2013 DAVIS-BESSE NUCLEAR POWER STATION

INITIAL LICENSE EXAMINATION

PROPOSED EXAM FILES

FENOC™
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- OPERATOR LICENSE EXAMINATION MATERIAL -
- WHEN SEPARATED FROM ENCLOSURE, HANDLE THIS DOCUMENT AS UNRESTRICTED -

April 10, 2013

10 CFR 55

L-13-140

Mr. Michael Bielby
Chief Examiner, Region III
U. S. Nuclear Regulatory Commission
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352

Subject:
Davis-Besse Nuclear Power Station, Unit 1
Docket Number 50-346, License Number NPF-3
Submittal of Written Operator License Examinations, Operating Tests, and Supporting Reference Material

Dear Mr. Bielby:

Enclosed are the written examinations, operating tests, and supporting reference material prepared by the Davis-Besse Nuclear Power Station (DBNPS) staff for the licensed operator examinations to be administered during the weeks of June 3 and June 10, 2013.

The enclosed items and supporting reference material, which are considered confidential, are being submitted to the NRC for review and approval in accordance with 10 CFR 55.40, "Written Examinations and Operating Tests – Implementation" and NUREG 1021, Operator Licensing Examination Standards for Power Reactors (Revision 9, Supplement 1).

Modifications to the previous submitted outlines were made as a result of feedback received from the chief examiner and the validation process. These modifications to the outlines are identified in bold italic print.

- OPERATOR LICENSE EXAMINATION MATERIAL -
- WHEN SEPARATED FROM ENCLOSURE, HANDLE THIS DOCUMENT AS UNRESTRICTED -

The materials enclosed shall be withheld from public disclosure until after the scheduled examinations are complete.

There are no regulatory commitments included in the submittal. If there are any questions or if additional information is required, please contact Mr. Anthony Stallard, Superintendent – Nuclear Operations, at (419) 321-7161 or Mark Klein, Lead Exam Developer at (419) 321-7773.

Sincerely,

Raymond A. Lieb

vaw

Enclosure: NUREG 1021 Forms and Operator License Examination Outline

cc: Regional Administrator, NRC Region III (w/o Enclosure)
Chief, Operations Branch, NRC Region III (w/o Enclosure)
DB-1 NRC/NRR Senior Project Manager (w/o Enclosure)
DB-1 Senior Resident Inspector (w/o Enclosure)
USNRC Document Control Desk (w/o Enclosure)
Utility radiological Safety Board (w/o Enclosure)

- OPERATOR LICENSE EXAMINATION MATERIAL -
- SHALL BE WITHHELD FROM PUBLIC DISCLOSURE UNTIL AFTER THE SCHEDULED EXAMINATIONS ARE COMPLETE -

Enclosure
L-13-140
NUREG 1021 Forms and Operator License Examination Outline

List of Enclosed NUREG Forms

Form ES-201-3, Examination Security Agreement (Up-to-date Copies)
Form ES-301-1, Administrative Topics Outline RO (Rev. 1)
Form ES-301-1, Administrative Topics Outline SRO (Rev. 1)
Form ES-301-2, Control Room/In-Plant Systems Outline RO (Rev. 1)
Form ES-301-2, Control Room/In-Plant Systems Outline SRO-I (Rev. 1)
Form ES-301-2, Control Room/In-Plant Systems Outline SRO-U (Rev. 1)
Form ES-301-3, Operating Test Quality Checklist (Rev. 1)
Form ES-301-4, Simulator Scenario Quality Checklist (Rev. 1)
Form ES-301-5, Transient and Event Checklist (Rev. 1)
Form ES-301-6, Competencies Checklist (Rev. 1)
RO Written Outline
Form ES-401-2, PWR Examination Outline RO (Rev. 1)
Form ES-401-3, Generic Knowledge and Abilities Outline Tier 3 RO (Rev. 1)
SRO Written Outline
Form ES-401-2, PWR Examination Outline SRO (Rev. 1)
Form ES-401-3, Generic Knowledge and Abilities Outline Tier 3 SRO (Rev. 1)
Form ES-401-4, Record of Rejected K/As (Rev. 1)
Form ES-401-6, Written Examination Quality Checklist (Rev. 1)
Form ES-D-1, Scenario Outline (Rev. 1)

List of Enclosed Exam Materials

9 Administrative Topics JPMs with applicable procedures
11 Control Room/In-Plant Systems JPMs with applicable procedures
4 simulator Scenarios
100 Written Examination Questions, answers, and reference pages for each question's correct answer
References provided to the candidates for the written examination

Facility: **Davis Besse** Date of Exam **6/3 thru 6/14 2013** Operating Test No.: ________

1. GENERAL CRITERIA		Initials a	b*	c#
a.	The operating test conforms with the previously approved outline; changes are consistent with sampling requirements (e.g., 10 CFR 55.45, operational importance, safety function distribution).	RJB	ARS	MEB
b.	There is no day-to-day repetition between this and other operating tests to be administered during this examination.	RJB	ARS	MEB
c.	The operating test shall not duplicate items from the applicants' audit test(s) (see Section D.1.a).	RJB	ARS	MEB
d.	Overlap with the written examination and between different parts of the operating test is within acceptable limits.	RJB	ARS	MEB
e.	It appears that the operating test will differentiate between competent and less-than-competent applicants at the designated license level.	RJB	ARS	MEB
2. WALK-THROUGH CRITERIA				
a.	Each JPM includes the following, as applicable: • initial conditions • initiating cues • references and tools, including associated procedures • reasonable and validated time limits (average time allowed for completion) and specific designation if deemed to be time critical by the facility licensee • specific performance criteria that include: - detailed expected actions with exact criteria and nomenclature - system response and other examiner cues - statements describing important observations to be made by the applicant - criteria for successful completion of the task - identification of critical steps and their associated performance standards - restrictions on the sequence of steps, if applicable	RJB	ARS	MEB
b.	Ensure that any changes from the previously approved systems and administrative walk-through outlines (Forms ES-301-1 and 2) have not caused the test to deviate from any of the acceptance criteria (e.g., item distribution, bank use, repetition from the last 2 NRC examinations) specified on those forms and Form ES-201-2.	RJB	ARS	MEB
3. SIMULATOR CRITERIA				
a.	The associated simulator operating tests (scenario sets) have been reviewed in accordance with Form ES-301-4 and a copy is attached.	RJB	ARS	MEB

	Printed Name / Signature	Date
a. Author	R.J. Brooks / [signature]	4/11/13
b. Facility Reviewer (*)	A.R. Stallard / [signature]	4/11/13
c. NRC Chief Examiner (#)	Michael Bielby / [signature]	4/23/13
d. NRC Supervisor	Hironori Peterson / [signature]	5/28/13

NOTE: * The facility signature is not applicable for NRC-developed tests.
Independent NRC reviewer initial items in Column "c"; chief examiner concurrence required.

Facility: **Davis Besse** Date of Exam **6/3 thru 6/14 2013** Operating Test No.: ____

	QUALITATIVE ATTRIBUTES	Initials a	Initials b*	Initials c#
1.	The initial conditions are realistic, in that some equipment and/or instrumentation may be out of service, but it does not cue the operators into expected events.	BJB	MT	MGB
2.	The scenarios consist mostly of related events.	BJB	MT	MGB
3.	Each event description consists of • the point in the scenario when it is to be initiated • the malfunction(s) that are entered to initiate the event • the symptoms/cues that will be visible to the crew • the expected operator actions (by shift position) • the event termination point (if applicable)	BJB	MT	MGB
4.	No more than one non-mechanistic failure (e.g., pipe break) is incorporated into the scenario without a credible preceding incident such as a seismic event.	BJB	MT	MGB
5.	The events are valid with regard to physics and thermodynamics.	BJB	MT	MGB
6.	Sequencing and timing of events is reasonable, and allows the examination team to obtain complete evaluation results commensurate with the scenario objectives.	BJB	MT	MGB
7.	If time compression techniques are used, the scenario summary clearly so indicates. Operators have sufficient time to carry out expected activities without undue time constraints. Cues are given.	N/A	N/A	MGB
8.	The simulator modeling is not altered.	BJB	MT	MGB
9.	The scenarios have been validated. Pursuant to 10 CFR 55.46(d), any open simulator performance deficiencies or deviations from the referenced plant have been evaluated to ensure that functional fidelity is maintained while running the planned scenarios.	BJB	MT	MGB
10.	Every operator will be evaluated using at least one new or significantly modified scenario. All other scenarios have been altered in accordance with Section D.5 of ES-301.	BJB	MT	MGB
11.	All individual operator competencies can be evaluated, as verified using Form ES-301-6 (submit the form along with the simulator scenarios).	BJB	MT	MGB
12.	Each applicant will be significantly involved in the minimum number of transients and events specified on Form ES-301-5 (submit the form with the simulator scenarios).	BJB	MT	MGB
13.	The level of difficulty is appropriate to support licensing decisions for each crew position.	BJB	MT	MGB

TARGET QUANTITATIVE ATTRIBUTES (PER SCENARIO; SEE SECTION D.5.d)	Actual Attributes						
1. Total malfunctions (5-8)	6	6	6	5	BJB	MT	MGB
2. Malfunctions after EOP entry (1-2)	2	2	1	2	BJB	MT	MGB
3. Abnormal events (2-4)	3	3	3	3	BJB	MT	MGB
4. Major transients (1-2)	2	1	1	1	BJB	MT	MGB
5. EOPs entered/requiring substantive actions (1-2)	1	1	1	1	BJB	MT	MGB
6. EOP contingencies requiring substantive actions (0-2)	1	1	0	1	BJB	MT	MGB
7. Critical tasks (2-3)	3	2	3	3	BJB	MT	MGB

Facility **Davis Besse** Date of Exam **6/3 thru 6/14 2013** Operating Test No.: ______

Competencies	APPLICANTS											
	RO ☑				SRO-I ☑				SRO-U ☑			
	SCENARIO				SCENARIO				SCENARIO			
	1	2	3	4	1	2	3	4	1	2	3	4
Interpret/Diagnosis Events and Conditions	1,3,4 5,6,7 8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8	1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8	1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8
Comply With and Use Procedures (1)	1,3,4 5,6,7 8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8	1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8	1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8
Operate Control Boards (2)	1,3,4 6,7,8 9,10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,4,5 6,7,8					3,6,7 8,9	2,4,6	1,2,5 6,7	5,6,7 8
Communicate and Interact	1,3,4 5,6,7 8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8	1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8	1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8
Demonstrate Supervisory Ability (3)					1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8	1,2,3 4,5,6 7,8,9 10	1,3,4 5,6,7 8	1,3,4 5,6,7	1,3,4 5,6,7 8
Comply With and Use Tech. Specs. (3)					2,5	1,5	2,4	3,4	2,5	1,5	2,4	3,4

Notes:
(1) Includes Technical Specification compliance for an RO.
(2) Optional for an SRO-U.
(3) Only applicable to SROs.

Instructions:

Check the applicant's license type and enter one or more event numbers that will allow the examiners to evaluate every applicable competency for every applicant.

Facility: **Davis Besse** Date of Exam **6/3 thru 6/14 2013** Exam Level: RO ☒ SRO ☒

	Item Description				Initial a	Initial b*	Initial c#
1.	Questions and answers technically accurate and applicable to facility				RJB	ARS	MEB
2.	a. NRC K/As referenced for all questions b. Facility learning objectives referenced as available				RJB	ARS	MEB
3.	SRO questions are appropriate per Section D.2.d of ES-401				RJB	ARS	MEB
4.	The sampling process was random and systematic (If more than 4 RO or 2 SRO questions are repeated from the last two NRC licensing exams, consult the NRR OL program office.)						MEB
5.	Question duplication from the license screening/audit exam was controlled as indicated below (check the item that applies) and appears appropriate: ✓ the audit exam was systematically and randomly developed; or ✓ the audit exam was completed before the license exam was started; or __ the examinations were developed independently; or ✓ the licensee certifies that there is no duplication; or __ other (explain)				RJB	ARS	MEB
6.	Bank use meets limits (no more than 75 percent from the bank, at least 10 percent new, and the rest new or modified); enter the actual RO / SRO-only question distribution(s) at right.	Bank 16/0 (21.3%/0%)	Modified 0/0 (0%/0%)	New 59/25 (78.7%/100%)	RJB	ARS	MEB
7.	Between 50 and 60 percent of the questions on the RO exam are written at the comprehension/analysis level; the SRO exam may exceed 60 percent If the randomly selected K/As support the higher cognitive levels; enter the actual RO / SRO question distribution(s) at right.	Memory 32/1 (42.7% / 4%)	C/A 43/24 (57.3% / 96%)		RJB	ARS	MEB
8.	References/handouts provided do not give away answers or aid in the elimination of distractors.				RJB	ARS	MEB
9.	Question content conforms with specific K/A statements in the previously approved examination outline and is appropriate for the Tier to which they are assigned; deviations are justified				RJB	ARS	MEB
10.	Question psychometric quality and format meet the guidelines in ES Appendix B.				RJB	ARS	MEB
11.	The exam contains the required number of one-point, multiple choice items; the total is correct and agrees with value on cover sheet				RJB	ARS	MEB

	Printed Name / Signature	Date
a. Author	R. J. Brooks / RJ Brooks	4/11/13
b. Facility Reviewer (*)	A. R. Stallard / A R Stallard	4/11/13 *MEB per telecon
c. NRC Chief Examiner (#)	Michael Bielby / Michael E Bielby	4/23/13
d. NRC Supervisor	Hironori Peterson / Hironori Peterson (HP)	5/28/13

Note: * The facility reviewer's initials/signature are not applicable for NRC-developed examinations.

\# Independent NRC reviewer initial items in Column "c"; chief examiner concurrence required.

1. The following plant conditions exist:

    - RCS pressure is 250 psig
    - Pressurizer temperature is 406 °F
    - Quench Tank pressure is 80 psig
    - Containment pressure is 14.7 psia
    - The crew has just finished drawing a Pressurizer steam bubble.

    The following event occurs:

    - The Pressurizer Safety fails open and the Quench Tank rupture disc ruptures.

    What will be the Pressurizer Safety Valve downstream temperature, for these conditions?

A. ~212 °F

B. ~325 °F

C. ~345 °F

D. ~406 °F

Answer: B

Explanation/Justification:

A. Incorrect. Plausible because this is the saturation temperature for 14.7 psia which the candidate could select if isenthalpic throttling is not considered.

B. Correct answer IAW Steam tables and isenthalpic throttling process. When the Pressurizer Safety Valve fails open, the rupture disc on the safety valve will blow releasing pressurizer steam to the CTMT atmosphere. Therefore the downstream conditions will be the CTMT conditions.

C. Incorrect. Plausible because this is the saturation temperature for 80 psig (Quench Tank pressure)

D. Incorrect. Plausible because this the temperature at which the event started

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Sys #	System	Category	KA Statement
000008	Pressurizer (PZR) Vapor Space Accident	AK1. Knowledge of the operational implications of the following concepts as they apply to a Pressurizer Vapor Space Accident:	Thermodynamics and flow characteristics of open or leaking valves

K/A# AK1.01 **K/A Importance** 3.2 **Exam Level** RO

References provided to Candidate Steam Tables **Technical References:** Steam Tables

Question Source: New **Level Of Difficulty: (1-5) 3** 3

Question Cognitive Level: High - Application **10 CFR Part 55 Content:** (CFR 41.8 / 41.10 / 45.3)

Objective:

2. A small break loss of coolant accident has occurred.

Which of the following describes the function of the Steam Generator **required** to mitigate this event?

