP-031.
Proposed References to be provided to applicants during examination - None
Learning Objective - Admin Self Study, Rad. Work Training
Question Source - ILC-09 NRC EXAM
Question Cognitive Level - F
10 CFR Part 55 Content - 41.12 / 43.4 / 45.9 / 45.10
Comments -

8.5 **Entry Into An LHRA**

CAUTION
No entries **SHALL** be authorized into an LHRA in which unrestricted exit from the area does not exist at all times. Controls **SHALL** be established to prevent individuals from being locked inside of an LHRA.

8.5.1 Individual requesting entry into an LHRA **SHOULD** notify RC Supervision / designee as soon as possible of the projected date, time, and purpose of the entry.

8.5.2 **IF** applicable, RC Supervision designee **SHOULD** contact RC Supervision prior to LHRA entries that are not for Operational, Health Physics or Chemistry Surveillance sampling activities.

8.5.3 RC Supervision / designee **SHALL NOT** permit a visitor access into an LHRA without successful completion of PAT & RWT or equivalent unless the individual has been exempted from PAT & RWT by the Manager of the Radiation Control Function.

NOTE:	The CV, posted LHRA at the entrance, is an example of an area requiring personnel assigned to control access during an entry.

8.5.4 RC Supervision/designee **SHALL** assign additional personnel, as applicable, to control access into LHRAs that cannot be secured otherwise.

8.5.5 Attachment 10.5, "LHRA Key Issue/Entry Form", **SHALL** be initiated for entries into an LHRA. When this form is completed for LHRA entries that do not require the issuance of a key, the applicable key issuance spaces on Attachment 10.5 **SHOULD** be marked NA.

8.5.6 Non RC personnel may be authorized to control access to an LHRA when deemed necessary by RC personnel. Non-RC personnel **MUST** be briefed on their responsibilities. Such authorizations **SHOULD** be documented on Attachment 10.6.

8.5.7 RC Supervision/designee **SHALL**:

- **DISCUSS** nature of work with the RC Technician assigned to provide radiation control coverage.
- **ISSUE** key(s) to the RC Technician(s) providing radiation control coverage, if applicable.

8.5.8 RC Supervision / Designee **MAY** issue a key to themselves in situations when other qualified RC personnel are not available.

8.5.9 An LHRA key **MAY** be transferred to another ANSI qualified individual who has received the Manager of the Radiation Control Function/Designee written approval to obtain and use the LHRA key in accordance with the requirements of section 8.7.

8.5.10 The RC Technician **SHALL** ensure that all doors or access points to the LHRA are closed/locked with challenge of lock(s) observed or performed by another individual **OR** physically manned upon completion of the job and/or exit of all personnel from the area.

8.5.11 **COMPLETE** Attachment 10.5, "LHRA Key Issue/Entry Form", as applicable for entries into LHRAs **AND** route to Plant Records.

8.6 Multiple Crews In An LHRA

8.6.1 Prior to assigning an RC Technician to cover multiple work crews, the RC Supervisor/designee **SHALL** ensure that multiple work crews can be covered in a safe manner. Discussion of multiple work crews **SHOULD** include as a minimum:

- Number of people
- Nature of the job
- Job duration

8.6.2 The RC Supervision/designee **SHALL** assign multiple work crews that cannot be covered in a safe manner to be covered by an additional RC Technician.

8.6.3 The RC Supervision/designee assigning multiple work crews to an RC Technician **SHALL** ensure the following are performed:

- The RC Technician is briefed on the nature of all work to be performed in the area
- Work groups are instructed to contact the assigned RC Technician when they are ready to enter the LHRA
- The door or access point(s) are secure **OR** physically manned to prevent access to the LHRA

8.6.4 The RC Technician **SHALL** ensure all doors **OR** access points to the LHRA are closed/locked with challenge of lock(s) observed or performed by another individual **OR** physically manned upon completion of the job and/or exit of all personnel from the area.

8.6.5 **COMPLETE** Attachment 10.5, "LHRA Key Issue/Entry Form", as applicable for entries into LHRAs **AND** route to Plant Records.

8.7 RC Technician Relief In LHRAs

8.7.1 **WHEN** another key to LHRA is available for issue, RC Technician **MAY** initiate Attachment 10.5, "LHRA Key Issue/Entry Form", **AND** be issued a separate key prior to relieving the RC Technician in the LHRA.

8.7.2 **PERFORM** the following when field transfer of LHRA key is required:

1. **CONTACT** RC Supervisor/designee to request permission for field transfer of LHRA key.
2. RC Supervisor/designee **VERIFIES** individual that will receive key has been approved by the Manager of the radiation Control Function/designee to obtain and use LHRA key.
3. RC Supervisor/designee **ENTERS** names of individuals transferring and receiving key and date and time of transfer in Section III of Attachment 10.5.
4. As soon as practical, individual who transferred key **MUST** initial by their printed name in Section III of Attachment 10.5.
5. RC Supervisor/designee **ENSURES** Section IV of Attachment 10.5 is completed upon return of key.

8.7.3 As a minimum, the RC Technician being relieved **SHALL** brief the relieving Technician on the:

- Radiological conditions
- Remaining dose of each worker
- Work Status
- Expected job duration

8.7.4 The RC Technician **SHALL** ensure all doors **OR** access points to the LHRA are closed/locked with challenge of lock(s) observed or performed by another individual **OR** physically manned upon completion of the job and / or exit of all personnel from the area.

8.7.5 **COMPLETE** Attachment 10.5, "LHRA Key Issue/Entry Form", as applicable for entries into LHRAs **AND** route to Plant Records.

LHRA KEY ISSUE/ENTRY FORM

I. TO BE COMPLETED BY RC SUPERVISOR/DESIGNEE

Job Location(s): (1) ____________ (2)____________ (3) ____________

LHRA Entry Authorized By: ____________

RC Technician Assigned: ____________ LHRA Key # ____________

____________ RC Supervisor/Designee ____________ Date ____________ Time

II. TO BE COMPLETED BY ASSIGNED TECHNICIAN

I have received LHRA Key # ____________ and I am aware of the radiological conditions and work to be performed in the areas. I understand that I am to maintain positive control of the key at all times. I understand that I am to return the key after the work is complete or prior to leaving the site, whichever comes first. If "field transfer" of the key occurs, I understand that Section III of this form is to be completed.

I understand that, if the area was entered, I shall ensure that: 1) control of the area has been turned over to an authorized individual, or 2) the area has been downposted and LHRA access control is no longer required, or 3) the area is Locked/Secured.