A. Steam Generators are not required to mitigate any loss of coolant accidents.

B. For certain small break LOCAs, heat removal by the SGs is necessary to satisfy the acceptance criteria of 10CFR50.46, Acceptance Criteria for Emergency Core Cooling Systems.

C. Only the isolation of Containment provide by the Main Steam Isolation Valves is required to mitigate a loss of coolant accident.

D. Boiler-Condenser Cooling provided by the Steam Generators is required to ensure condensed steam is returned to the Reactor Vessel to provide adequate RCS inventory for loss of coolant accidents.

Answer: B

Explanation/Justification:

A. Incorrect - Maintaining SG's available as a heat removal capability is required to ensure that Core cooling is provided if flow out the break is not sufficient.

B. Correct per DB-OP-02000 Bases and Deviation Document Step 5.6 and 5.7. Maintaining SG's available as a heat removal capability will ensure that Core cooling is provided if flow out the break is not sufficient.

C. Incorrect – Although the MSIVs will isolate Containment, without a break in the Steam Generator or Main Steam Line, Containment Integrity is not affected by the position of the MSIV.

D. Incorrect – Although the condensed steam is returned to the reactor vessel, adequate RCS inventory requires HPI or LPI operation.

Sys #	System	Category	KA Statement
000009	Small Break LOCA	EK2. Knowledge of the interrelations between the small break LOCA and the following:	S/Gs

K/A# EK2.03 **K/A Importance** 3.0 **Exam Level** RO

References provided to Candidate None

Technical References: DB-OP-02000 R19 Bases and Deviation Document Steps 5.6 and 5.7 for SBLOCA requirement to maintain SG available. 10CFR50.46

Question Source: New

Level Of Difficulty: (1-5) 3

Question Cognitive Level: Low - Fundamental

10 CFR Part 55 Content: (CFR 41.7 / 45.7)

Objective:

STEP 5.6

Verify proper SG level control by AFW using Specific Rule 4, Steam Generator Control.

Purpose: Raising SG level to the loss of SCM setpoint (124/130 inches) will establish the necessary inventory for Boiler Condenser Cooling (BCC). This level will also assist in establishing primary side natural circulation, which would be necessary to obtain Primary to Secondary Heat Transfer.

Bases: For most events, including most LOCAs, the core can be adequately cooled by using HPI or LPI cooling. For certain small break LOCAs, heat removal by the SGs is necessary to satisfy the acceptance criteria of 10CFR50.46. SG levels must be increased to the loss of SCM setpoint at the required minimum SG fill rate until the setpoint is reached. Specific Rule 4 requires full continuous AFW flow until setpoint is reached. Full continuous flow will provide approximately 800 gpm per SG as limited by AFW cavitating venturies Full continuous flow exceeds the minimum of 225 gpm to each SG with 2 SG(s) in service or 450 gpm to a single SG with 1 SG in service. The minimum SG fill rate is the rate necessary to ensure that maximum expected energy is removed from the reactor coolant.

The loss of SCM setpoint provides sufficient surface area for Boiler Condenser Cooling (BCC). Condensing the steam in the RCS via BCC will reduce RCS pressure so that HPI flow rate will increase to a value where its heat removal rate will match decay heat production in time to ensure the core remains covered.

If SFRCS trips on Low SG Pressure due to MU/HPI Cooling or raising SG level (not a secondary side malfunction), direction is provided (step 5.7) to reestablish AFW flow to the isolated SG and raise level. This action will allow use of the isolated SG for SG Heat Transfer if necessary.

AFW should be used because the elevation of the AFW nozzles is high enough to provide the required condensing surface without level established in the SGs. The level setpoint is high enough to provide the required condensing surface during periods of no AFW flow. At the loss of SCM setpoint, the amount of BCC, combined with HPI cooling, will keep the core cooled and covered.

Setpoints: None

References:

1. EOP TBD Volume 1, Section III.B.3
2. EOP TBD Volume 3, Chapter IV.C.4.4.3
3. 10 CFR 50.46
4. Safety Evaluation SE 87-0292, Safety Evaluation for FCR 86-330 Auxiliary Feedwater Level Control

5. B&W Document 51-1224886-02, OTSG Refill Summary Report

6. USAR 15.2.8.2.3, Loss of Normal Feedwater, Results Analysis

Deviations: No

The EOP TBD Volume 2 Section III.B.3 describes limiting AFW flow can be limited to minimize SG cooling during periods when no primary to secondary heat transfer exists. In accordance with Specific Rule 4.1, full continuous AFW flow is maintained until appropriate SGs levels are reached. This is acceptable based on the following:

1. The raised loop design at Davis-Besse requires much lower SG levels to promote natural circulation than other B&W plants. Therefore automatic AFW level control setpoints are lower, less AFW is added to reach setpoint, and overcooling due to AFW addition is not a serious concern. An historical review of AFW initiations prior to 1988 supports the conclusion that AFW flow at the maximum rate until the desired setpoint is reached, does not cause significant overcooling at Davis-Besse even with low decay heat and AFW flow at maximum (≈1200 gpm/SG).

2. A plant modification added cavitating venturies in the 1988 outage to limit AFW flow to approximately 800 GPM/SG versus about 1200 GPM/SG previously obtained. This modification further reduces the concern of AFW flow causing overcooling.

3. Accident analysis described in USAR 15.2.8.2.3 requires 600 GPM AFW flow in < 40 seconds during a loss of feedwater event. The automatic AFW flow control system is designed to provide maximum flow until setpoint is reached. Throttling of AFW flow when less than setpoint would require the operator to override the automatic safety system control. It is not desired to add procedure guidance to allow or require AFW throttling when below the desired SG level setpoint, based on SG pressure criteria. Throttling, at all, is in conflict with requirements to obtain maximum flow. A SG pressure decrease could (and most likely would) be caused by excessive steam flow. Throttling AFW flow to limit a SG pressure decrease caused by excessive steam flow is inappropriate and could lead to unnecessary SG dry out.

STEP 5.7

IF AT ANY TIME SFRCS Trips on low SG pressure due to MU/HPI Cooling or raising SG Levels, then restore AFW to the isolated SG and restore SG level.

Purpose: The purpose of this step is to ensure that both SGs are available or remain available as a method for providing Core cooling.

Bases: Maintaining SG's available as a heat removal capability will ensure that Core cooling is provided if flow out the break is not sufficient. Adequate core cooling can be provided solely based on break/HPI flow provided the break is large enough. Depending on break size, it may be necessary for break/HPI flow to be augmented by SG heat removal to obtain the desired cooldown rates.

SFRCS Actuation on Low pressure isolates the affected SG on both Steam side (MSIV's and AFW Steam Supplies) and the Feedwater side (MFW and AFW). Table 1 may be used to establish the proper lineup to restore steam from that SG to the AFW pumps and feedwater from the AFW Pump to that Steam Generator.

Setpoints: None

References:

1. EOP TBD Volume 1, Section III.B.3.
2. EOP TBD Volume 1, Section III.B.17.

Deviations: No

3. A Large Break Loss of Coolant Accident occurred.

Which of the following sets of Plant Conditions indicates inadequate core cooling exists?

Incore Thermocouple temperature average _________(1)__________.

WITH

Reactor Coolant System Pressure _________(2)__________.

A. (1) 400 °F
(2) 400 PSIG

B. (1) 600 °F
(2) 1540 psig

C. (1) 500 °F
(2) 680 psig

D. (1) 550 °F
(2) 600 psig

Answer: D

Explanation/Justification: ICC is normally determined using Figure 2 of DB-OP-02000 which labels the Temperature/Pressure relationships that represent ICC conditions. For this question, steam tables are provide. Candidate must demonstrate understanding of plant condition using the saturation curve.

A. Incorrect –ICC is indicated by Superheated conditions. Values provided indicate subcooled conditions exist.

B. Incorrect –. ICC is indicated by Superheated conditions. Values provided indicate saturated conditions exist. Candidate that assumes highest temperature is indicative of ICC would pick this combination.

C. Incorrect – ICC is determined using Figure 2 of DB-OP-02000. ICC is indicated by Superheated conditions. Values provided indicate saturated conditions exist. .

D. Correct – ICC is determined using Figure 2 of DB-OP-02000. ICC is indicated by Superheated conditions. Values provided indicate superheated conditions exist, ICC exists.

Sys #	System	Category	KA Statement
000011	Large Break LOCA	EA2. Ability to determine or interpret the following as they apply to a Large Break LOCA:	Verification of adequate core cooling

K/A# EA2.10 **K/A Importance** 4.5 **Exam Level** RO

References provided to Candidate Steam Tables

Technical References: DB-OP-02000 R26 Figure 2
Bases and Deviation Document for DB-OP-02000 R19 step 5.13

Question Source: New

Level Of Difficulty: (1-5) 3

Question Cognitive Level: High - Application

10 CFR Part 55 Content: (CFR 43.5 / 45.13)

Objective:

STEP 5.13

IF AT ANY TIME ICC exists, then go to section 9.0, Inadequate Core Cooling

Purpose: The purpose of this step is to provide the criterion for transferring to the ICC section.

Bases: Inadequate Core Cooling (ICC) is not expected as long as these guidelines are followed and the actions are successfully completed. However, any transient can progress into ICC conditions, provided enough equipment failures occur. If the RCS is superheated, adequate core cooling no longer exists. Consequently, actions must be taken to restore the RCS to at least saturated conditions as quickly as possible.

Due to instrument response time, rapid RCS pressure drops may result in superheated conditions being displayed on the T_{SAT} meters (NEG MARGIN light lit) when the RCS is actually saturated.

Superheated conditions should be confirmed prior to entry into Section 9, by selecting INCORE for the T_{SAT} meter input AND rotating the INCORE TEMPERATURE selector through all positions (for both channels) while monitoring the T_{SAT} meter.

If both channels are available, then a total of five or more working incore detectors displaying a NEG MARGIN confirms that superheated conditions exist. If only one channel is available, then a total of three or more working incore detectors displaying a NEG MARGIN confirms that superheated conditions exist.

Due to instrument error (±24.2°F for incore thermocouples) and rate of instrument response during rapid transients, it is possible that although the RCS P/T plot is slightly to the right of the saturation curve, the RCS is indeed only saturated. The fact that the RCS is saturated rather than superheated can be verified by noting that the incore thermocouple temperature moves parallel to the saturation curve. If ICC conditions actually exist the RCS P/T plot will continue to trend into the ICC region away from the saturation curve.

Due to the nature of the actions that will be taken when in Section 9, Inadequate Core Cooling, DO NOT route to Section 9 unless superheated conditions actually exist (Incore Thermocouple trending away (increasing) from the saturation line at a value greater than the maximum instrument error).

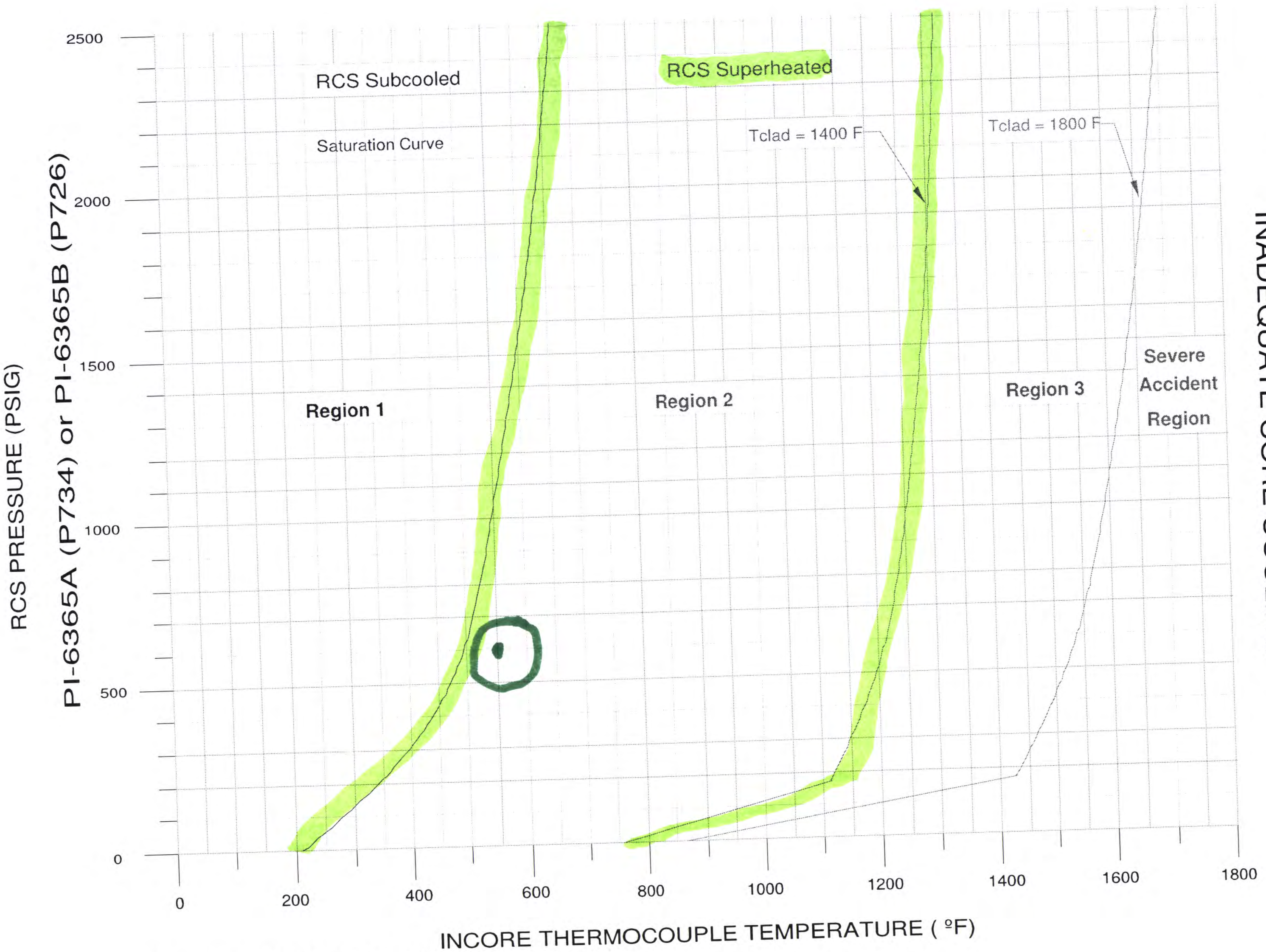
Setpoints: None

References: 1. EOP TBD Volume 1, Section III.B.9

Deviations: No

Figure 2

INCORE T/C TEMPERATURE vs RC PRESSURE FOR INADEQUATE CORE COOLING



Framatome 51-5015400-01 Fig. 5-4
SPDS
CC1.13

4. The plant is operating at 100% power with all systems in normal alignment for this power level.

Which of the following abnormal conditions requires an **IMMEDIATE** power reduction and stopping the affected Reactor Coolant Pump?