____________ RC Technician ____________ Date ____________ Time

III. FIELD TRANSFER OF LHRA KEY

☐ Field Transfer of LHRA Key from: ____________ (Print Name/Initials) To: ____________ (Print Name)

Date: ____________ Time: ____________

IV. AREA CLOSEOUT

☐ Area(s) not entered.

☐ Area(s) downposted - LHRA access control no longer required (approved by ____________ Print Name)

☐ All doors in above listed area(s) that have been entered have been physically challenged upon exit and verified to be closed and locked. Verified by: ____________ Print Name

☐ Responsibility for LHRA access control was turned over to the following authorized individual:

____________ Print Name

Performed By: ____________ RC Technician ____________ Date ____________ Time

Comments:

V. KEY RETURN Key returned to Shift/Lead Tech by: ____________ Key Holder (Initials) / ____________ Shift/Lead Tech (Initials)

VI. TO BE COMPLETED BY RC SUPERVISOR/DESIGNEE

Reviewed By: ____________ RC Supervisor/Designee ____________ Date ____________ Time

3.4 **Airborne Radioactivity Area (ARA)**

A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

In excess of the Derived Air Concentrations (DACs) specified in Appendix B of 10CFR20, or

To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6% of the Annual Limit on Intake (ALI) or 12 DAC-hours.

3.5 **Beta-Gamma DAC-Fraction Action Level**

Beta-gamma airborne radioactivity above which an air sample should be counted for alpha airborne radioactivity.

3.6 **Barrier/Barricade**

A physical structure (for example, rope, wall, door, swing gate) that checks the advance of personnel, such that the structure would need to be removed, opened or climbed over or under to gain access.

3.7 **Contamination Area (CA)**

Any area accessible to personnel where the removable surface contamination is in excess of 1,000 dpm/100 cm^2 beta-gamma and/or 20 dpm/100 cm^2 alpha.

3.8 **Direct Surveillance**

Under the positive control of an individual who has direct line of sight to the entrance of the area to challenge individuals prior to entering.

3.9 **High Radiation Area (HRA)**

An area accessible to individuals, in which radiation levels from radiation sources external to the body, could result in an individual receiving a dose equivalent in excess of 100 mrem in one hour at 30 cm from the radiation source or 30 cm from any surface that the radiation penetrates.

3.10 **Hot Spot (HS)**

A local intense source of radiation with a contact dose rate greater than 100 mrem per hour and greater than five times the dose rate at 30 cm.

3.11 **Label**

A sticker or tag which is attached to a container of radioactive material for the purpose of providing radiological information necessary to inform the worker of radiation hazards associated with the container. A label can also be pre-printed with caution wording and a radiation symbol supplemented by handwritten hazard information. (See also RAM tag definition)

3.12 **Licensed Material**

Source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under a general or specific license.

3.13 Locked High Radiation Area (LHRA)

Areas with dose rates greater than 1,000 mrem per hour at 30 centimeters from the radiation source or from any surface penetrated by the radiation, but less than 500 Rads per hour at 1 meter from the radiation source or from any surface penetrated by the radiation. (For CR-3 only, greater than or equal to 1000 mrem/hr at 30 cm applies).

3.14 Rad

A unit of absorbed dose equal to 100 ergs/g in any medium.

3.15 Radioactive Material that Requires Labeling

Material in which the amount of radioactivity exceeds the quantities specified in 10CFR20, Appendix C.

3.16 Radioactive Materials Area (RMA)

Any room or area where radioactive material is used or stored in amounts exceeding 10 times the amount of such material as specified in 10CFR20, Appendix C.

3.17 Radiation Area (RA), includes Neutron Radiation Area

An area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in one hour at 30 cm from the radiation source or from any surface that the radiation penetrates.

3.18 Radiation Control Area (RCA)

Any area within a restricted area that is posted for radiological protection purposes.

3.19 Radioactive Material (RAM) Tag

A radioactive material tag which can be used to meet the labeling requirements of 10CFR20.1904.

3.20 "Radiation Survey Required Prior to Entry" or "Controlled Radiation Protection" Area

Any area within an RCA that is further designated, controlled, and posted for a specific radiological protection purpose.

3.21 Rem

The special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (Q).

3.22 Restricted Area

An area, access to which is limited by a physical barrier such as a wall, fence, or by continuous surveillance and control of access by a representative of the company, for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.

3.23 Very High Radiation Area (VHRA)

An area accessible to individuals, in which radiation levels from radiation sources external to the body, could result in an individual receiving an absorbed dose in excess of 500 rads in one hour at one meter from a radiation source or one meter from any surface that the radiation penetrates.

72. G2.3.4 001

Which ONE (1) of the following are the correct values for the 10CFR20 Federal Adult Occupational Dose Limits?

	Extremities	Skin	Lens of Eye
A.	15 rem/yr	50 rem/yr	5 rem/yr
B.✓	50 rem/yr	50 rem/yr	15 rem/yr
C.	50 rem/yr	15 rem/yr	5 rem/yr
D.	50 rem/yr	15 rem/yr	15 rem/yr

The correct answer is B.

A. Incorrect - The extremities and lens of eye limits are incorrect. Plausible since the lens of eye limit listed is lowest value, which is expected.

B. Correct

C. Incorrect - The skin and lens of eye limits are incorrect. Plausible since the lens of eye limit listed is the lowest value, which is expected. Also, would seem logical that the skin would have a lower dose limit based on the surface area involved.

D. Incorrect - The skin limit is incorrect. Plausible because it would seem logical that the skin would have a lower dose limit based on the surface are involved.

Question 72
Tier 3
K/A Importance Rating - RO 3.2 SRO 3.7

Knowledge of radiation exposure limits under normal or emergency conditions.

Reference(s) - Sim/Plant design, DOS-NGGC-0004
Proposed References to be provided to applicants during examination - None
Learning Objective - Admin Self Study, Rad. Worker Training
Question Source - BANK (Not used an NRC Exam from 2004 to present.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.12 / 43.4 / 45.10
Comments -

5.0 PREREQUISITES

N/A

6.0 PRECAUTIONS AND LIMITATIONS

N/A

7.0 SPECIAL TOOLS AND EQUIPMENT

N/A

8.0 ACCEPTANCE CRITERIA

N/A

9.0 INSTRUCTIONS

R2.1 9.1 Adult Occupational Dose Limits

9.1.1 Whole Body - The more limiting of a total effective dose equivalent equal to 5 rem or the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye equal to 50 rem.