A. MU59A, RCP 2-1 Seal Return Isolation Valves fails closed.

B. Computer Point L828, 2-1 Motor Lower Bearing Low Oil Level Alarm with stable bearing temperatures.

C. Computer Point T828, 2-1 Motor Stator Temperature Alarm with indicated temperature 350 °F.

D. Computer Points for 2-1 Seal Cavity Pressure P833 (second stage) reads 1100 psig, and P834 (third stage) reads 50 psig

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Answer: C

Explanation/Justification:

A. Incorrect – Shutdown is required within 30 minutes, not immediately.
B. Incorrect – Shutdown is required if bearing temperatures are rising with low oil level, not immediately.
C. Correct – Power reduction and Shutdown is immediately required per DB-OP-02515 Step 4.6.1 RNO.
D. Incorrect – Values provided indicated a single RCP Seal Stage is failed. Immediate Shutdown is not required for single stage failure per DB-OP-02515, Step 4.1.1

Sys #	System	Category	KA Statement
000015/ 000017	Reactor Coolant Pump (RCP) Malfunctions	Generic	Knowledge of abnormal condition procedures.

K/A# 2.4.11 **K/A Importance** 4.0 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02515 R11, RC Pump and Motor Malfunctions Step 4.6.1 RNO

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR: 41.10 / 43.5 / 45.13)

Objective:

4.6 RCP Motor Problems

<table>
<tr><th>ACTION/EXPECTED RESPONSE</th><th>RESPONSE NOT OBTAINED</th></tr>
<tr><td>___ 4.6.1 Check that RCP Motor conditions are within operational limits:

o RCP Motor Vibration Annunciator resets (6-1-A thru D) AND RCP vibration is less than 2 mils.

1-1 V788
1-2 V808
2-1 V828
2-2 V838

o Bentley-Nevada (SPDS) Shaft Displacement X AND Y axis is less than 29 mils.

o Any Motor Bearing Temp (Upper-Upthrust-Downthrust-Lower) less than 190°F:

1-1 T789, T790, T785, T787
1-2 T809. T810, T805, T807
2-1 T829, T830, T825, T827
2-2 T849, T850, T845, T847

o Motor Oil Level is NOT in alarm OR motor bearing temperatures stable if oil level is in alarm.

o Motor Stator Temperature is less than 300°F:

1-1 T788
1-2 T808
2-1 T828
2-2 T848

o Motor Current is between 200 and 370 Amps.</td><td>IF AT ANY TIME RCP Motor conditions exceed operational limits, THEN perform one of the following:

___ o IF the Reactor is Critical with 4 RCPs operating, THEN perform Attachment 1, Reactor Coolant Pump Shutdown to stop the affected RCP. (Command SRO Directed).

o IF the Reactor is Critical with 3 RCPs operating, THEN perform the following:

___ a. Trip the Reactor.

___ b. Stop the affected RCP

___ c. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.

___ o IF the Reactor is Shutdown, THEN stop the affected RCP.</td></tr>
</table>

ATTACHMENT 1: REACTOR COOLANT PUMP SHUTDOWN

The purpose of this attachment is to provide direction for stopping a Reactor Coolant Pump during 4 pump operation with the Reactor Critical. Due to the coordination required between the ATC and BOP operators, the attachment is directed by the Command SRO.

The Command SRO will direct performance of this Attachment.

____ 1. Reduce reactor power to 72 percent or less.
REFER TO DB-OP-02504, Rapid Shutdown.

____ 2. IF time permits,
THEN place SG Load Ratio (ΔTc) in Auto.
Refer to DB-OP-06401, Integrated Control System Operating Procedure.

____ 3. Stop the affected RCP.

____ 4. Verify proper Feedwater flow ratios of 2.4 to 1. (Feedwater flow should be approximately 5.74 MPPH to the SG with 2 RCPs vs. 2.38 MPPH to the SG with one RCP at 72 percent power – Approximately 70% to 30% ratio for other power levels).

____ 5. Verify Tave control transferred to the RC loop with two RCPs.

____ 6. Check RCS flow is greater than the flow required by TS 3.4.1, DNB Limits.
REFER TO DB-OP-03006, Miscellaneous Instrument Shift Checks. (Computer Point F744)

____ 7. Notify I&C to reduce the RPS High Flux Trip setpoints within 10 hours.
REFER TO TS 3.4.4, RCS Loops – Modes 1 and 2.

5. Following the loss of **BOTH** Makeup Pumps from full power operations, why is RCS pressure reduced to 1700 to 1800 psig?

Reducing RCS Pressure will____.

A. reduce Reactor Coolant Pump seal leak off, preserving RCS Inventory.

B. allow the Reactor Protective System to be place in Shutdown Bypass.

C. allow the Safety Features Low RCS Pressure Trip to be blocked.

D. allow the High Pressure Injection system to restore RCS Inventory.

Answer: D

Explanation/Justification:

A. Incorrect – Plausible because this would reduce seal leakoff, RCS Invertory is preserved by isolating Letdown for this event.

B. Incorrect – Plausible because in a normal shutdown, Shutdown Bypass Operation can be established at this RCS Pressure range.

C. Incorrect – Plausible because in a normal shutdown, RCS Pressure is reduced to slow the transition when blocking the SFAS Low RCS Pressure Trip at 1670 psig prior to SFAS Actuation at 1600 psig..

D. Correct – The ability to add inventory to the RCS is established by starting High Pressure Injection in piggyback mode which will then provide approximately 1800 psig discharge pressure allowing flow to the RCS.

Sys #	System	Category	KA Statement
000022	Loss of Reactor Coolant Makeup	AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Reactor Coolant Makeup:	Actions contained in SOPs and EOPs for RCPs, loss of makeup, loss of charging, and abnormal charging

K/A# AK3.02 **K/A Importance** 3.5 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02512 R14, Makeup and Purification System Malfunctions Attachment 6.

Question Source: New **Level Of Difficulty: (1-5)** 2

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR 41.5, 41.10 / 45.6 / 45.13)

Objective:

ATTACHMENT 6: RCS PRESSURE CONTROL AFTER REACTOR TRIP

This attachment provides instructions for RCS pressure control after a Reactor Trip. Makeup Injection capability is assumed to be unavailable. RCS pressure is reduced to less than the shutoff head of LPI/HPI piggyback, but maintained greater than the SFAS Low RCS Pressure Trip.

1. IF RCS pressure is NOT low enough to allow HPI flow to recover PZR level, THEN perform the following:

_____ a. Turn off all PZR Heaters.

_____ b. Reduce RCS pressure to between 1700 and 1800 psig using RC 2, PZR SPRAY VALVE.

_____ c. Throttle HPI flow to maintain Pressurizer level 80 to 120 inches.

_____ d. Maintain RCS Pressure between 1700 and 1800 using Pressurizer Heaters AND RC 2, PZR SPRAY VALVE as necessary.

2. WHEN Pressurizer Level is approximately 100 inches, THEN perform the following:

_____ a. Restore Letdown to service as an aid in maintaining Pressurizer level 80 to 120 inches. REFER TO DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture, Attachment 13, Controlling the MU System.

_____ b. Divert Letdown to the CWRTs as necessary by positioning MU 11, THREE-WAY to CLN WST to CLN WST.

_____ c. Reduce injection flow to a single HPI nozzle to minimize thermal cycling.

_____ d. Maintain Makeup Tank Level 55 to 86 inches as follows:

1. Align MU Pump Suctions to the MU Tank.

_____ • MU6405, MU PUMP 1 SUCTION THREE WAY

_____ • MU3971, MU PUMP 2 SUCTION THREE WAY

_____ 2. Drain the Makeup Tank to the Reactor Coolant Drain Tank as necessary via MU189, MAKEUP TANK 1 OUTLET ISO TO RC DRN TK. (Located on the catwalk outside of the CWMT Room watertight door.)

6. The following plant conditions exist:

- A plant cooldown is in progress for refueling.
- Reactor Coolant Pumps 2-1 and 2-2 are in service.
- DH Train 2 is in service
- DH Train 1 is out of service being transferred from LPI to DHR Mode
- RCS temperature is 180 °F
- Pressurizer level is 80 inches
- RCS pressure is 220 psig

The following event occurs:

- A loss of Off-Site Power occurs
- EDG 2 fails to start

Based on these conditions:

In accordance with DB-OP-02527, Loss of Decay Heat Removal, what is the **PRIORITY** for how core heat removal will be established?

A. Maintain current RCS temperature Conditions using Turbine Bypass Valves and Natural Circulation.

B. Allow RCS to heatup to Mode 4, then use Atmospheric Vent Valves and Natural Circulation to control RCS temperature.

C. Allow RCS to heatup to Mode 4, then use Makeup, High Pressure Injection, and the High Point Vents to establish Feed and Bleed Cooling.

D. Maintain current RCS temperature Conditions using Makeup, High Pressure Injection, and the PORV to establish Feed and Bleed Cooling.

<u>Answer: B</u>

Explanation/Justification:

A. Incorrect – This outcome would be desired to avoid transition back into Mode 4, but the loss of offsite power has caused a loss of Circ Water Pumps and therefore the main condenser. TBVs will close once Condenser Pressure rises to 17 inch HgA.

B. .Correct - Step by step priority as listed in DB-OP-02527 R15, Loss of Decay Heat Removal step 4.1.7 RNO

C. Incorrect – At low RCS Pressures, the flow out the High Point Vents will be insufficient to remove core decay heat. The RCS would heatup beyond Mode 4 (greater than 280 F). Candidate may assume PORV is not available for this scenario. The PORV is DC Powered

D. Incorrect – Although Feed and Bleed cooling would be successful in removing decay heat, it is likely the PORV flow at low RCS pressures would not be sufficient to allow continued cooldown, In addition, SG heat transfer is prioritized above Feed and Bleed Cooling in DB-OP-02527, Loss of Decay Heat Removal.

Sys #	**System**	**Category**	**KA Statement**
000025	Loss of Residual Heat Removal System (RHRS)	AA1. Ability to operate and / or monitor the following as they apply to the Loss of Residual Heat Removal System:	RCS/RHRS cooldown rate

K/A# AA1.01 **K/A Importance** 3.6 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02527 R15, Loss of Decay Heat Removal step 4.1.7 RNO.

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 41.7 / 45.5 / 45.6)

Objective:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1.7 IF either Decay Heat Pump can be placed in service to provide core cooling, THEN perform one of the following: ___ • Attachment 1, Starting Decay Heat Pump 1. OR ___ • Attachment 2, Starting Decay Heat Pump 2.	IF decay heat removal can not be established using the DHR Pumps, THEN perform the following: ___ a. Evacuate Containment. REFER TO RA-EP-02864, Containment Evacuation. ___ b. Establish Containment Closure. REFER TO DB-OP-06904, Shutdown Operations. c. Establish an alternate means of removing Decay Heat: ___ 1. IF either SG is functional AND the RCS is full or can be filled with the RCS pressure boundary intact, THEN perform Attachment 3, Establish SG Heat Transfer. **(SRO Directed)** OR ___ 2. IF the Refueling Canal is Filled with SF1 OR SF2 open or can be opened, THEN perform Attachment 4, Using the SFP Cooling System to Cool the Core. OR ___ 3. Perform Attachment 5, Establish Feed and Bleed Cooling. **(SRO Directed)**

7. The following plant conditions exist:

- The plant is operating at 100% power.

The following indications occur:

- 11-4-B, CCW PMP 1 FLOW LO, annunciator is in alarm with a flowrate of 2400 gpm.
- 2-3-A, LETDOWN TEMP HI, annunciator is in alarm with a temperature of 144 °F.
- 11-1-B, CCW HX 1 OUTLET TEMP HI, annunciator is in alarm with a temperature of 122°F.

Which one of the following actions will automatically occur?

A. CCW Pump 1 will trip.

B. The standby CCW pump will start.

C. CCW Non-Essential Header will isolate.

D. Letdown cooler inlet isolation valve, MU 2B, will close.

Answer: D

xplanation/Justification:

A. Incorrect – Plausible because the CCW Pump is operating at a low flow condition. It would be logical to have the pump trip to protect the pump.

B. Incorrect – Plausible because the CCW Pump is operating at a low flow condition, but above the Flowrate to cause and automatic start of the Standby Pump

C. Incorrect – Plausible because the CCW system is operating abnormally. Closing the non-essential header isolation could protect the essential functions provided by CCW.

D. Correct – CCW temperatures associated with the letdown cooler will rise with reduced flow that would lead to a high temperature isolation of letdown flow.

Sys #	System	Category	KA Statement
000026	Loss of Component Cooling Water (CCW)	AA1. Ability to operate and / or monitor the following as they apply to the Loss of Component Cooling Water:	Flow rates to the components and systems that are serviced by the CCWS; interactions among the components

K/A# AA1. 07 **K/A Importance** 2.9 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02002 R08 Annunciator 2-3-A Letdown/Makeup Alarm Panel 2 Annunciators

Question Source: BANK 37623 **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 41.7 / 45.5 / 45.6)

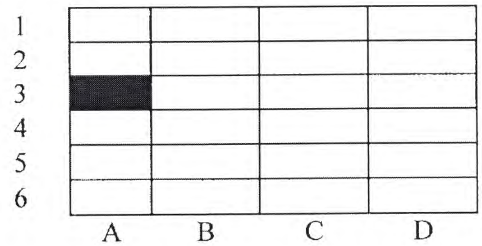
Objective:

LETDOWN/MAKEUP ALARM PANEL 2 ANNUNCIATORS

2-3-A

M	T715
LETDOWN TEMP HI	

Panel 2



COLOR: White

ACTUATING DEVICE(S)		SETPOINTS	
1.	TSH 3745B at the Delay Coil	1.	≥135°F
2.	TSH 3745A upstream of Delay Coil	2.	≥160°F
3.	TS MU8 Downstream of Flow element	3.	≥135°F

1.0 SYMPTOMS

1.1 Annunciator Alarm (2-3-A) LETDOWN TEMP HI

1.2 RC Letdown temperature greater than or equal to 135°F

2.0 IMMEDIATE ACTIONS

None

3.0 SUPPLEMENTARY ACTIONS

3.1 Verify MU 2B, LETDOWN COOLER INLET ISOLATION, has closed at greater than or equal to 135°F Letdown temp.

3.2 IF temperature reaches greater than or equal to 160°F,
THEN verify that MU 1A, LETDOWN COOLER 1 INLET ISOLATION, and MU 1B, LETDOWN COOLER 2 INLET ISOLATION, close.

8. The plant is operating at 100% power with all systems in normal alignment for this power level.

The selected RCS Pressure Instrument from the Reactor Protective System to Non-Nuclear Instrument System **INSTANTANEOUSLY** fails **HIGH**.

Which of the following describes how the plant will respond to this failure?

The Pressurizer PORV will __________(1)_________.
The Pressurizer Spray Valve will __________(2)_________.
The Pressurizer Heaters will __________(3)_________.

A. (1) remain closed
(2) remain closed
(3) remain energized

B. (1) open
(2) open
(3) de-energize

C. (1) open
(2) remain closed
(3) de-energize

D. (1) remain closed
(2) open
(3) remain energized

Answer: B

Explanation/Justification:

A. Incorrect – Plausible if the candidate believes the RCS signal is SASS protected like most other NNI signals. Instantaneous failures would normally cause a SASS transfer for SASS protected instrument inputs resulting in no change to the input for the PORV, Spray Valve, or Pressurizer Htrs.

B. Correct – The selected RPS Pressure signal is used to control the PORV, the PZR Spray Valve, and the Pressurizer Heaters. A high failure will cause the PORV to Open, the Pressurizer Spray Valve to Open, and the Pressurizer Heaters to turn off.

C. Incorrect –. Plausible if the candidate thought that the safety grade Reactor Protective System RCS Pressure signal is used to control the PORV. Since PORV has the most impact on the plant, this conclusion is logical.