9.1.2 Skin - A shallow dose equivalent equal to 50 rem.

9.1.3 Lens of Eye - A lens dose equivalent equal to 15 rem.

9.1.4 Extremities - A shallow dose equivalent equal to 50 rem.

9.2 Occupational Dose to Minors

Minors shall not be employed to work in radiation control areas, although they may enter as visitors.

9.3 Progress Energy Annual Administrative Dose Limits

9.3.1 0.5 rem Progress Energy dose if non-Progress Energy dose for the current year has not been determined. No dose extension is permitted.

9.3.2 2 rem Progress Energy dose not to exceed 4 rem total dose if non-Progress Energy dose for the current year has been determined.

73. G2.4.25 001

Which ONE (1) of the following identifies the procedure that provides the Incident Commander with detailed method of attack strategies for a fire in the MDAFW Pump Room?

A. AOP-041, Response to Fire Event

B. OMM-002, Fire Protection Manual

C✓ OMM-003, Fire Protection Pre-Plans

D. APP-044, Fire Alarm Response Manual

The correct answer is C.

A. Incorrect - AOP-041 is a relatively new AOP that provides control room direction on how to address a fire in the plant. However, this procedure does not contain specific attack strategies for specific plant areas.

B. Incorrect - This procedure establishes the responsibilities and methods for implementation of the RNP Fire Protection Program.

C. Correct

D. Incorrect - This procedure provides control room responses for Fire Alarm Console alarms. Does not provide attack strategies for the fire brigade.

Question 73
Tier 3
K/A Importance Rating - RO 3.3 SRO 3.7

Knowledge of fire protection procedures.

Reference(s) - Sim/Plant design, AOP-041, OMM-002, OMM-003, APP-044
Proposed References to be provided to applicants during examination - None
Learning Objective - OMM-003-003
Question Source - BANK (Last used on 2004 NRC Exam.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 43.5 / 45.13
Comments - K/A match because candidate must know that OMM-003 provides the plans and strategies for safe and effective fire suppression by the Unit 2 Fire Brigade and offsite fire companies.

Reviewed and approved by MAB.

Progress Energy

R
Reference Use

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL

VOLUME 3

PART 1

OMM-003

FIRE PROTECTION PRE-PLANS/UNIT NO. 2

REVISION 56

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1.0 PURPOSE

1.1 Provide the plans and strategies for safe and effective fire suppression by the Unit 2 Fire Brigade and offsite fire companies.

1.2 This procedure satisfies the pre-planning requirements of 10 CFR 50.48, 10 CFR 50, Appendix R to Part 50 and 29 CFR 1910, Subpart L.

2.0 REFERENCES

2.1 10 CFR 50.48, Fire Protection

2.2 10 CFR 50, Appendix R to Part 50 - Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

2.3 29 CFR 1910, Subpart L - Fire Protection

2.4 29 CFR 1910.1030, Bloodborne Pathogens

2.5 Technical Specifications Section 5.4.1

2.6 Updated FSAR Section 9.5.1

2.7 SAF-CPL-003, Fire Prevention, Control and Evacuation

2.8 SAF-SUBS-015, Bloodborne Pathogens (Health and Safety Guidance Document)

2.9 AOP-041, Response to Fire Event

2.10 FP-001, Fire Emergency

2.11 FP-002, Fire Report

2.12 OP-801, Fire Water System

2.13 OP-804, Halon Fire Suppression System

2.14 OP-805, CO_2 Suppression System

2.15 OP-809, Diesel Generators' Carbon Dioxide Suppression System

2.16 OP-909, Fuel Oil System

2.17 EDP-001, 4160V AC Buses

2.18 EDP-002, 480V AC Buses

2.19 EDP-003, MCC Buses

2.20 EDP-004, 125V DC Buses

2.21 EDP-005, Auxiliary Fuse Panels

2.22 EDP-006, Lighting Panels

2.23 EDP-007, Power Panels

2.24 EDP-008, Instrument Buses

2.25 EDP-009, Freeze Protection Panels

2.26 DSP-001, Alternate Shutdown Diagnostic

2.27 DSP-002, Hot Shutdown Using the Dedicated Shutdown/Alternate Shutdown System

2.28 ACR 93-498, Plant Labeling Concerns

2.29 CR 97-00505, OMM-003 Does Not Address the Third Level of the Auxiliary Building

2.30 Report Number 0132-00193-RPT-001, "Combustible Loading and Heat of Combustion Report for H. B. Robinson Unit 2" by VECTRA Technologies, Inc.

2.31 OMM-002, Fire Protection Manual

2.32 ESR 98-00509, North Service Water Header Replacement

2.33 HBR2-11937, Fire Pre-Plan Drawings, Sheets 1 through 60

2.34 EC 49229, Interim Security Measures for High Threat Environment

2.35 AR 62523, Assessment 54014 IFMC #6

2.36 EC 51614, Charging Pump Backup Air Supply

2.37 NCR 129905 (CAPR), Fire Brigade Training Self Assessment Issue 1

2.38 NCR 330053, Human Performance Error Performing OST-692

3.0 RESPONSIBILITIES

3.1 Fire Brigade Incident Commander (FBIC)

3.1.1 The FBIC should establish a Command Post in an appropriate location, at a safe distance from any fire or respiratory hazard. The Command Post shall **NOT** be in the same building as the fire. The Command Post should provide adequate space to work with pre-plans, accountability board, radio, etc. Direct observation of the scene is desirable, but not always possible. [CAPR NCR 129905]

3.1.2 Should reference to the applicable pre-plan as soon as reasonably and safely possible.

3.1.3 Using the applicable pre-plan and ATTACHMENT 10.1 as a guide, maintain overall Command and Control of the fire scene.

3.1.4 Using ATTACHMENT 10.2, maintain a record of the event for use in the FP-002 Fire Report. Maintaining this record in a "real time" basis is not to interfere with proper command and control OR personnel safety.

3.1.5 Call for additional assistance as soon as there is any possibility that the fire will progress faster or farther than the minimum fire brigade staffing can safely contain and control. This should also include the considerations for:

1. Back-up man power for clean-up and extended reflash watch duties.
2. Environmental conditions such as high heat and/or humidity. (29 CFR 1910, Subpart L, Appendix A to 1910.157)

3.1.6 Allow the removal (doffing) of Self Contained Breathing Apparatus (SCBA) after determining that the atmospheric conditions do not present any immediate or near term health effects.

3.1.7 Ensure that the liquid run off from any fire is monitored and sampled for any possible radioactive, chemical and/or oil contamination.

3.1.8 Ensure complete documentation of any personnel exposures to hazardous materials and/or bodily fluids IAW SAF-SUBS-015 and Fire Brigade Member Responsibility 3.3.6 for Bloodborne Pathogens.

3.2 Control Room

NOTE:	This procedure may be used in parallel with AOP-041, FP-001 and DSP-001.

3.2.1 Should reference the applicable pre-plan as soon as reasonably and safely possible to anticipate the needs of the FBIC.

3.2.2 Keep the FBIC informed of any changes to the ventilation system including stopping of fans as directed in AOP-041.

3.3 All Fire Brigade Members

3.3.1 Keep the FBIC informed of the existence and extent of any exposure fires.

3.3.2 Full protective clothing (turn-out gear) with SCBA shall be worn (donned) by all Fire Brigade members actively involved with fire suppressions, rescue and/or post-fire salvage and overhaul. (29CFR 1910, Subpart L, Appendix A to 1910.156)

3.3.3 Judicially use fire water in the Auxiliary Building to prevent:

- Flooding of previously unaffected areas
- Over filling of the Auxiliary Building Sumps and the Waste Holdup Tank
- Wetting down of unaffected plant equipment

3.3.4 Consider any liquid run off from a fire as potentially hazardous material until sample results can prove otherwise.

3.3.5 Extreme caution should be exercised when fire fighting in the area of potentially energized electrical equipment. The use of water on potentially energized equipment can cause severe electrical shock to all individuals in contact with the fire hose or any run off. As a general rule, if the FBIC calls for a water suppression attack, a fog pattern spray should be used on any potentially energized equipment while maintaining a separation of at least 10 feet from the equipment to the fire fighters. A minimum of 30 feet separation is required for a water fog or foam attack in the transformer yard or switchyard. Use of foam on potentially energized electrical equipment should be avoided because of the conductive nature of the product.

3.3.6 Bloodborne Pathogens Precautions as Related to Fire Victim Rescue or Recovery (29 CFR 1910.1030, SAF-SUBS-015)

1. Universal Precautions is an approach to infection control. According to the concept of Universal Precautions, all human blood and certain body fluids are treated as if known to be infectious for Human Immunodeficiency Virus (HIV) Hepatitis B Virus (HBV) and other bloodborne pathogens.
2. Firefighter turnout gloves do not provide adequate protection from bloodborne pathogens. For non-emergency situations, such as first aide administration away from the fire or post-fire recovery of a fire victim, the firefighter shall wear latex, vinyl or rubber gloves as hand protection. The first responder can assist and provide guidance for controlling personnel exposures.
3. In emergency situations, such as removal of a fire victim during or as part of fire fighting, it is understood that the firefighter can not change gloves prior to touching or handling the victim. In these cases the firefighter shall change gloves **AND** wash their hands as soon as possible. Documentation of exposures shall be as described in SAF-SUBS-015.

3.3.6 (Continued)

4. With the exception of turnout gloves, firefighter turnout gear provides adequate protection from blood and body fluids. Helmet face shields shall be fully lowered to ensure facial protection when not wearing an SCBA.

5. Firefighter turnout gear that is or potentially may be contaminated by blood or body fluids shall be properly removed, segregated and bagged in biohazard marked bags. These bags shall be marked for either cleaning or disposal.

3.3.7 Assess the on-scene conditions and extinguish the fire using the following guidelines (Two-in/Two-out Rule):

- Use teams with a minimum of two members for interior structural fire fighting or rescue situations.
- With the exception of rescue situations involving the retrieval of a known victim, verify a Back-up Team of at least two Fire Brigade members is established outside the IDLH atmosphere prior to commencing interior structural fire fighting.

4.0 PREREQUISITES

N/A

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Ensure that the fire area is ventilated as soon as safely possible. This will reduce the smoke, heat and steam in the area, thus improving visibility, equipment safety and firefighter safety. This will also provide more timely access in areas such as the Auxiliary Building First Floor for implementation of DSP actions and for assessment of damage/repairs.

5.2 If an area has exterior doors, the primary method of ventilation should be through them to the outside. When ventilating from the Auxiliary Building directly to the outside environment, Health Physics will need to monitor the contamination levels of the discharge.

5.3 When natural draft ventilation is used, providing an opening at a higher elevation and an opening at a lower elevation creates a chimney effect to more efficiently move smoke out of a building.

5.4 Smoke ejectors can be used alone with or without extension trunks or in series using extension trunks. When using extension trunks, the following limitations apply. When using a single fan, up to one extension trunk (20') can be used on the intake side and up to two extension trunks (40') can be used on the discharge side. When using fans in series, the first fan in line can use up to one extension trunk (20') on the intake side and each fan beyond the first can have up to two trunks (40') on both the intake and the discharge side of the fan. There is no maximum number of fans that can be used in a series configuration. Smoke ejectors and trunks may be found in the Fire Equipment Building. If in-house power is unavailable, a portable generator is located on the Mezzanine level of the Turbine Building near the Condenser Vacuum Pump enclosure.

5.5 Portable sump pumps may be needed to remove excess water. When discharging to exterior plant areas, consideration should be given to potential contamination and hazardous chemical content. Water runoff in the Auxiliary Building and the CV should drain to their respective sumps and discharge to the Waste Holdup Tank. Additional guidance for Auxiliary Building and CV flooding may be found in AOP-032.

5.6 Where possible, smoke should be prevented from entering portions of the Auxiliary Building that are otherwise unaffected by the fire event. Smoke propagation into unaffected areas can increase the potential for inadvertent activation of detection and protection systems. This can also interfere with the performance of DSP actions, when implemented. When any activity requires that a fire door be blocked open during a firefighting evolution, the decision to do so must be carefully considered. For example, if there is a choice between advancing a hose line from the Auxiliary Building hallway into a room through a blocked-open fire door and advancing a hose line from the outside, through an exterior door, it is strongly recommended that hose lines be advanced from the exterior.

5.7 Entry into DSP-002 will result in loss of some plant equipment, including the motor driven fire pump.

5.8 The concentrated discharge of Halon 1211 from portable fire extinguisher(s) on a fire can produce toxic by-products. If personnel are present in the fire room without protective breathing apparatus (such as a fire victim), usage of Halon 1211 should be restricted to the following amounts if fire room ventilation is not in progress:

- For a 17 lbs. hand held Halon 1211 Fire Extinguisher do not use the entire contents in less than 2120 cubic feet of air volume.
- For a 150 lbs wheeled Halon 1211 Fire Extinguisher, do not use the entire contents in less than 18,705 cubic feet of air volume.