D. Incorrect – Plausible if the candidate thought that the safety grade Reactor Protective System RCS Pressure signal is used to control only the Pressurizer Spray Valve. The remaining positions would be correct if supply with a different pressure signal.

Sys #	System	Category	KA Statement
000027	Pressurizer Pressure Control System (PZR PCS) Malfunction	AK2.03 Knowledge of the interrelations between the Pressurizer Pressure Control Malfunctions and the following:	Controllers and positioners

K/A# AK2.03 **K/A Importance** 2.6 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02513, Pressurizer System Abnormal Operation Att. 2 page 54

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 41.7 / 45.7)

Objective:

ATTACHMENT 2: BACKGROUND INFORMATION

Purpose:
The purpose of DB-OP-02513, Pressurizer System Abnormal Operation, is to provide operator direction for control of Pressurizer parameters and to restore Pressurizer pressure and level if possible during abnormal conditions associated with the Pressurizer System.

Technical Specifications:
3.4.1, RCS Pressure, Temperature and Flow DNB Limits
3.4.4, Reactor Coolant Loops – Modes 1 and 2
3.4.9, Pressurizer
3.4.10 Pressurizer Safety Valves
3.4.11, Pressurizer Pilot Operated Relief Valve (PORV),
3.4.13, Operational Leakage

USAR Sections:
5.5.10 Pressurizer
5.5.11 Pressurizer Quench Tank and Cooler
5.5.14 Safety and Relief Valves
5.6 Instrumentation Application Reactor Coolant System

Discussion

Each section will be discussed separately.

Symptom 2. 1 - Failure of Pressure Input to Heaters, Spray and PORV

If the selected RCS pressure input fails low then all Pressurizer heaters will energize. Alternate pressure indicators such as PAM, SFAS and RPS should be used to verify RCS pressure. Pressurizer Heaters can be operated manually. If the selected RCS pressure fails high, the PORV will open, the Pressurizer Spray Valve opens, and the Pressurizer Heaters will de-energize if in automatic. Closing the PORV block and Spray block valves should stop the pressure decrease. Pressurizer Heaters can be operated manually.

An alternate instrument may by selected by exchanging RCS pressure input to NNI from RPS. DB-OP-06403, Reactor Protection System (RPS) and Nuclear Instrumentation (NI) Operating Procedure provides this direction. If an alternate instrument is not available or can not be selected, the decision to continue power operations should include consideration of the impact on Risk when operating with the PORV and Pressurizer Spray Valve either blocked or no automatic control signal.

9. The plant is operating at 100% power with all systems in normal alignment for this power level.

The Reactor Protective System (RPS) generates a valid reactor trip signal, but the Control Drive Trip Breakers fail to open.

In accordance with DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture, the Reactor Operator in the Control Room momentarily deenergizes 480 volt Unit Substations E2 AND F2.

Following restoration of power to E2 and F2, which of the following previously running loads will return to operation without operator action?

A. Radwaste Exhaust Fan.

B. Main Station Exhaust Fan.

C. Clean Waste Monitor Tank Transfer Pump.

D. Spent Fuel Pool Pump.

Answer: D

Explanation/Justification:

A. Incorrect – There is no seal in feature for this fan. The Radwaste Ventilation System would be lost until the fan is restarted
B. Incorrect – There is no seal in feature for this fan. The Main Station Exhaust System would be lost until the fan is restarted
C. Incorrect – There is no seal in feature for this pump. This RCS inventory addition source would be lost until the pump is restarted.
D. Correct – The controller for the SFP Pumps have a seal in feature that would restart the pump following restoration of power.

Sys #	System	Category	KA Statement
000029	Anticipated Transient Without Scram (ATWS)	EK2. Knowledge of the interrelations between ATWS and the following:	Breakers, relays, and disconnects

K/A# EK2.06 **K/A Importance** 2.9* **Exam Level** RO

References provided to Candidate None **Technical References:** Eng Change Package 10-0654

Question Source: New **Level Of Difficulty: (1-5)** 2.5

Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR 41.7 / 45.7)

Objective:

FirstEnergy

ENGINEERING CHANGE PACKAGE COVERSHEET

NOP-CC-2003-14

ECP No. 10-0654-001

Rev. 0

[ ] BV1	[ ] BV2	[X] DB	[ ] PY

[ ] Administrative Document-Only	[ ] Document-Only Equivalent	[ ] Equivalent Change
[ ] Informal Change	[ ] Document-Only Design	[X] Design Change
[ ] Temporary Modification	TM Expiration Date/Outage	

Title: Change Control Ckt. for MP44-1 to Latching Starter.

Administative Order No.	Work Breakdown Structure (WBS) No.	At-Risk Changes Incorporated:	
200430916	NONE	NONE	[ ] **Safety Related** [ ] **Augmented Quality** [X] **Non-Safety**

Functional Location(s)	System(s) Affected	Order(s)	Notification(s)
DB-BE2176	DB-SUB067-01	200438059	600650285
DB-HIS1602	DB-SUB067-01	200438059	600650285
DB-MP44-1	DB-SUB067-01	200438059	600650285
DB-NP44-1	DB-SUB067-01	200438059	600650285

Initiating Document(s):

CR 10-77843 CA 2

Change Summary: *This is an executive summary of the change. Provide a full narrative of the problem. Include the cause and the reason for the change. Note any interim measures that will be eliminated by the change (e.g., temporary modifications or fire watches) or any deficient conditions that will be temporarily resolved by the change.*

Condition Report 10-77843 requires making enhancements to the control circuits for the Spent Fuel Pool Pump motors. The enhancements involve changing the motor control circuits from seal-in starter circuits to latching (latch-in) starter circuits. ECP 10-0654-001 changes the control circuit for the Spent Fuel Pool Pump 1-1 motor, MP44-1.

Included in the scope of this ECP is replacing Control Room HIS1602 and local operator NP44-1 with switches that do not provide a lock-out feature. Switches without a lock-out feature are appropriate with latching starter circuits. Since the appearance of HIS1602 changes, the switch installed as HIS1602 in the Simulator must also be changed.

ECP 10-0654-001 does not eliminate any interim measures.

Level of Rigor to be applied to this ECP

[ ]	Conceptual Design	[ ]	Design Review Team
[ ]	Project Team	[ ]	Design Verification Team
[ ]	Failure Modes and Effects Analysis	[ ]	Development of Procurement Specification
[ ]	Common Mode Failure Analysis	[ ]	Increased Oversight of Vendor Design Activity
[X]	Engineering Assessment Board Review	[ ]	Subject Matter Expert
	[ ] Prior to Detailed Design	[ ]	Development of Verification Plan
	[ ] Periodically During Detailed Design	[ ]	Project Manager
	[X] Following Detailed Design completion	[ ]	Enhanced Procurement
[ ]	Pre-Operational Testing/Accelerated Preventive Maintenance or Surveillance	[X]	Other: None. Increased level of Rigor is not warranted for this ECP because the change does not involve any of the five (5) criteria given in NOP-CC-2003 Rev. 15, Attachment 3 Section G

Responsible Engineer *(Print Name and Sign)*	Date	Issue Owner	Phone
Kreinbihl, William W. Kreinbihl	01/10/2011	Chew, David	7652

APPROVAL

FirstEnergy	ENGINEERING CHANGE PACKAGE COVERSHEET NOP-CC-2003-14	Page 1 of 2 ECP No. 10-0654-002 Rev. 0

[ ] BV1	[ ] BV2	[X] DB	[ ] PY

[ ] Administrative Document-Only	[ ] Document-Only Equivalent	[ ] Equivalent Change
[ ] Informal Change	[ ] Document-Only Design	[X] Design Change
[ ] Temporary Modification	TM Expiration Date/Outage	

Title: Change Control Ckt. for MP44-2 to Latching Starter.

Administative Order No.	**Work Breakdown Structure (WBS) No.**	**At-Risk Changes Incorporated:**	
200430933	NONE	NONE	[ ] **Safety Related** [ ] **Augmented Quality** [X] **Non-Safety**

Functional Location(s)	**System(s) Affected**	**Order(s)**	**Notification(s)**
DB-BF2106	DB-SUB067-01	200438068	600650286
DB-HIS1604	DB-SUB067-01	200438068	600650286
DB-MP44-2	DB-SUB067-01	200438068	600650286
DB-NP44-2	DB-SUB067-01	200438068	600650286

Initiating Document(s):

CR 10-77843 CA 2

Change Summary: *This is an executive summary of the change. Provide a full narrative of the problem. Include the cause and the reason for the change. Note any interim measures that will be eliminated by the change (e.g., temporary modifications or fire watches) or any deficient conditions that will be temporarily resolved by the change.*

Condition Report 10-77843 requires making enhancements to the control circuits for the Spent Fuel Pool Pump motors. The enhancements invlove changing the motor control circuits from seal-in starter circuits to latching (latch-in) starter circuits. ECP 10-0654-002 changes the control circuit for the Spent Fuel Pool Pump 1-2 motor, MP44-2.

Included in the scope of this ECP is replacing Control Room HIS1604 and local operator NP44-2 with switches that do not provide a lock-out feature. Switches without a lock-out feature are appropriate with latching starter circuits. Since the appearance of HIS1604 changes, the switch installed as HIS6104 in the Simulator must also be changed.

ECP 10-0654-002 does not eliminate any interim measures.

Level of Rigor to be applied to this ECP

[ ]	Conceptual Design	[ ]	Design Review Team
[ ]	Project Team	[ ]	Design Verification Team
[ ]	Failure Modes and Effects Analysis	[ ]	Development of Procurement Specification
[ ]	Common Mode Failure Analysis	[ ]	Increased Oversight of Vendor Design Activity
[X]	Engineering Assessment Board Review	[ ]	Subject Matter Expert
	[ ] Prior to Detailed Design	[ ]	Development of Verification Plan
	[ ] Periodically During Detailed Design	[ ]	Project Manager
	[X] Following Detailed Design completion	[ ]	Enhanced Procurement
[ ]	Pre-Operational Testing/Accelerated Preventive Maintenance or Surveillance	[X]	Other: None. Increased level of Rigor is not warranted for this ECP because the change does not involve any of the five (5) criteria given in NOP-CC-2003 Rev. 15, Attachment 3 Section G

Responsible Engineer *(Print Name and Sign)*	**Date**	**Issue Owner**	**Phone**
Kreinbihl, William W. K. Bihl	01/10/2011	Chew, David	7652

APPROVAL

10. Plant conditions are as follows:

- A SG tube has ruptured on SG 1.
- The reactor is tripped.
- RCS pressure is 1990 psig.
- RCS Tave is 548 °F.
- BOTH SGs are being steamed through the Turbine Bypass Valves.

Which one of the following will occur if SG 1 exceeds 250 inches?

A. The MSIV on SG 1 closes so that ONLY SG 2 may be steamed to the condenser.

B. SFRCS will realign Aux Feedwater to ONLY feed SG 2.

C. The MSIVs on BOTH SGs close and prevent steaming of BOTH SGs to the condenser.

D. The AFW level control setpoint for SG 2 is set to 124 inches and BOTH the AFW supply and Main Steam isolation close for SG 1.

Answer: C

Explanation/Justification: SFRCS will actuate on high SG level. The setpoint is 250 inches.

A. Incorrect – Plausible since only the #1 SG MSIV closes since that is the only SG operating at a high level.

B. Incorrect – Plausible since #1 SG is at a high level, we should stop feeding it by aligning both AFW pumps to feed #2 SG.

C. Correct – High level in either SG will close both MSIVs.

D. Incorrect – Plausible because elevated level in #2 SG will promote heat transfer that may be needed if #1 SG is removed from service.

Sys #	System	Category	KA Statement
000038	Steam Generator Tube Rupture (SGTR)	EA2. Ability to determine or interpret the following as they apply to a SGTR:	Status of MSIV activating system

K/A# EA2.12 **K/A Importance** 3.9* **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02000 R26 Table 1 SFRCS Response

BANK 36449 **Level Of Difficulty: (1-5)** 2.5 - 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 43.5 / 45.13)

Objective:

17.0 TABLES

TABLE 1

SFRCS
Actuated
Equipment
Sheet 1 of 2

SFRCS Actuated Equipment	SFRCS AUTOMATIC ACTUATION: SG Low Pressure SG 1	SG Low Pressure SG 2	SG High Level OR Reverse Delta P	SG Low Level OR Loss of All RCPs	SFRCS MANUAL ACTUATION[3]: Manual Initiate 6401 & 6402	Manual Initiate & Isol 6403 & 6404
FW612 (Z674)	CL	CL	CL	-	-	CL
SP6B (Z673)	CL	CL	CL	-	-	-
FW780	CL	CL	CL	-	-	CL
FW779	CL	CL	CL	-	-	CL
SP6A (Z678)	CL	CL	CL	-	-	-
FW601 (Z679)	CL	CL	CL	-	-	CL
ICS11B (Z961)	CL	CL	CL	-	-	CL
SP7B (Z675)	CL	CL	CL	-	-	CL
SP7A (Z680)	CL	CL	CL	-	-	CL
ICS11A (Z969)	CL	CL	CL	-	-	CL
MS101 (Z683)	CL	CL	CL	-	-	CL
MS100 (Z686)	CL	CL	CL	-	-	CL
MS101-1 (Z685)	CL	CL	CL	-	-	CL
MS100-1 (Z688)	CL	CL	CL	-	-	CL
MS611	CL	CL	CL	-	-	CL
MS394 (Z684)	CL	CL	CL	-	-	CL
MS375 (Z687)	CL	CL	CL	-	-	CL
MS603	CL	CL	CL	-	-	CL

[3]Manual Actuation Response assumes both trains actuation pushbuttons were depressed.

11. INITIAL CONDITIONS:
- RCS temperature 500 °F
- RCS pressure 1000 psig
- RCS cooldown in progress
- A Main Steam Line Break on #2 SG in Containment occurs.

CURRENT CONDITIONS:
- RCS temperature 425 °F
- RCS pressure 750 psig

Assuming no change in Main Steam Line break size, from initial to current condition, subcooling margin has ____(1)_______ and steam flow out the break has ____(2)_______.

A. (1) risen
(2) lowered

B. (1) risen
(2) risen

C. (1) lowered
(2) lowered

D. (1) lowered
(2) risen

Answer: A

Explanation/Justification: Note: During an RCS Cooldown, the SFRCS Low SG Pressure Trip would be blocked at the RCS temperature provided. SFRCS would not actuate on Low SG Pressure for this scenario.

A. Correct – Subcooled margin for the initial conditions would be approximately 45 degrees while SCM for current conditions would be approximately 85 degrees. Steam Flow would be reduced as SG Pressure Lowers.

B. Incorrect – While SCM will have risen as noted in A above, steam line break flow will be dependant on SG pressure. As the RCS cools, SG pressure will lower and therefore break flow will lower, however candidate may assume SCM drives the Steam flow rate like aSGTR – That is, reducing SCM reduces leak rate.

C. Incorrect – Candidate may select this response assuming lower RCS temperatures produces lower SCM.. While steam line break flow will be dependant on SG pressure. As the RCS cools, SG pressure will lower and therefore break flow will lower.

D. Incorrect – Candidate may select this response assuming lower RCS temperatures produces lower SCM.. While steam line break flow will be dependant on SG pressure. As the RCS cools, SG pressure will lower and therefore break flow will lower, however candidate may assume SCM drives the Steam flow rate like a SGTR – That is, reducing SCM reduces leak.