5.9 When selecting access for fire attack, areas with two or more entry points have been ranked as primary, secondary and other. These rankings are based on factors such as safety of the fire brigade, availability to firefighting equipment, effects of smoke propagation, impact on fire suppression systems, doors that must be propped open, safe shutdown strategies, etc. "Primary" access is generally viewed as the best access point that will have the least impact on the fire brigade and plant, followed by the "secondary" access. Any remaining entry points are identified as "other". Based on the location and dynamics of the fire, plant conditions and the location of responding fire brigade personnel, the FBIC can choose the direction and method of attack that is best suited for the evolving fire conditions.

5.10 The Fire Hydrants on Robinson Site use different colored hydrant tops to indicate which hydrant is supplied by which fire water system (NCR 330053):

5.10.1 Hydrants supplied by the Unit 1 Fire Water System have WHITE tops.

5.10.2 Hydrants supplied by the Unit 2 Fire Water System have RED tops.

5.10.3 Two hydrants west and south of the Unit 2 Primary Access Portal (PAP) West, Building 300, have WHITE tops. These hydrants are supplied from the Darlington County potable water system.

5.10.4 Several Fire Hydrants on Unit 1 and Unit 2 have identical Hydrant numbers without a unit designator. Personnel operating a fire hydrant must use all applicable human performance tools to ensure that the correct hydrant on the correct unit is being operated.

6.0 SPECIAL TOOLS AND EQUIPMENT

6.1 Smoke ejectors and extension trunks as needed to meet ventilation requirements of affected area(s). Ventilation equipment available at Fire Equipment Building, in Turbine Building at Mezzanine level just north of Vacuum Pump enclosure, in Auxiliary Building second level at Drumming Room, and CV Access Area adjacent to RCA Tool Room.

6.2 Forcible entry tools

6.3 Portable Generator located in Turbine Building at Mezzanine level just north of Vacuum Pump enclosure.

6.4 AFFF foam Part Number 71591309 Bulk Warehouse location 10W1A1.

7.0 ACCEPTANCE CRITERIA

N/A

8.0 INSTRUCTIONS

NOTE:	The following additional preplans exist for areas within the First Floor Auxiliary Building (See Table of Contents): Aux Bldg Hallways, Cable Vaults, Charging Pump Room, CCW Pump Room, CV Access Area and RCA Tool Room, A & B EDGs, Inside AO Office, Pipe Alley, Radwaste Facility, RCA Dress Out Area, WHUT and RHR HX Rooms, SI Pump Room, Water Storage Tanks (RWST, PWST, MTs & WCTs).

8.1 Auxiliary Building Hallway - Central

8.1.1 Fire Hazards

Combustible material in this area includes electric cables in cable trays, electric control panels, 4.5 gallons of lube oil in the Station Air Compressor, 4.5 gallons of lube oil in each Instrument Air Compressor, and 0.5 gallons of lube oil in each Service Water Booster Pump for a total of approximately 15 gallons.

8.1.2 Fixed Fire Suppression System

Fixed fire suppression for Aux. Bldg. Hallway - Central consists of a pre-action sprinkler system with 212°F sprinkler heads and is actuated as follows:

1. Automatically through the Low Voltage Fire Detection System
2. Manually at the Fire Detection and Actuation Panels (FDAP-A1 or FDAP-B1) with the Zone System Manual Actuation Switch for Fire Detection Zone 12
3. Manually at the pre-action valve which is located on the north wall of the Aux. Bldg. Hallway - Central

8.43 Auxiliary Feedwater Pump Room

8.43.1 Fire Hazards

3 ½ gallons of lubricating oil in each of the two pumps and 16 ft^3 of cable insulation

8.43.2 Fixed Fire Suppression System

None Applicable

8.43.3 Guidelines for Fire Attack

1. Access for Fire Attack

   a. Primary – From Turbine Building through Security Gate 16 and then through FDR-5.

   b. Secondary – From Auxiliary Building South Hallway through FDR-26. FDR-26 is also identified as a radiological boundary.

2. Method of Attack

   a. Small fire - portable fire extinguishers may be used.

   b. Large or fast spreading fire - hose streams or foam may be used at the discretion of the FBIC.

   c. Use full protective clothing with self-contained breathing apparatus (SCBA).

3. Portable Fire Suppression Equipment Available

   a. Fire extinguishers located in Aux. Bldg. Hallway- South and the Turbine Bldg.- Halon 1211 and Dry Chemical

   b. One hose station located in Aux. Bldg. Hallway- South near the Waste Disposal Panel and one hose station in the Turbine Bldg. near Security Gate 16.

   c. 150 lb. Halon 1211 wheeled extinguisher in Detection Zone 12 near the Service Water Booster Pumps

   d. Foam fire equipment

4. Exposure Protection

   a. Protect adjacent pumps from any fire.

8.43.3 (Continued)

5. Ventilation

   a. Small quantities of smoke can be handled by the Auxiliary Building HVAC System.

   b. Large volumes of smoke will likely require venting to the outside through FDR-5. Venting smoke through FDR-26 is discouraged as it can spread into the Auxiliary Building and cause inadvertent Pre-Action Sprinkler System actuation. Airborne contamination levels will need to be monitored before and during venting operations. Portable Ventilation Equipment is located in the Fire Equipment Building and in the Turbine Building at Mezzanine Level north of the Vacuum Pump Enclosure.

6. Potential Radiological/Toxic Hazards

   a. Low Level contamination possible

   b. Respiratory hazard due to toxic smoke and possible visual problem during fire

   c. Fire water runoff would discharge to the storms drains and require monitoring of the Settling Ponds.

8.43.3 (Continued)

7. Plant Systems Affecting Fire Fighting Efforts

   a. De-energize affected electrical equipment to prevent electrical shock hazard and additional ignition sources.

   b. Lighting and 110VAC wall receptacles for Aux. Feedwater Pump Room are fed from Lighting Panel 26 located in the hallway outside the Charging Pump Room.

   c. HVH-7A & 7B are powered from MCC-6 & 5 respectively and can be operated locally from the breaker.

   d. Other major power supplies include:
   V2-16A (MCC-9 & 10)
   V2-16B & V2-20B (MCC-10)
   V2-16C & V2-20A (MCC-9)
   FCV-1424 & FCV-1425 are powered from IB-2 & IB-3 respectively.

   e. Refer to EDP-006 for further information about Electrical Distribution System.

8.43.4 Operations Requiring Control Room Authorization

Safety related equipment in Aux. Feedwater Pump Room includes the two motor driven Auxiliary Feedwater Pumps and Discharge MOVs. A fire in this room could disable both of the Motor Driven Auxiliary Feedwater Pumps. Safe shutdown can still be accomplished without these two pumps. Steam Generator water inventory can be maintained by the Main Feed Pumps or, if they are unavailable, by operation of the Steam Driven Auxiliary Feedwater Pump.

ALARM

ZN-7 Fire Alm. TRN-A Aux. Feedwater Pump Room

AUTOMATIC ACTIONS

1. None Applicable

CAUSE

1. Possible fire condition in alarmed zone.

OBSERVATIONS

1. A valid alarm exists if the CRT alarm text display is RED.
2. **IF** the CRT alarm text is YELLOW, **THEN** an open or faulty circuit exists at the Transceiver. The FAC may not be able to detect an alarm at the associated FDAP.
3. Smoke or fire in alarmed zone.
4. Fire alarm on FDAP-A1.
5. Fire alarm on FAC.

ACTIONS

NOTE: **YELLOW** alarms indicate a trouble condition. Therefore, some actions may not be required.

1. Immediately dispatch FPAO or closest Fire Brigade Member to investigate cause of alarm.
2. If an additional alarm on opposite train is received, perform the following:
   - Activate Fire Brigade IAW AOP-041
   - Secure area ventilation fans IAW AOP-041
   - Reference OMM-003 for mitigation action
   - Reference DSP-001 for potential actions
3. If alarm is due to causes other than fire or smoke conditions, consult FP-012 for required number of operable detectors in that zone and corrective actions to be taken until alarm is cleared.
4. Declare ZN-7 TRN-A alarms out of service until current alarm is cleared.

DEVICE SETPOINTS

1. Smoke Detector - Ionization
2. Manual Pull Station

POSSIBLE PLANT EFFECTS

1. Damage to plant systems and equipment due to fire and smoke.
2. Additional alarms **CANNOT** be received from this zone and train.

REFERENCES

1. AOP-041, Response to Fire Event
2. FP-001, Fire Emergency
3. FP-012, Fire Protection Systems Minimum Equipment and Compensatory Actions
4. DSP-001, Alternate Shutdown Diagnostic
5. OMM-003, Fire Protection Pre-Plans/Unit No. 2

ALARM

ZN-7 Fire Alm. TRN-B Aux. Feedwater Pump Room

AUTOMATIC ACTIONS

1. None Applicable

CAUSE

1. Possible fire condition in alarmed zone.

OBSERVATIONS

1. A valid alarm exists if the CRT alarm text display is RED.
2. **IF** the CRT alarm text is YELLOW, **THEN** an open or faulty circuit exists at the Transceiver. The FAC may not be able to detect an alarm at the associated FDAP.
3. Smoke or fire in alarmed zone.
4. Fire alarm on FDAP-B1.
5. Fire alarm on FAC.

ACTIONS

NOTE:	**YELLOW** alarms indicate a trouble condition. Therefore, some actions may not be required.

1. Immediately dispatch FPAO or closest Fire Brigade Member to investigate cause of alarm.
2. If an additional alarm on opposite train is received, perform the following:
   - Activate Fire Brigade IAW AOP-041
   - Secure area ventilation fans IAW AOP-041
   - Reference OMM-003 for mitigation action
   - Reference DSP-001 for potential actions
3. If alarm is due to causes other than fire or smoke conditions, consult FP-012 for required number of operable detectors in that zone and corrective actions to be taken until alarm is cleared.
4. Declare ZN-7 TRN-B alarms out of service until current alarm is cleared.

DEVICE SETPOINTS

1. Heat Detectors - 135°F

POSSIBLE PLANT EFFECTS

1. Damage to plant systems and equipment due to fire and smoke.
2. Additional alarms **CANNOT** be received from this zone and train.

REFERENCES

1. AOP-041, Response to Fire Event
2. FP-001, Fire Emergency
3. FP-012, Fire Protection Systems Minimum Equipment and Compensatory Actions
4. DSP-001, Alternate Shutdown Diagnostic
5. OMM-003, Fire Protection Pre-Plans/Unit No. 2

74. G2.4.39 001

Given the following plant conditions:

- Plant was at 100% RTP.
- At time 1205 a Reactor Trip and several events occurred.
- At time 1215 an ALERT is declared by the CR-SEC.
- At time 1225 the Emergency Notification Form is completed and approved by the CR-SEC.

Which ONE(1) of the following identifies the **LATEST** time that the initial notification to the State and County officials is due?

A. 1220

B.✓ 1230

C. 1235

D. 1240

The correct answer is B.

A. Incorrect. This is the time at which the declaration must be made by the CR-SEC.

B. Correct.

C. Incorrect. The CR-SEC has 15 minutes to declare the event and then 15 minutes from declaration to notify the state and counties. This theoretically gives the CR-SEC 30 minutes to make a notification. However, since the declaration was made at 1215 the notification must be made by 1230. This distractor is based on 30 minutes from 1205.

D. Incorrect. This distractor is based on 15 minutes incorrectly added to the time the ENF form was completed and approved. The notification must be made within 15 minutes of the event declaration.

Question 74
Tier 3
K/A Importance Rating - RO 3.9 SRO 3.8

Knowledge of RO responsibilities in emergency plan implementation.

Reference(s) - Sim/Plant design, EPNOT-01, EPCLA-01
Proposed References to be provided to applicants during examination - None
Learning Objective - Emergency Communicator Qualification
Question Source - BANK (Used on the 2007 NRC Exam.)
Question Cognitive Level - F
10 CFR Part 55 Content - 41.10 / 45.11
Comments -

EMERGENCY NOTIFICATIONS QUICK START GUIDE

COMMUNICATIONS CHECKLIST

Event Classification:
___ Unusual Event ___ Alert ___ Site Area Emergency ___ General Emergency

Required Emergency Notifications

Time Classification Declared	Maximum Contact Time (Min.)	Notification Due By	Follow-up Due w/in	Agency	Phone / Backup
	+ 15 = ASAP and no greater than 15		60 minutes	Counties WP & EOC State Warning Point & Backup Warning Point	Sel. Sig. A1 (See ERO Phone Book for back-up numbers)
	+ 60 =		As Needed	NRC Site Inspector	See ERO Phone Book
	+ 60 = ASAP and no greater than 60		As needed	NRC	ETS See sticker or ERO Phone Book
Following applicable at ALERT or higher classification only					
	+ 120 =		As Needed	ANI	See ERO Phone Book
	At earliest opportunity		As Needed	INPO	See ERO Phone Book

Recommended Emergency Notifications
Instructions: This form may be used for each change in event classification.