Sys #	System	Category	KA Statement
000040	Steam Line Rupture – Excessive Heat Transfer	Generic	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.

K/A# 2.1.7 **K/A Importance** 4.4 **Exam Level** RO

References provided to Candidate Steam Tables **Technical References:** Fundamental Theory - Steam Table and General Physics HTFF Chapter 4 page 3

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.5 / 43.5 / 45.12 / 45.13)

Objective:

MASS FLOW RATE

Fluid flow is inherently dynamic; it involves the movement of matter. Therefore, the units of fluid flow are dynamic units. They involve the rate at which the matter moves. The mass flow rate, $\dot{m}$, of a fluid, is defined as the mass of the fluid which passes a reference point per unit time. Thus, if 3×10^7 pounds mass of steam flows past a point in one hour, the mass flow rate is 3×10^7 pounds mass per hour.

The mass flow rate ($\dot{m}$) equals the product of the density of the fluid (ρ) and the cross-sectional area of flow (A) and the average fluid velocity (ν_{av}). Or the mass flow rate can be calculated by multiplying by the cross-sectional area of flow (A) and the average fluid velocity (ν_{av}), and dividing the results by the specific volume of the fluid (υ).

$$\dot{m} = \rho A \nu_{av}$$

$$\dot{m} = \frac{A \nu_{av}}{\upsilon}$$

Where:

$\dot{m}$	=	mass flow rate (lb_m/hr, kg/hr)
ρ	=	density (lb_m/ft^3, kg/m^3)
A	=	cross-sectional area of flow (ft^2, m^2)
ν_{av}	=	average fluid velocity (ft/hr, m/hr)
υ	=	specific volume (ft^3/lb_m, m^3/kg)

Equation 4-1

Mass flow rate is commonly used for liquids. In practical applications involving liquid water, it is assumed that water is an incompressible liquid having a constant density and specific volume. The value most commonly used for the density of liquid water is 62.4 lb_m/ft^3. Actually, the density of water depends upon both the pressure and the temperature. If the is fluid is compressible and undergoes temperature and pressure changes it is important to use density and the mass flow rate equation.

In practical applications involving steam, it cannot be assumed that the fluid (steam) is incompressible. Values for the specific volume of steam, as a function of its pressure and temperature, are given in the steam tables.

The following example demonstrates mass flow rate.

Calculate the mass flow rate of water with a density of 62.4 lb_m/ft^3, flowing with an average velocity of 5 ft/sec, in a pipe with an inside diameter of 1.049 in.

First, find the cross-sectional area (ft^2) of flow:

$$A = \frac{1}{4}\pi D^2$$

$$A = \frac{1}{4}(3.14)(1.049\,\text{in})^2$$

$$A = 0.864\,\text{in}^2\left(\frac{\text{ft}^2}{144\,\text{in}^2}\right)$$

$$A = 0.006\,\text{ft}^2$$

Then, find the mass flow rate (lb_m/hr):

$$\dot{m} = \rho A \nu_{av}$$

$$\dot{m} = \left(62.4\frac{lb_m}{ft^3}\right)\left(0.006\ \ ft^2\right)\left(5\frac{ft}{sec}\right)\left(\frac{3{,}600\ sec}{hr}\right)$$

$$\dot{m} = 6{,}739.2\frac{lb_m}{hr}$$

Example 4-1

12. The plant is operating at 55%.

The following event occurs:

- Both Main Feedwater Pumps trip

Without other induced changes in plant conditions,

The Control Rod Trip breakers open **DIRECTLY** due to an ______(1)____

The Turbine trips **DIRECTLY** due to ______(2)____

A. (1) RPS trip
(2) CRD Trip Confirm

B. (1) RPS trip
(2) SFRCS trip

C. (1) ARTS trip
(2) SFRCS trip

D. (1) ARTS trip
(2) CRD Trip Confirm

Answer: D

Explanation/Justification:

A. Incorrect – The RPS trips would not actuate until plant condition such as RCS Pressure changed. As a result, RPS would not directly trip the reactor for this scenario. This is the basis for installing the ARTS System.

B. Incorrect – The RPS trips would not actuate until plant condition such as RCS Pressure changed. As a result, RPS would not directly trip the reactor for this scenario. This is the basis for installing the ARTS System. SFRCS does directly generate a Turbine Trip Signal.

C. Incorrect – ARTS would trip the reactor, but tripping both MFP will not directly trip SFRCS. An SFRCS Trip will directly trip the Main Turbine.

D. Correct – ARTS senses MFP Turbine status and causes a reactor trip if both MFP Turbine Trip. CRD Trip Confirm will cause EHC to trip the Main Turbine.

Sys #	System	Category	KA Statement
000054	Loss of Main Feedwater (MFW)	AA2. Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW):	Occurrence of reactor and/or turbine trip

K/A# AA2.01 **K/A Importance** 4.3 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06202 pg72, DBBP-TRAN-0034 pg 6&7

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 43.5 / 45.13)

Objective:

ATTACHMENT 5: BYPASSING MAIN TURBINE TRIPS

NOTE

- 100 series TB's are located in the back of EHC Panel C5757A.
- 200 series TB's are located in the back of EHC Panel C5757B.

1.0 Bypass the following Main Turbine trips as necessary by lifting the associated wire(s). (N/A trips not bypassed)

BYPASS	TRIP	TB	TERM	WIRE NO.
________	Loss of Stator Cooling	109	9	P1/Black
________	Shaft Pump Disch Low Press	245	1	P1/Black
________	Thrust Brg Wear Detector/Low Lube Oil Press	243	1	P1/Black
________	Low EHC Fluid Press	245	3	P1/Black
________	Vacuum Trip	237	6	P1/Red*
________	MSR High Level	235	6	P1/Black*
________	Customer Trips (SFRCS, CRD Trip Confirm, Generator Lockout)	146	5	P1/Black*

*both wires must be lifted

Wires lifted by ____ Date ______________

ATTACHMENT 2: LICENSED OPERATOR MEMORY LIST
Page 1 of 11

REACTOR PROTECTION SYSTEM

Name	Setpoint
Manual	Manual
High Flux	104.9% (4 RCP) 80.6% (3 RCP)
RC High Temperature	618°F
Flux /Δ Flux /Flow *	Variable per COLR figure 6 (Doghouse Curve)
RC Low Pressure *	1900 PSIG
RC High Pressure	2355 PSIG
RC Pressure-Temperature *	Variable
High Flux/Number of RC Pumps On *	55.1% 1/1 RCP combination 0% 0/0, 0/1, 1/0, 2/0, 0/2 RCP combination(s)
Containment Pressure High	4 PSIG
Shutdown Bypass High Pressure	1820 PSIG

* Trips are bypassed when Shutdown Bypass is actuated.

RPS Channel Number	Power Supply	Trip Breaker
1	Y1	B
2	Y2	A
3	Y3	D
4	Y4	C

ATTACHMENT 2: LICENSED OPERATOR MEMORY LIST

CONTROL ROD DRIVE		
Power Train	**Power Supply**	**Trip Breaker(s)**
E Train	E2 via Inductrol	B & D
F Train	F2 via Motor Generator Set	A & C

ANTICIPATORY REACTOR TRIP SYSTEM	
Name	**Setpoint (nominal)**
Steam Feed Rupture Control System Actuation	(Low Pressure, Reverse Differential Pressure, High Level, Loss of RCP's, Low Level)
Turbine Trip	EHC Pressure Switches 275 PSIG
Loss of Both Main Feed Pump Turbines	Hydraulic Pressure 75 PSIG

ARTS Channel Number	Essential Power Supply	Trip Breaker
1	Y1	B
2	Y2	A
3	Y3	D
4	Y4	C

1.0 INTRODUCTION

A. PowerPoint located in S:TRAINING\TIME\OPS\SYS\MEDIA\SYS-500's\OPSSYSI505 ARTS

B. State the lesson objectives. SLIDE 1-7

2.0 PRESENTATION

A. History SLIDE 8

Following the accident at TMI-2, the NRC identified the Pilot Operated Relief Valves (PORV) failure as a major industry concern.

1. Plants were required to take steps to reduce challenges to the PORV.
   a. In response to this, the PORV setpoint was raised above the RCS High Pressure Trip Setpoint.
2. Additionally, the NRC directed B&W Plants to develop a means to trip the reactor during anticipated secondary plant transients which cause significant increases in RCS pressure.
   a. ARTS was developed in response to this directive.

B. Purpose/Function

1. ARTS provides Reactor Trip signals for secondary plant conditions that were not originally included in the RPS.
   a. Loss of both MFPs
   b. TG trip from >40% Rx power
   c. SFRCS actuation
2. An immediate Reactor trip reduces the Reactor heat input prior to reaching the PORV's lift setpoint.

C. Design Basis

1. ARTS is to operate in advance of the RCS High Pressure Reactor Trip to reduce the peak RCS pressure and thus reduce challenges to the PORV.

D. Design Criteria

1. The design and operation of the "ARTS" will not degrade the reliability of the RPS or SFRCS. SLIDE 9
2. Separation shall be maintained between redundant safety-related class 1E channels, and between 1E and non-1E channels.
   a. Separation criteria shall meet the requirements of IEEE 279-1971 except for the portion of the system in RPS which meets the requirement of IEEE 279-1968. IEEE = Institute of Electrical and Electronics Engineers
3. The system shall be fully testable.

13. The plant is operating at 100% power with all systems in normal alignment for this power level.

A Tornado hits the Switchyard damaging all three offsite lines causing a loss of offsite power.

Approximately 1 minute after the Reactor Trip, the following conditions are noted:

- A Bus = zero volts
- B Bus = zero volts
- C1 Bus = zero volts
- D1 Bus = zero volts
- 1-3-H, D1 Bus Lockout
- Breaker AD213, SBODG to D2 BUS TIE BREAKER tripped open due to a D2 Lockout.

Which of the following strategies must be implemented to restore power to an essential 4160 volt bus?

A. Start EDG1 to restore power to Bus C1.

B. Start the SBODG to restore power to Bus C1.

C. Start the SBODG to restore power to Bus D1.

D. Start EDG 2 to restore power to Bus D1.

Answer: A

Explanation/Justification:

A. Correct – The SBODG is not available due to lockout on Bus D2 which causes AD213 being open. EDG2 is not available due to D1 being locked out.
B. Incorrect – The SBODG is not available due to lockout on Bus D2 indicated by breaker AD213 being open.
C. Incorrect – The SBODG is not available due to lockout on Bus D2 indicated by breaker AD213 being open.
D. Incorrect - EDG2 is not available due to D1 being locked out.

Sys #	System	Category	KA Statement
000055	Loss of Offsite and Onsite Power (Station Blackout)	EA1. Ability to operate and monitor the following as they apply to a Station Blackout:	Restoration of power with one ED/G

K/A# EA1.06 **K/A Importance** 4.1 **Exam Level** RO
References provided to Candidate None **Technical References:** DB-OP-02000 R26 Specific Rule 6 Step 6.1 RNO
Question Source: New **Level Of Difficulty: (1-5)** 3
Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 41.7 / 45.5 / 45.6)
Objective:

Specific Rule 6, Power For C1 And D1 Buses OR EDG Start

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6.1 IF a loss of Power to C1 OR D1 Bus occurred OR an EDG(s) has started THEN perform the following:	
___ 1. Verify the affected train(s) EDG is running.	Attempt to start EDG(s) that failed to start as follows: ___ 1. Press Control Room EDG START pushbutton(s). ___ 2. IF the EDG(s) failed to start, THEN dispatch an Operator to attempt a local Start. REFER TO DB-OP-06316, EDG Operating Procedure.
___ 2. Verify the affected train(s) essential bus (C1 – D1) is energized.	IF the EDG is running, but EDG Output Breaker did NOT close: THEN perform the following: ___ 1. Place DG 1 (2) SYNC switch in the EDG BKR TO C1 (D1) position. 2. Attempt to close the EDG(s) output breaker: ___ • EDG 1 – AC 101 ___ • EDG 2 – AD 101 ___ 3. Turn SYNC switch to OFF (to allow power restoration from other sources).

14. The plant had been operating at 100% power

The following event occurs:

- Loss of off-site power
- All systems work as designed
- Natural circulation flow has been confirmed in accordance with DB-OP-06903, Plant Cooldown.

Which one of the following actions will raise the heat transfer rate from the Reactor Coolant System to the Steam Generators?

A. Lowering Steam Generator steaming rates

B. Lowering Steam Generator water levels

C. Raising Steam Generator pressures

D. Raising Steam Generator Auxiliary Feedwater flow rates

Answer: D

Explanation/Justification:

A. Incorrect – Lowering SG Steaming rate will cause a rise in SG pressure and a lowering of differential temperature between the RCS and the SG, reducing the heat transfer rate.
B. Incorrect – Lowering SG level will reduce the heat transfer surface area of the SG, reducing the overall heat transfer coefficient, reducing the heat transfer rate.
C. Incorrect – A rise in SG pressure will lower the differential temperature between the RCS and the SG, reducing the heat transfer rate.
D. Correct – Raising AFW Flow rates will provide additional cooling flow and level in the SG providing a larger heat sink inducing a higher heat transfer rate.

Sys #	System	Category	KA Statement
000056	Loss of Offsite Power	AK1. Knowledge of the operational implications of the following concepts as they apply to Loss of Offsite Power:	Principle of cooling by natural convection

K/A# AK1.01 **K/A Importance** 3.7 **Exam Level** RO

References provided to Candidate None **Technical References:** Lesson Plan OPS-SYS-I103.09 pages 23 & 24

Question Source: BANK 36546 **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR 41.8 / 41.10 / 45.3)

Objective:

d. When Reactor Coolant System pressure is less than the minimum pressure to keep dissolved gases in solution, or pressure indication is lost and you can't prove minimum pressure requirements are met (Curve CC1.11 & CC1.12)

e. After fill or refill of Core Flood lines and/or loss of level below instrument range

f. After draining and filling of any system connected to Reactor Coolant System which has unvented high points

g. Loss of Makeup Tank level below instrument range unless Makeup tank was valved out during drain and refill

h. Operation of Pressurizer spray with N_2 present

2. If either of the following conditions exist, the center Control Rod Drive flange shall be vented — DB-OP-06000

a. Reactor Coolant System dissolved gas concentration > 100 standard cc/kg

b. If temperature and pressure are below and to the right of the curve for the Reactor Coolant System dissolved gas concentration

K. Natural Circulation — Slide 56, Objective 22K

1. Indications — DB-OP-06903

a. Reactor Coolant System ΔT has stabilized — Shouldn't exceed 50°F

b. Steam Generator heat removal exists via Turbine Bypass Valve position, Atmospheric Vent Valve position, and Auxiliary Feedwater flow

c. Incore and T_{HOT} temperatures stabilize and are coupled — Not rising

d. Reactor Coolant System at least 50°F subcooled — per T_{SAT} meters TDI 4950 or 4951

e. T_{COLD} and Steam Generator T_{SAT} are coupled

Q - While on Natural Circulation, is T_{AVE} higher or lower than T_{AVE} while on forced circulation?

A - Higher

2. Methods of promoting/inducing natural circulation

a. Using Auxiliary Feedwater will raise the thermal center in the steam generators which raises the driving head of the Reactor Coolant System in the Steam Generator due to rise in density.

b. Steam Generator pressure can be lowered. This will lower T_{SAT} which raises the ΔT between the Reactor Coolant System and Steam Generator.