8.2.4 Electronic Emergency Notification Form Completion

CAUTION

Initial notifications are to be made within 15 minutes. Follow up notifications shall be made within 60 minutes from the completion of the previous notification, or more frequently if warranted by changing conditions. The 60 minute clock will start when the first agency disconnects from notification call.

CAUTION

IF a higher emergency classification is declared prior to completing an in-progress notification, **THEN** complete the notification of the lower event before starting the notification for the higher classification. Both notifications must still be completed within 15 minutes of their respective declarations. If additional resources are available, assign a second communicator to start preparing the notification for the higher classification.

IF a higher emergency classification is declared while preparing an initial notification for the lower emergency classification, **THEN** one of the following two approaches may be used:

IF the notification of the higher event can be prepared, approved, and commenced within 15 minutes of the lower classification, **THEN** prepare the initial notification for the higher event.

OR

IF the notification of the higher event **cannot** be prepared, approved and commenced within 15 minutes of the lower classification, **THEN** complete the notification of the lower event before starting the notification for the higher classification. Both notifications must still be completed within 15 minutes of their respective declarations. If additional resources are available, assign a second communicator to start preparing the notification for the higher classification.

(RIS 2007-02)

1. Instructions for completing the form are included in Attachment 10.5, Nuclear Power Plant Emergency Notification Form, of this procedure.

8.2.5 Transmit State and County Notifications

1. All agencies shall be contacted for each initial and follow-up notification. Agencies that do not respond shall be contacted by any means available, as soon as possible.

2. **ESTABLISH** communications with the State and County agencies using any of the following:

NUCLEAR POWER PLANT EMERGENCY NOTIFICATION FORM
INSTRUCTIONS FOR COMPLETION

CAUTION

Initial notifications are to be made within 15 minutes of the declaration of an emergency. Follow up notifications shall be made within 60 minutes from the completion of the previous notification, or more frequently if warranted by changing conditions. The 60 minute clock will start when the first agency disconnects from notification call.

All efforts should be expended to obtain information required for the Electronic Emergency Notification Form. **IF** an upgrade in classification occurs when the follow-up message is due, **THEN** "upgraded ENF forthcoming" should be annotated in "Remarks". This information is to be promptly transmitted to the State and County agencies, as soon as it is available.

Messages should include an up-to-date description of what is happening at the plant within the constraints of timely notifications. To ensure messages contain adequate and accurate information about current plant conditions, messages should be developed as promptly as possible. ENF reviews will be conducted by EOF Facility personnel, if available. It may be necessary to determine a "cut off time" for new message information, so that these reviews can be made. The ERM will direct EOF personnel through the ENF line by line; and the POA, TAM and RCM will verify the accuracy of the ENF, using the following guidance:

Lines 1, 2, 3, 4 – POA verifies accuracy
Lines 5, 6, 7 – RCM verifies accuracy
Line 8 – TAM verifies accuracy
Line 9 – RCM verifies accuracy
Lines 10, 11, 12 – POA verifies accuracy
Line 13 – POA verifies accuracy
Lines 14, 15, 16 – RCM verifies accuracy (reference the Rascal "Source Term Summary" sheet, as applicable)
Line 17 – ERM approves

Lines 1 through 13 **AND** Line 17 **MUST BE COMPLETED** on an **INITIAL** Electronic Emergency Notification Form. Information for Line 9 may not be available for the initial notification. If met data is not available, then state this in the Remarks (Line 13) and provide the data on a follow-up notification, as soon as the data is available. For **TERMINATION** messages, only Lines 1 through 4, 10, and 17 are required.

Information included on the initial form **AND** Lines 14 through 16 **MUST BE COMPLETED** on a **FOLLOW-UP** Electronic Emergency Notification Form, unless Line 6 (EMERGENCY RELEASE) is selected.

An electronic Emergency Notification Form is available and can be accessed through the NGG Standard Desktop.

UNUSUAL EVENT

PART A - Checklist

NOTE:	Blanks are provided for place keeping only. Logs are the official record. The steps in this attachment may be performed in any order or concurrently.

CAUTION

The Shift Manager/SEC may NOT direct other individuals to perform the following actions:

- The decision to notify offsite authorities;
- Making offsite Protective Action Recommendations (PAR)
- Classifying or terminating the emergency
- Authorizing exposures in excess of 10CFR20 limits during a declared emergency

1. **RECORD** the times

- Event occurred at ____________________
- UNUSUAL EVENT Declaration made at ________________________
  - Required to be made within 15 minutes of the initiating event.
- ERO Activation started at _________________________
  - Recommended to be made within 5 minutes of the emergency classification.
- Notification to Offsite Agencies required by ____________________
  - Required to be made within 15 minutes of the Declaration.
- Followup Notification to Offsite Agencies required by: ____________________
  - Required to be provided every 30 to 60 minutes after the Initial Notification.
- NRC Notification required by: _________________________
  - Required to be made within 60 minutes of the emergency classification. Recommended to provide as soon as practical.

CR EMERGENCY CONTROL QUICK START GUIDE

NOTE:	This is a summary level guide and does not replace the procedure steps.

1. Implement EALs as necessary. It is the expectation that the time between exceeding an EAL and declaration of event will not exceed 15 minutes, unless extraordinary conditions prevail. Annotate time of the off normal condition. Continue through the Matrix until a General Emergency has been identified, or until the Matrix has been reviewed. _____

2. Direct an Emergency Communicator to report to the Control Room at this time. This will support communication activities and augmentation of the ERO. _____

3. Proceed to AP-030, "NRC Reporting Requirements", if there is no event classification. _____

4. Declare the highest event classification identified by announcing the event to the Control Room and that you are assuming role as the SEC. This ends the 15 minute clock for the event declaration, and starts the 15 minute clock to notify the appropriate State and County agencies. Announce classification to the Site, as directed in this procedure. _____

5. Fill out the Emergency Notification Form. Detailed instructions are in EPNOT-01, "CR/EOF Emergency Communicator."

6. Develop, approve, and FAX/communicate the Emergency Notification Form. Notify State and County agencies via Selective Signaling System or an alternate means. The notification clock stops after the first voice contact is established with an approved form. First contact is considered complete after site identification, type of message, and emergency classification is provided to the agency. This is the time entered on the Emergency Notification Form of EPNOT-01, "CR/EOF Emergency Communicator." _____

7. Assess EALs for changing plant conditions. _____

75. G2.4.9 001

Given the following plant conditions:

- Plant cooldown is in progress. RCS Temperature is at 290°F.
- A LOCA has occurred.
- CV pressure has increased to 1.4 psig.
- "A" RHR pump is providing decay heat removal.
- There is no indication of a rupture in the RHR System.
- RCS letdown has been isolated.
- Two charging pumps are running at maximum speed.
- PZR level is 12% and lowering.
- RCS subcooling is 40°F.

Which ONE (1) of the following completes the statement below?

IAW AOP-033, Shutdown LOCA, the next step required to be performed for mitigation strategy is to ......

A. check SI Pump Suction Line to RWST - ANY REASON TO BELIEVE STEAM BOUND.

B.✓ start the remaining Charging Pump and raise speed to maximum.

C. verify available SI Pump Breakers - RACKED IN

D. stop "A" RHR Pump.

The correct answer is B.

A. Incorrect - If all three charging pumps were running at maximum speed with the indications given then this would be the correct answer.

B. Correct - AOP-033, Step 8, has the operator to check all charging pumps running at full speed if PZR level is lowering and letdown is isolated.

C. Incorrect - SI pump breakers are verified racked in once the SI pump suction line to RWST has been verified to not to be steam bound. AOP-016 directs the crew to trip the reactor and go to PATH-1 if PZR level cannot be maintained with two charging pumps at maximum speed and letdown isolated. This makes starting a SI pump a plausible distractor.

C. Incorrect. Flow should not be raised when indications of cavitation exists. The normal flow specified in AOP-020 is 3000 gpm to 3750 gpm, so a rise in flow would still be in band. The second part of the distractor is correct.

D. Incorrect - "A" RHR pump would be stopped if PZR level is less than 10% or RCS subcooling is less than 35°F. These conditions are not met, however, PZR level is continuing to lower.

Question 75
Tier 3
K/A Importance Rating - RO 3.8 SRO 4.2

Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies.

Reference(s) - Sim/Plant design, AOP-033
Proposed References to be provided to applicants during examination - None
Learning Objective - AOP-033-004
Question Source - NEW
Question Cognitive Level - H
10 CFR Part 55 Content - 41.10 / 43.5 / 45.13
Comments -

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
* 1.	Determine If RHR Pumps Should Be Stopped:	
	a. Check RHR Pumps Aligned for Core Cooling - ANY RUNNING	a. Observe the NOTE prior to Step 2 and Go To Step 2.
	b. Check the following: • PZR level - LESS THAN 10% [32%] OR • RCS subcooling - LESS THAN 35°F [55°F]	b. IF PZR level OR RCS subcooling lowers to less than limits, THEN verify the RHR Pumps are stopped. Observe the NOTE prior to Step 2 and Go To Step 2.
	c. Verify RHR Pumps - STOPPED	Distractor

NOTE

FRP-S.1 is NOT applicable for this event unless directed by the CSFSTs.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
2.	From The RTGB, Verify Reactor Tripped As Follows: • REACTOR TRIP MAIN AND BYP - OPEN • Rod Position indication - ZERO • Rod Bottom lights - ILLUMINATED	IF the reactor does NOT trip, THEN dispatch an Operator to the Rod Drive MG Set Room to Open REACTOR TRIP BREAKERS A AND B.
3.	Make PA Announcement For Procedure Entry	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
6.	Isolate RCS Letdown As Follows:	
	a. Verify LTDN LINE STOP Valves - CLOSED: • LCV-460A • LCV-460B	
	b. Verify HIC-142, PURIFICATION FLOW - SET TO 0%	b. Locally close RHR-760, RHR SYSTEM TO LETDOWN LINE. Location: North side of RHR HEAT EXCHANGER B on platform. A flashlight will be needed.
	c. Verify CVC-387, EXCESS LTDN STOP - CLOSED	
	d. Verify HIC-137, EXCESS LTDN FLOW - SET TO 0%	
7.	Establish Charging Flow As Follows:	
	a. Verify HIC-121, CHARGING FLOW Controller - ADJUSTED TO 0% (OPEN)	
	b. Verify OPEN CVC-310B, LOOP 2 COLD LEG CHG	b. Verify OPEN CVC-310A, LOOP 1 HOT LEG CHG.
8.	Check Charging Pump Status - ALL RUNNING AT FULL SPEED	Raise charging flow as follows: a. Start all available Charging Pump. b. Raise speed on the running Charging Pump(s) to maximum.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
9.	Determine If Charging Flow Is Adequate:	
	a. Check PZR level: • GREATER THAN 10% [32%] AND • STABLE OR RISING	a. Observe NOTE prior to Step 10 and Go To Step 10.
	b. Check RCS subcooling - GREATER THAN 35°F [55°F]	b. Observe NOTE prior to Step 10 and Go To Step 10.
	c. Control charging flow as necessary to maintain PZR level	
	d. Go To AOP-016, Excessive Primary Plant Leakage	

NOTE

The SI Pump suction line could become steam bound if valves have been cycled causing hot RCS to flow through the line back to the RWST.

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED
10.	Check SI Pump Suction Line To RWST - ANY REASON TO BELIEVE STEAM BOUND	Go To Step 12.
		Distractor
11.	Vent The SI Pumps At The Casing Vents • SI-888E SI PUMP "A" VENT • SI-888D SI PUMP "A" VENT • SI-888J SI PUMP "B" VENT • SI-888K SI PUMP "B" VENT • SI-888N SI PUMP "C" VENT • SI-888W SI PUMP "C" VENT	

STEP	INSTRUCTIONS	RESPONSE NOT OBTAINED

12. Verify ONE SI Pump - AVAILABLE ← Distractor

- SAFETY INJECTION PUMP A (480V-E1, CMPT 21C)

  OR

- SAFETY INJECTION PUMP C (480V-E2, CMPT 23B)

  OR

- SAFETY INJECTION PUMP B from the appropriate Bus if being used as a replacement pump:

  - 480V BUS E-1-E-2 TIE (480V-E1, CMPT 22B)

    OR

  - 480V BUS E-2-E-1 TIE (480V-E2, CMPT 29B)

13. Verify The Following SI Valves - OPEN

a. SI PUMP RECIRC Valves:

- SI-856A
- SI-856B

b. RWST DISCH Valves:

- SI-864A
- SI-864B

c. SI DISCH CROSS CONN Valves:

- SI-878A
- SI-878B