(1) Lower Steam Generator pressure until Steam Generator T_{SAT} is 40-60°F lower than incore temperature — DB-OP-02000 Section 6

(2) After Reactor Coolant Pump bump, lower Steam Generator pressure until Steam Generator T_{SAT} is 90-100°F lower than incore temperature.

c. Bump Reactor Coolant Pumps to induce heat transfer — Requires TSC concurrence

d. Boiler-condenser heat transfer could occur. This is cyclic in nature (i.e. flow, no flow, flow, conditions.)

L. Subcooling Margin

1. Minimum of 20°F for forced flow

M. Reactor Coolant System Leakage and Leak Rate Calculations

1. Covered by technical specifications and a daily surveillance test

N. Technical Specifications

1. Technical Specifications

a. 3.4.1 - Reactor Coolant System Pressure, Temperature, and flow Departure from Nucleate Boiling Limits — Slide 57 Link to Technical Specification

(1) 4 Pump Limits

(a) Pressure ≥ 2064.8psig

(b) Temperature ≤ 610°F

(c) Flow ≥ 389,500 gpm

(2) 3 Pump Limit

(a) Pressure ≥ 2060.8psig

(b) Temperature ≤ 610°F

(c) Flow ≥ 290,957 gpm

(3) MODE 1

b. 3.4.2 - Reactor Coolant System Minimum Temperature for Criticality

(1) Each Reactor Coolant System loop average temperature (T_{AVE}) shall be ≥ 525°F.

(2) Applicability

(a) MODE 1

(b) MODE 2 with k_{eff} ≥ 1.0

c. 3.4.3 - Reactor Coolant System Pressure, Temperature, and heatup and cooldown rates shall be maintained within the limits specified in the Pressure/Temperature Limits Report.

(1) At all times

15. The following conditions exist:

- The plant is operating at 100% power during the Winter.
- SW Pump 1 (Loop) is supplying Primary loads
- SW Pump 2 (Loop) is supplying Secondary loads
- SW Pump 3 breaker is racked out.

A rupture downstream of SW1399, SW HDR 1 TO TPCW HX occurs.

All automatic actions occur as designed.

Which ONE of the following describes the automatic response if any of Service Water and Circulating Water Systems?

A. No Impact –SW1 continues to carry Primary Loads, SW 2 continues to carry Secondary Loads.

B. SW 1 continues to carry Primary Loads, SW 1395 SW HDR 2 TO TPCW HX closes to isolate the break, and CT2955, TPCW HX SUPPLY FROM CIRC WTR opens to allow Circ Water to carry TPCW load.

C. SW1 carries Train 1 Essential Loads. SW Train 2 carries Train 2 Essential Loads only. CT2955, TPCW HX SUPPLY FROM CIRC WTR opens to allow Circ Water to carry TPCW load.

D. SW1 carries Train 1 Essential Loads. SW Train 2 carries Train 2 Essential Loads only. SW1395 close to isolate Secondary Header. CT2955, TPCW HX SUPPLY FROM CIRC WTR initially opens, but then closes to isolate the leak. TPCW Cooling is lost.

Answer: D

Explanation/Justification:

A. Incorrect – The piping downstream of SW1399 and SW1395 is common, The breaks prevents either SW Line from supplying these loads. In addition, the break will cause the CT2955 Check Valves to sense low pressure causing a loss of Circ Water Supply as well. Plausible if candidate assumes the supplies are independent and a break on the out of service supply will not affect the in service supply.

B. Incorrect – Plausible because Circ Water provide backup cooling for TPCW loads when SW supply is lost, but not when lost due to line break.

C. Incorrect – Plausible because Circ Water provide backup cooling for TPCW loads when SW supply is lost, but not when lost due to line break.

D. Correct –.The piping downstream of SW1399 and SW1395 is common, The breaks prevents either SW Line from supplying these loads. In addition, the break will cause the CT2955 Check Valves to sense low pressure causing a loss of Circ Water Supply to TPCW as well

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Sys #	System	Category	KA Statement
000062	Loss of Nuclear Service Water	AK3. Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water:	The conditions that will initiate the automatic opening and closing of the SWS isolation valves to the nuclear service water coolers

K/A# AK3.01 **K/A Importance** 3.2* **Exam Level** RO

References provided to Candidate None **Technical References:** OS020 SH2 R45 Service Water CL6 & CL9

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 41.4, 41.8 / 45.7)

Objective:

CONTROL LOGICS

CL-1 WITH REGARD TO THE SERVICE WATER SYSTEM, THE FOLLOWING ACTIONS WILL OCCUR IN THE EVENT OF A SAFETY FEATURES ACTUATION SYSTEM (SFAS) LEVEL 2 SIGNAL:

COMPONENT	SIGNAL	ZONE	ACTION	REMARKS
SW PUMP 1-1	SA241A	J-5	START	BLOCK PUSHBUTTON
SW PUMP 1-2	SA242A	J-11	START	BLOCK PUSHBUTTON
SW PUMP 1-3	SA241B, SA242B	J-7	START	BLOCK PUSHBUTTON
VALVE 1395	SA272F	F-13	CLOSE	BLOCK PUSHBUTTON
VALVE 1399	SA271F	G-13	CLOSE	BLOCK PUSHBUTTON
VALVE 1424	SA241C	C-8	OPEN	BLOCK PUSHBUTTON
VALVE 1429	SA241D, SA242D	C-10	OPEN	BLOCK PUSHBUTTON
VALVE 1434	SA242C	C-13	OPEN	BLOCK PUSHBUTTON

TO STOP A SERVICE WATER PUMP OR CLOSE A SERVICE WATER LINE VALVE DURING A SFAS, EACH COMPONENTS' "BLOCK" PUSHBUTTON MUST BE DEPRESSED FIRST.

CL-2 COOLING WATER HEAT EXCHANGER OUTLET TEMPERATURE CONTROL VALVE 630 (ZONE B-14) MODULATES TO MAINTAIN 85°F IN RESPONSE TO TIC630 (OS-022, H-10).

LOGIC FOR VALVES 631 AND 632 (ZONES B-15 AND B-16) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC631 AND TIC632 (OS-022,H-8 AND H-7) RESPECTIVELY.

CL-3 SERVICE WATER PUMP 1-1 (ZONE J-5) STARTS AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS PROVIDED SERVICE WATER PUMP 1-3 (ZONE J-7) SUPPLY BREAKER IS NOT CLOSED:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

SERVICE WATER PUMP 1-1 WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:

- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY OS-058, J-7)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, J-7)
- BUS UNDERVOLTAGE SENSED BY 27/C1 RELAY (OS-058,G-5)
- 4.16KV BUS C1 LOCKOUT RELAY 86-1/C1 ACTUATES (SEE DWG OS-058 *CD-1*)

SERVICE WATER PUMP 1-2 (ZONE J-11) STARTS AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS PROVIDED SERVICE WATER PUMP 1-3 (ZONE J-7) SUPPLY BREAKER IS NOT CLOSED:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

SERVICE WATER PUMP 1-2 WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:

- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY OS-058, J-24)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, J-24)
- BUS UNDERVOLTAGE SENSED BY 27/D1 RELAY (OS-058,G-5)
- 4.16KV BUS D1 LOCKOUT RELAY 86-1/D1 ACTUATES (SEE DWG OS-058 *CD-1*)

CL-4 CONTAINMENT AIR COOLER 1-1 SERVICE WATER OUTLET VALVE 1356 (ZONE C-1) MODULATES TO MAINTAIN 75°F IN RESPONSE TO TIC1356 (OS-033A,E-4) ONLY WHEN CONTAINMENT AIR COOLER FAN 1-1 (OS-033A,F-5) IS IN HIGH SPEED.

CONTAINMENT AIR COOLER 1-1 OUTLET VALVE SW1356 OPENS FULLY UPON A SLOW SPEED START SIGNAL TO CONTAINMENT AIR COOLER FAN 1-1. SW1356 WILL REMAIN FULLY OPEN IF CONTAINMENT AIR COOLER 1-1 IS STOPPED FROM SLOW SPEED. SW1356 WILL FULLY CLOSE IF CONTAINMENT AIR COOLER 1-1 IS STOPPED FROM FAST SPEED.

HANDSWITCH HIS1356 (ZONE C-1) WILL CLOSE SW1356 ONLY WHEN CONTAINMENT AIR COOLER 1-1 IS OFF. TEMPERATURE MODULATION MAY ALSO CLOSE SW1356 WHEN CONTAINMENT AIR COOLER 1-1 IS OPERATING IN FAST SPEED AND SW1356 IS CONTROLLING IN AUTO.

LOGIC FOR VALVES 1357 AND 1358 (ZONES C-6 AND C-3) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC1357 AND TIC1358 (OS-033A, E-9 AND E-6) RESPECTIVELY.

CL-5 SERVICE WATER PUMP 1-3 (ZONE J-7) WHEN ALIGNED AS PUMP 1-1 STARTS AUTOMATICALLY PROVIDED ONE OF ITS SUPPLY BREAKERS IS RACKED IN AND THE FOLLOWING CONDITIONS EXIST:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

PUMP WILL TRIP THE SAME AS PUMP 1-1 (SEE *CL-3*).

SERVICE WATER PUMP 1-3 (ZONE J-7) WHEN ALIGNED AS PUMP 1-2 STARTS AUTOMATICALLY PROVIDED ONE OF ITS SUPPLY BREAKERS IS RACKED IN AND THE FOLLOWING CONDITIONS EXIST:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

PUMP WILL TRIP THE SAME AS PUMP 1-2 (SEE *CL-3*).

CL-6 SERVICE WATER TO COOLING WATER HEAT EXCHANGER ISOLATION VALVE 1399 (ZONE G-13) WILL CLOSE AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS:

- SFAS SIGNAL (SEE *CL-1*)
- SERVICE WATER PUMP 1-1 (ZONE J-5) OR SERVICE WATER PUMP 1-3 (ZONE J-7) ACTING AS SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE <50 PSIG AS SENSED BY PSL1376A (ZONE D-7).

LOGIC FOR VALVE 1395 (ZONE F-13) IS SIMILAR.

CL-7 COMPONENT COOLING HEAT EXCHANGER OUTLET ISOLATION VALVE 1424 (ZONE C-8) WILL MODULATE TO MAINTAIN 95°F IN RESPONSE TO TIC1424 (OS-021,K-7).

LOGIC FOR VALVE 1434 (ZONE C-13) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC1434 (OS-021,D-7).

VALVE 1429 (ZONE C-10) WILL MODULATE TO MAINTAIN 95°F IN RESPONSE TO TIC1429 (OS-021,G-7) PROVIDED THAT BREAKER AD108 (OS-058,H-25) FOR COMPONENT COOLING PUMP 1-3 (OS-021,G-3) IS RACKED IN AND HIS1429A (ZONE B-11) IS IN "AUTO". WHEN BREAKER AD108 IS RACKED OUT AND BREAKER AC108 (OS-058,H-8) IS RACKED IN, HIS1429B (ZONE B-12) "AUTO" PUSHBUTTON MUST BE DEPRESSED.

CL-8 SERVICE WATER STRAINER 1-1 MOTOR (ZONE H-6) WILL START AND SERVICE WATER STRAINER 1-1 DRAIN VALVE 1375 (ZONE K-6) WILL OPEN WHEN ANY OF THE FOLLOWING CONDITIONS EXIST:

I. SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≤116 PSIG AS SENSED BY PSH2917A (ZONE K-5).

II. DIFFERENTIAL PRESSURE ACROSS STRAINER 1-1 IS ≥ 4.9 PSID AS SENSED BY PDIS1379A (ZONE J-6) AND STRAINER 1-1 HANDSWITCH HIS1379 (ZONE H-6) IS IN "AUTO".

III. STRAINER 1-1 HANDSWITCH IS IN "HAN".

SERVICE WATER STRAINER 1-1 WILL STOP WHEN THE APPROPRIATE CONDITION EXISTS:

A. WHEN STRAINER 1-1 IS STARTED BY CONDITION I, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≥98 PSIG AS SENSED BY PSH2917 (ZONE K-5).

B. WHEN STRAINER 1-1 IS STARTED BY CONDITION II, THE STRAINER MOTOR WILL STOP AFTER 2 MINUTES.

C. WHEN STRAINER 1-1 IS STARTED BY CONDITION III, THE STRAINER MOTOR WILL STOP 2 MINUTES AFTER ITS HANDSWITCH IS PLACED IN "AUTO" OR "OFF".

D. WHEN STRAINER 1-1 IS STARTED BY CONDITION II AND WHILE RUNNING, CONDITION I IS SENSED, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≥98 PSIG AS SENSED BY PSH2917 AND THE STRAINER HAS BEEN RUNNING FOR ≥2 MINUTES.

E. WHEN STRAINER 1-1 IS STARTED BY CONDITION III AND WHILE RUNNING, CONDITION I IS SENSED, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≥98 PSIG AS SENSED BY PSH2917 AND ≥2 MINUTES AFTER ITS HANDSWITCH IS PLACED IN "AUTO" OR "OFF".

CONDITION "E" IS SIMILAR WHEN THE STRAINER IS STARTED BY CONDITION I AND WHILE RUNNING, CONDITION III EXISTS.

SERVICE WATER STRAINER 1-1 DRAIN VALVE 1379 WILL CLOSE WHEN IT IS FULL OPEN AND SERVICE WATER STRAINER 1-1 IS STOPPED.

LOGIC FOR STRAINERS 1-2, 1-3 AND 1-4 (ZONES J-12, J-8 AND J-14) IS SIMILAR EXCEPT DISCHARGE PRESSURE SETPOINTS. FOR STRAINERS 1-2 AND 1-3, ARE 105 PSIG, 93 PSIG AND 114 PSIG, 98 PSIG (INCREASING, DECREASING) RESPECTIVELY AND STRAINER 1-4 DOES NOT HAVE DISCHARGE PRESSURE INTERLOCKS AND DIFFERENTIAL PRESSURE ACROSS STRAINER IS ≥ 2.4 PSID AS SENSED BY PDIS4691 (ZONE J-14) AND DILUTION PUMP STRAINER 1-4 DRAIN VALVE CT4690 (ZONE K-13) WILL CLOSE WHEN IT IS ≥20% OPEN AND DLTN/BACKUP SERVICE WATER STRAINER 1-4 IS STOPPED.

STRAINERS 1-1 (F15-1), 1-2 (F15-2), 1-3 (F15-3) AND 1-4 (F15-4) WILL NOT OPERATE IF A THERMAL OVERLOAD EXISTS FOR THEIR RESPECTIVE MOTOR STARTERS.

CL-9 COOLING WATER HEAT EXCHANGER CIRCULATING WATER VALVE CT1353 (ZONE C-14) OPENS AUTOMATICALLY WHEN PSL2988 (ZONE F-19) SENSES ≤ 20 PSIG, PROVIDED PDS3988 (ZONE A-8) SENSES ≥ 0.3 PSID.

THE VALVE WILL CLOSE AUTOMATICALLY WHEN PDS3988 SENSES <0.3 PSID FOR 2 MINUTES.

CL-10 SERVICE WATER TO INTAKE FOREBAY VALVE 2930 (ZONE B-3) OPENS AUTOMATICALLY WHEN PSH2930 (ZONE B-4) SENSES PRESSURE ≥ 50 PSIG. SERVICE WATER TO INTAKE STRUCTURE VALVE 2929 (ZONE B-2) OPENS AUTOMATICALLY WHEN PSH2929 (ZONE B-3) SENSES ≥ 50 PSIG FOR 20 SECONDS. VALVES 2930 AND 2929 MUST BE MANUALLY CLOSED VIA THEIR RESPECTIVE HANDSWITCHES HIS2930 AND HIS2929 (ZONES A-2 AND A-1).

NOTE: ONE OF ADMINISTRATIVELY CONTROLLED VALVES 2929, 2930, 2931, OR 2932 (ZONE B-4) MUST BE OPEN WITH ITS BREAKER OPEN.

CL-11 FOR A LOOP/LOCA, CONTAINMENT AIR COOLER INLET VALVE 1366 CLOSES UPON POWER RESTORATION. REFILL LOGIC AUTOMATICALLY OPENS SERVICE WATER INLET VALVE 1366 (ZONE E-3) WHEN CONTAINMENT AIR COOLER FAN 1-1 (OS-33A, F-5) STARTS. REFILL LOGIC SEQUENCE IS AS FOLLOWS:

A. WAIT 30 SECONDS AFTER FAN START FOR OUTLET VALVE OPENING OR SW PUMP RESTART FOLLOWING A LOSS OF POWER.
B. PARTIALLY OPEN CONTAINMENT AIR COOLER INLET VALVE TO FILL PIPING AT A REDUCED FLOW RATE.
C. WAIT 180 SECONDS FOR CONTAINMENT AIR COOLER AND ASSOCIATED PIPING TO FILL.
D. OPEN INLET VALVE COMPLETELY FOR SW FLOW, AND ILLUMINATE BLUE INDICATING LIGHT "REFILL SEQUENCE COMPLETE" (ZONE E-1)

FOR A LOOP ONLY, CONTAINMENT AIR COOLER INLET VALVE 1366 CLOSES UPON POWER RESTORATION, IF CONTAINMENT AIR COOLER FAN 1-1 WAS IN SLOW SPEED PRIOR TO THE LOOP. REFILL LOGIC AUTOMATICALLY OPENS SERVICE WATER INLET VALVE 1366 AS DESCRIBED ABOVE. IF CONTAINMENT AIR COOLER FAN 1-1 WAS IN FAST SPEED PRIOR TO LOOP, SERVICE WATER FLOW TO THE CONTAINMENT AIR COOLER MUST BE MANUALLY RESTORED.

IF FAN IS STOPPED NORMALLY, VALVE MUST BE MANUALLY CLOSED VIA ITS HANDSWITCH HIS1366 (ZONE E-2).

IF POWER IS LOST, REFILL LOGIC WILL CLOSE CONTAINMENT AIR COOLER INLET VALVE WHEN POWER IS RESTORED, AND DISABLE OPEN CONTROL SWITCH HIS1366 (ZONE E-2).

REFILL LOGIC MAY BE DISABLED BY DEPRESSING GREEN PUSHBUTTON AT BE1142HS (ZONE E-1).

WHEN POWERED FROM TRAIN 1 (BE1207), THE LOGIC FOR CONTAINMENT AIR COOLER 1-3 INLET VALVE 1368 (ZONE E-5) IS SIMILAR.

LOGIC FOR VALVES 1367 AND 1369 (ZONES E-8 AND E-5) IS SIMILAR.

CL-12 CONTROL ROOM EMERGENCY CONDENSING UNIT 1 OUTLET VALVE 2927 (ZONE F-10) OPENS AUTOMATICALLY WHEN THE CREVS COMPRESSOR UNIT STARTS AND THE SYSTEM IS IN THE WATER COOLED MODE (OS-032B, *CD-1*).

VALVE 2927 CLOSES AUTOMATICALLY WHEN EITHER OF THE FOLLOWING CONDITIONS OCCUR:

- SHIFTED TO THE AIR COOLED MODE
- CREVS COMPRESSOR UNIT SHUTS DOWN.

LOGIC FOR VALVE 2928 (ZONE F-11) IS SIMILAR.

CL-13 DELETED.

CL-14 BACKUP SERVICE WATER PUMP P180 (ZONE J-15) WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:

- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY OS-058, E-24)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, F-24)
- 4.16KV BUS C2 LOCKOUT RELAY 86-1/C2 ACTUATES (SEE OS-058 *CD-2*)
- ACTUATION OF THE REVERSE PHASE SEQUENCE UNDERVOLTAGE RELAY 47/C2 (SEE OS-058, NOTE 10)

CL-15 FLOW CONTROL VALVE 5896 (ZONE F-10) WILL MODULATE TO MAINTAIN THE CONTROL ROOM EMERGENCY VENTILATION SYSTEM COMPRESSOR S33-1 (SEE OS-032B, E 4) REFRIGERANT DISCHARGE PRESSURE AT 126 PSIG.

LOGIC FOR FLOW CONTROL VALVE 5897 (ZONE F-11) IS SIMILAR.

CL-16 SERVICE WATER VALVE 1424, (ZONE C-8) MOVES TO FULL OPEN POSITION WHEN THE INSTRUMENT AIR PRESSURE SENSED BY PSL1424 (ZONE C-9) LOWERS TO 75 PSIG OR BELOW.

LOGIC FOR SERVICE WATER VALVES 1434 AND 1429 (ZONE C-13 AND C-10) AS SENSED BY PSL1434 AND PSL 1429 (ZONE C-14 AND C-12) IS SIMILAR.

NOTES

1. THE FOLLOWING VALVES HAVE INTERNALS REMOVED:

VALVE	ZONE	VALVE	ZONE
		115	K-3
		117	K-3
		130	B-12
107	J-3	329	B-2
109	J-3	382	F-3

2. TO MAINTAIN SYSTEM REDUNDANCY AND CHANNEL SEPARATION FOR THE SERVICE WATER SYSTEM, VALVES 1399 AND 1395 (ZONES G-13 AND F-13) SHOULD NOT BE OPEN AT THE SAME TIME.

3. WHITE INDICATING LIGHTS (ZONES G-5,G-7,G-8 AND G-11) WILL ILLUMINATE WHEN THEIR RESPECTIVE PUMPS SENSE A PHASE A OR C TIME DELAY OVERCURRENT (*CL-3* AND *CL-5*). WHITE LIGHT ON HIS3609 (ZONE G-15) IS NOT WIRED.

5. FOR OPERATION OF VALVES 5067 AND 5068 (ZONES F-4 AND K-5) SEE CONTAINMENT HYDROGEN DILUTION SYSTEM DWG OS-033C, *CL-3*.

6. FOR GENERAL NOTES, PIPING SYMBOLS, INSTRUMENTATION SYMBOLS AND OPERATIONAL SCHEMATIC INDEX, SEE INDEX SHEET DWG OS-000.

7. 125V DC CONTROL POWER FOR BREAKERS AC107, AC109, AD109, AD107 AND AC201 (ZONES H-5, H-7, H-8, H-11 AND H-15) IS SUPPLIED FROM THEIR RESPECTIVE SWITCHGEAR 125V DC CONTROL BUS. SEE 4.16 KV SYSTEM DWG OS-058, NOTE 6.

8. VALVES 1356, 1358 AND 1357 (ZONES C-1,C-3 AND C-6) HAVE AUXILIARY AIR VOLUME TANKS (NOT SHOWN).

9. SYSTEM IS LINED UP FOR NORMAL OPERATION IN ACCORDANCE WITH APPLICABLE PROCEDURES. THE INDICATED VALVE LINEUP DEPICTS CCW HT EXCH 1-3 ALIGNED AS THE PRIMARY SPARE, TPCW HX 1-1 AND 1-2 IN SERVICE, TPCW 1-3 NOT IN SERVICE AND THE BSW PUMP LINED UP AS A DILUTION PUMP.

10. DELETED

11. HAND INDICATING SWITCH HIS3609A (G-14) IS LOCATED INSIDE MOTOR STARTER CABINET AP1800.

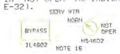
12. VALVE 48 (ZONE E-16) IS AN ISOLATION TELL-TALE.

13. 4.16KV SUPPLY TO SERVICE WATER PUMP 1-3 (ZONE J-7) CAN BE SELECTED FROM BUS C1 BREAKER AC109 (ZONE H-7) OR BUS D1 BREAKER AD109 (ZONE H-8) VIA TRANSFER SWITCHGEAR BREAKERS ACD4 OR ACD5 (OS-058,J-9). BREAKER ACD4 LINES UP POWER FROM BUS C1 AND BREAKER ACD5 LINES UP POWER FROM BUS D1. ACD4 AND ACD5 ARE MECHANICALLY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED AT THE SAME TIME.

14. 480V SUPPLY TO CONTAINMENT AIR COOLER 1-3 SERVICE WATER INLET VALVE 1368 (ZONE E-5) CAN BE SELECTED FROM BREAKER BE1207 (ZONE E-4) OR BREAKER BF1224 (ZONE E-5) VIA ISOLATION BREAKERS BEF128 AND BEF129 (NOT SHOWN). BREAKER BEF128 LINES UP POWER FROM BREAKER BE1207 AND BREAKER BEF129 LINES UP POWER FROM BREAKER BF1224. BEF128 AND BEF129 ARE KIRK KEY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED AT THE SAME TIME.

15. SETPOINTS FOR RSH8432 AND FSL8432 (ZONE A-6) ARE SPECIFIED BY RADIOLOGICAL CONTROLS IN THE DAVIS-BESSE RADIATION MONITOR SETPOINT MANUAL.

16. WHENEVER THE SERVICE WATER SYSTEM IS INOPERABLE, THE OPERATOR IS TO PLACE "SERV WTR" HANDSWITCH HS4802 (ZONE E-33) IN "NOT OPER" AS INDICATED BY THE "BYPASS" LIGHT (ZONE E-32).



NOTE 16

17. VALVES SW64 THROUGH SW75 HAVE BEEN DELETED (REMOVED) BY EWR 02-0343-00.

18. COMPUTER POINT P995 WILL ALARM AT ≥ 2.7 PSID AS SENSED BY PDIS4691 (ZONE J-14)

19. ORIFICE PLATE IN FE9808 AND FE9809 ARE INTERCHANGEABLE.

20. ALL VALVES ARE PREFIXED WITH "SW" UNLESS OTHERWISE NOTED.

21. TO ADDRESS SINGLE ACTIVE FAILURE CONCERNS, THE AIR SUPPLY HAS BEEN DISCONNECTED FROM SW2945 AND THE VALVE SHALL REMAIN IN ITS FAILED OPEN POSITION. (REF. ECR 03-0087-00)

22. VALVE SW15 (ZONE E-12) MAY BE THROTTLED TO BALANCE FLOW IN ACCORDANCE WITH APPLICABLE PROCEDURES.

23. BLUE LIGHT EXTINGUISHES WHEN THE FOLLOWING CONDITIONS EXIST:
   - ANY FUSE HAS BLOWN
   - THE DISCONNECT SWITCH IS OPEN
   - THE MCC HAS BEEN DEENERGIZED
   - THREE PHASE ELECTRICAL LOAD IMBALANCE

24. VALVES SW36, SW37, AND SW38 (ZONES C-8, C-10 AND C-13) ARE REQUIRED TO BE THROTTLED TO PROVIDE RUNOUT PROTECTION FOR THE SERVICE WATER PUMPS.

25. AS AN ACCEPTABLE CONDITION, OUTBOARD VACUUM BREAKER VALVES ARE NOT NEEDED TO SUPPORT SERVICE WATER SYSTEM OPERATION. WHEN OUTBOARD VALVE IS REMOVED, A FLANGED PIPE ELBOW SHALL BE INSTALLED TO DIRECT ANY POTENTIAL INBOARD VALVE LEAKAGE TOWARD THE FLOOR. (REF. ECR 05-0086-00 & ECR 05-0086-01)

26. AS AN ACCEPTABLE CONDITION, OUTBOARD VACUUM BREAKER VALVES ARE NOT NEEDED TO SUPPORT SERVICE WATER SYSTEM OPERATION. (REF. ECR 05-0086-02)

27. OPENING OF ALL FOUR BREAKERS BEF151, BEF152, BEF153, AND BEF154 SIMULTANEOUSLY REMOVES CONTROL POWER TO SW1358 (ZONE B-4) AND IT WILL FAIL IN THE OPEN POSITION.

45

28. ECCS ROOM COOLER #3 IS MECHANICALLY ABANDONED PER ECP 11-0777.

REFERENCES

DRAWINGS

M-041A
M-041B
M-041C
M-320-53
M-320-55
M-320-56
M-320-59
E-34B SH 14
E-44B SH 6A
E-44B SH 6B
E-48B SH 6A
E-48B SH 6B
E-48B SH 6C
E-48B SH 6D
E-48B SH 7
E-48B SH 7A
E-48B SH 8
E-48B SH 8A
E-48B SH 9A
E-48B SH 9B
E-48B SH 11A
E-48B SH 11B
E-48B SH 11C
E-48B SH 11D
E-48B SH 11E
E-48B SH 11F
E-48B SH 12
E-48B SH 12A
E-48B SH 13
E-48B SH 14A
E-48B SH 14B
E-48B SH 14C
E-48B SH 15
E-48B SH 26
E-48B SH 27
E-48B SH 28
E-48B SH 28A
E-48B SH 28B
E-48B SH 29
E-48B SH 30
E-48B SH 31A
E-48B SH 31B
E-48B SH 32
E-48B SH 33A
E-48B SH 33B
E-48B SH 33C
E-48B SH 37A
E-48B SH 37B
E-48B SH 37C
E-48B SH 37D
E-48B SH 44
E-48B SH 46A
E-48B SH 46B
E-48B SH 50
E-48B SH 51
E-58B SH 4
E-60B SH 3
E-60B SH 4A

NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DES MGR
45	7/24/12	INC. DCN 11-0777-002-017 REV.00 GEN. UPDATE ADD NEW NOTE 28 FROM DCN 11-0777-002-016 (WRITTEN AGAINST SH.1) SEE. NOTIF. 600766483	SBV	SAC	-	KPT	-	-	-
44	10/25/11	INC. DCN'S 11-0412-001-037 & 11-0412-002-007 BOTH REV.00							
43	10/22/11	INC. DCN 11-0593-001-020 REV.00	SBV	SAC	-	CJB	-	-	-
42	11/2/10	INC. DCN 10-0630-001-001 REV.00	SBV	SAS	-	JHR	-	-	-
41	12/20/07	INC. DCN 07-0088-00-005 REV.00	SBV	SAS	-	SJO	-	-	-
0	11/4/88	INFORMATION ONLY	HB	EVT	HRB	CML	PF	RPH	JAN VMW

SCALE NONE | DESIGNED FXG | DRAWN HRB | DATE 11-4-88

DAVIS-BESSE NUCLEAR POWER STATION
UNIT NO 1

OPERATIONAL SCHEMATIC ©
SERVICE WATER SYSTEM

DRAWING NO: OS-020 SH 2 | REV: 45

DB 07-24-12
DFN=/OPSCH/OS20S2.DGN

16. Which ONE of the following describes the purpose of the Main Generator Under-excited Reactive Ampere Limiter (URAL)?

A. Establishes a MINIMUM megawatt output (loading) for the main generator to prevent a reverse power condition.

B. Establishes a MINIMUM LAGGING Power Factor to maintain grid stability.

C. Prevents voltage Regulator output from RISING to a level which would cause excessive armature heating.

D. Prevents the Voltage Regulator output from LOWERING to a level which could cause the Main Generator to drop out of synchronization (slip poles) with the grid.

Answer: D

Explanation/Justification:

A. Incorrect – Plausible if the Candidate believe excitation levels are related to minimum loading level to prevent a reverse power condition.

B. Incorrect – Plausible if the Candidate believe excitation levels are related to Power Factor to ensure the limiting power factors for Generator Operation are observed.

C. Incorrect – Plausible if the Candidates assume the limitor acts to reduce current flow and therefore heat.

D. Correct - The under excited reactive ampere limit circuit acts to limit the amount of under excitation permitted on the generator. This limit is for the purpose of allowing the generator to be safely operated, continuously in an under excited condition, with sufficient margin between the excitation limit and the stability limit of the generator.

Sys #	System	Category	KA Statement
0077	Generator Voltage and Electric Grid Disturbances	AK1. Knowledge of the operational implications of the following concepts as they apply to Generator Voltage and Electric Grid Disturbanc es:	Under-excitation

K/A# AK1.03 **K/A Importance** 3.3 **Exam Level** RO

References provided to Candidate None **Technical References:** System Description SD005 R4, Main Generator page 2-15

Question Source: BANK 32205 **Level Of Difficulty: (1-5)** 2.5 - 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.4, 41.5, 41.7, 41.10 / 45.8)

Objective:

The lead end of the collector assembly faces away from the rotor body. Connections from the collector are made to a lead assembly located in the bore hole. The connections from the field winding to the bore hole lead assembly are made using radial studs.

The alternator brush rigging consists of six brush holders clamped on an insulated steel stud, with one brush in each holder. The brush holders are so located that three brushes ridge on each of the collector rings.

The bearings are forced-oil lubricated from the main turbine lube-oil system. The bearings are mounted in the alternator end shields in a similar manner to the main turbine-generator. Each bearing is insulated from the end shield to prevent bearing damage due to the flow of shaft current. The bearings have double insulation which consists of a sandwich of two rings of insulation isolating a ring of steel of the bearing liner casing. Insulated leads are brought out to terminals on the end shield to provide a means of making contact with the isolated steel ring in checking the insulation.

Alternator air coolers are mounted horizontally in the top of the alternator.

The excitation cubicle C4301 contains alternator-exciter field power thyristors, thyristor a-c regulator (generator voltage regulator).

Alternator field control is achieved by phase control of the field power thyristors. A-C regulator controls main turbine-generator armature voltage. D-C regulator controls alternator terminal voltage (corresponds to generator field voltage).

The alternator field receives power from the alternator armature through the thyristor (silicon-controlled rectifiers) field power circuit. The thyristor bridge contains two switchable bridges of thrystors, each one of which has sufficient capability to furnish rated alternator excitation.

The regulator is equipped with exciter field current limit, underexcited reactive ampere limit, reactive current compensator, maximum excitation limit circuits.

The function of the exciter field current limit circuit is to protect the exciter field circuit, especially the SCR's from abnormal regulator action which might cause an excessively high current. Excessively high current would cause thermal damage to components before relaying or operator action could act to correct the situation.

The underexcited reactive ampere limit circuit acts to limit the amount of underexcitation permitted on the generator. This limit is for the purpose of allowing the generator to be safely operated, continuously in an underexcited condition, with sufficient margin between the excitation limit and the stability limit of the generator.

The maximum excitation limit is designed to protect the generator field with automatic excitation from overheating due to prolonged overexcitation. This overexcitation can be caused due to abnormal system conditions or failure of the voltage regulator component.

17. A loss of ALL feedwater has occurred. Both MU pumps are running.

Attempts are being made to restore feedwater to both SGs in accordance with DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture.

The following plant conditions exist:

- RCS pressure is 2200 psig and lowering
- The PORV (RC2A) is open.
- T-hot is 615 °F and rising in Loop 1 and 610 °F and rising in Loop 2.

Based on these conditions, what will be the status of PORV Block and PORV control switches?

The PORV block valve (RC 11) control switch will be ____(1)____; the PORV (RC2A) control switch will be ____(2)____.

A. (1) OPEN
(2) AUTO

B. (1) OPEN
(2) LOCK OPEN

C. (1) CLOSED
(2) AUTO

D. (1) CLOSED
(2) LOCK OPEN

Answer: B

Explanation/Justification: At Davis-Besse, the beyond design bases Loss of all Feedwater event is mitigated via MU/HPI PORV Cooling. This question is related to control of the PORV and Flowpath through the PORV Block

A. Incorrect – The position of the PORV Block is correct, but having the PORV in Auto will cause the valve to close when RCS Pressure reaches 2155 psig stopping the MU/HPI PORV Cooling Flowpath.
B. Correct – These positions are the DB-OP-02000 Attachment 4 position of the valves during MU/HPI PORV Cooling.
C. Incorrect – The position of the PORV Block is incorrect stopping flow and having the PORV in Auto will cause the valve to close when RCS Pressure reaches 2155 psig also stopping the MU/HPI PORV Cooling Flowpath.
D. Incorrect – The position of the PORV Block is incorrect, stopping the MU/HPI PORV Cooling Flowpath.

Sys #	System	Category	KA Statement
BW/E04	Inadequate Heat Transfer - Loss Of Secondary Heat Sink	EA1. Ability to operate and / or monitor the following as they apply to the (Inadequate Heat Transfer)	Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.

K/A# EA1.1 **K/A Importance** 4.4 **Exam Level** RO
References provided to Candidate None **Technical References:** DB-OP-02000 R26 Attachment 4 page 271
Question Source: BANK 37388 **Level Of Difficulty: (1-5)** 3
Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.7 / 45.5 / 45.6)
Objective:

ATTACHMENT 4: INITIATE MU/HPI COOLING

8. IF Makeup Pump 2 is the only Makeup Pump running, THEN perform the following:

   ______ a. Close MU6409 MU PUMP CROSS CONNECT HEADER ISOLATION.

   ______ b. Open MU6420, PZR LEVEL CONTROL VALVE BYPASS.

   ______ c. Verify MU6422, MU CTMT ISOLATION is open.

______ 9. Close MU6407, MU PUMP 1 MINIMUM RECIRC.

______ 10. Close MU6406, MU PUMP 2 MINIMUM RECIRC.

______ 11. Verify RC11, PORV BLOCK is open (may require closing BE1602 at E16B).

______ 12. Verify Attachment 8, Place HPI/LPI/MU in Service, is complete.

> CAUTION 13
>
> DO NOT go to Section 5, Lack of Adequate SCM, but continue with the steps below if Adequate Subcooling Margin is lost

______ 13. Lock open RC2A, PORV.

14. **IF AT ANY TIME** Adequate Subcooling Margin is lost, THEN perform the following:

   ______ a. Trip all Reactor Coolant Pumps.

   b. Transfer Subcooled Margin Inputs to Incore Thermocouples:

      ______ • Post Accident Monitoring Panel 1

      ______ • Post Accident Monitoring Panel 2

      ______ • Safety Parameter Display System (SPDS).

18. Following a normal Reactor Trip, from full power operation, DB-OP-02000, RPS, SFAS, SFRCS, Trip or SG Tube Rupture, directs the operator to use the plant computer to record the following computer point voltage values:

- J213, J215, and J217 for J Bus Voltage

AND

- J221, J223, and J225 for K Bus Voltage

What is the reason for recording these voltages?

To complete the Surveillance required to verify compliance with ______________

A. TS 3.8.1, AC Sources Operating. The normal opening of ACB 34560 and 34561 following a reactor trip will impact operability of off site power sources.

B. TS 3.8.2, AC Sources Shutdown. The normal transfer of A and B Buses to the Startup Transformers following a Reactor Trip, may have rendered the Shutdown AC Sources inoperable.

C. TS 3.8.9 Distribution Systems Operating. The normal opening of ACB 34560 and 34561 following a reactor trip will impact operability of the Distribution system - Operating.

D. TS 3.8.10, Distribution Systems Shutdown. The normal transfer of A and B Buses to the Startup Transformers following a Reactor Trip, may have rendered the Shutdown Distribution Systems inoperable.

Answer: A

Explanation/Justification:

A. Correct - The opening of the Generator Output Breakers disrupts the normal ring bus configuration which may impact Off-Site Sources. As a result, this surveillance verifies the Off-Site Sources remain operable. -

B. Incorrect –TS 3.8.2 is only applicable in Modes 5 and 6. The candidate may select this TS since the Main Generator is shutdown.

C. Incorrect - The opening of the Generator Output Breakers disrupts the normal ring bus and does not affect the Distribution Systems Operating which are the in plant electrical distribution.

D. Incorrect –TS 3.8.10 is only applicable in Modes 5 and 6. The candidate may select this TS since the Main Generator is shutdown and power is being supplied from the Startup Transformers vice the Auxiliary Transformers.

Sys #	**System**	**Category**	**KA Statement**
BW/E10	Post-Trip Stabilization	Generic	Ability to use plant computers to evaluate system or component status.

K/A# 2.1.19 **K/A Importance** 3.9 **Exam Level** RO

References provided to Candidate None

Technical References: DB-OP-02000 R26 Attachment 26 Page 400
Bases and Deviation Document for DB-OP-02000 R19 Attachment 26 page 501

Question Source: New **Level Of Difficulty: (1-5)** 2

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.10 / 45.12)

Objective:

ATTACHMENT 26: ELECTRICAL SYSTEM ACTIONS

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. To comply with TS 3.8.1 Actions, check the following:	___ IF any condition is NOT met, THEN notify the Command SRO to comply with the applicable portion of TS 3.8.1.
___ Check all Switchyard breakers, disconnects, and air break switches are closed with exception of ACB34560 and ACB34561. (34620 may be open)	
___ Check at least 2 of the 3 offsite 345Kv lines, Bayshore, Lemoyne and Ohio Edison are connected by observing electrical power flow on the offsite 345Kv lines or by contacting SCC.	
___ Check both Startup Transformers AND both Bus Tie Transformers are in-service.	
___ Check Computer points J213, J215, and J217 indicates > 339.2 KV for J Bus.	___ REFER TO DB-SC-03023, Off-Site AC Sources Lined up and Available
J Bus Volts ______/______/________	
___ Check Computer points J221, J223, and J225 indicates > 339.2 KV for K Bus.	___ REFER TO DB-SC-03023, Off-Site AC Sources Lined up and Available
K Bus Volts ______/______/________	
___ Check Bus C1 and D1 voltages are between 3.75 to 4.40 Kv.	
C1 Bus Volts __________	
D1 Bus Volts __________	
___ Record Completion Time _________	
___ Document completion OR current electrical status in the Unit Log.	

Attachment 26

Electrical System Actions.

Purpose: The purpose of this attachment is to provide direction for the electrical system for those events where the plant is stabilized without the need to address specific symptoms. This guidance addresses transfer of house loads from the Main Generator to offsite power and restoration guidance if electrical buses are deenergized in the event of an ATWS. In addition, Electrical System checks necessary to verify the condition of the electrical system post trip are provided in Attachment 26.

Bases: Attachment 26 confirms house electrical power has transferred to off-site sources by verifying A and B Buses have transferred to an offsite power source. This automatic action ensures 13.8 kV electrical power will be available.

The generator output breakers are verified open. Since the Turbine has lost motive force (steam flow), continued operations with an output breaker closed would motorize the Main Generator and cause possible generator damage. Disconnect switch 34620 is opened by the System Dispatcher to prevent an inadvertent flashover of 34560 or 34561 from energizing and damaging the Main Generator.

Power flow is checked to determine if a breaker fail similar to an event at Fermi Nuclear Station has occurred. Direction is provided to the turbine Trip Abnormal Procedure to resolve this situation.

The step provides direction to verify compliance with TS 3.8.1 and TRM 8.8.1. The normal opening of ACB 34560 and 34561 will impact operability of off site power sources. As a result, a step is provided to ensure the required lines are operable or directs compliance with TS 3.8.1 Action requirements. When required computer points for K or J bus are not available, a reference to DB-SC-03023, Off-Site AC Sources Lined up and Available is provided. This procedure provides alternate methods to check for required voltage.

References to system operating procedures are provided to restore Spent Fuel Pool Cooling and Auxiliary Building Ventilation if E2 and F2 were deenergized as an immediate action in response to an ATWS event. No specific dose assessment has been performed for the Auxiliary Building actions to restore Spent Fuel Pool Cooling and Auxiliary Building Ventilation. This is acceptable based on the following:

- Significant time is available to restore SFP cooling based on the volume of inventory available to receive heat in the SFP. This allows sufficient time to evaluate actual conditions and determine a course of action in accordance with DB-OP-02547, Spent Fuel Pool Cooling Malfunctions.

19. The plant is in Mode 6.

Which of the following conditions does NOT ensure adequate Shutdown Margin is maintained for Fuel Handling Operations?

A. Minimum RCS Fill water temperature is 70 ºF based on moderator temperature coefficient.

B. Nuclear Instrumentation should be monitored closely during a fill with fuel in the core. If an unexplained rise in neutron count rate occurs, filling shall immediately stop and the cause determined.

C. DB-OP-06904, Attachment 2, Isolation of Water Sources to the RCS is performed to Caution Tag required valves closed prior to Fuel Handling Operations.

D. Fuel Assembly movements are to be performed in the prescribed order and to the locations specified by the Fuel Movement Sequence Sheets.

Answer: A

Explanation/Justification:

A. Correct - 70ºF is the minimum temperature for the Reactor Vessel for performing Hydrostatic Testing in accordance with DB-OP-06000, RCS Fill and Vent. It is not related to Shutdown Margin.

B. Incorrect – Monitoring Nuclear Instrumentation for unexplained rise in neutron count rate could be indicative of insufficient shutdown margin.

C. Incorrect – Potential RCS Dilution flowpaths are tagged to prevent inadvertent dilution of the Reactor Coolant System which would reduce shutdown margin.

Incorrect – The sequence provided in the Fuel Movement Sequence sheets ensures shutdown margin is maintained as positive reactivity is added to the core. Improper placement of a number of assemblies could result in inadequate shutdown margin in that portion of the core.

Sys #	System	Category	KA Statement
000036	Fuel Handling Incidents	AK1. Knowledge of the operational implications of the following concepts as they apply to Fuel Handling Incidents :	SDM

K/A# AK1.02 **K/A Importance** 3.4 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06000 R26, RCS Fill and Vent Step 2.2.4, 2.2.6, DB-OP-06904 R42, Shutdown Operations Step 7.2 DB-OP-00030 R12, Fuel Handling Operations Step 4.3

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 41.8 / 41.10 / 45.3)

Objective:

2.1.7 Some valve operations require entry to CTMT. Ensure the proper RWP is used for entry and the appropriate RP Supervisor is informed of the area to be entered.

2.1.8 Any type of water (borated or not) that is spilled on or above the Reactor Vessel Closure Head (RVCH) could potentially stain the RCVH or leave deposits that must be evaluated. The Shift Manager and the Engineering Programs Supervisor are to be notified and a Condition Report is to be initiated if any amount of water is spilled on or above the RVCH to determine the impact on the In-Service Inspection (ISI) and Boric Acid Control BACC programs.

2.2 Equipment

2.2.1 Containment Vent Header pressure shall be less than RCS pressure during venting operations to the Gaseous Radioactive Waste System.

2.2.2 RCS pressure and temperature shall be less than 2200 PSIG and 200°F, respectively, prior to venting CRDMs. If RCS temperature exceeds 200°F and CRDM venting operations are still required, then follow the limits and precautions identified in DB-MM-09190, Control Rod Drive Venting and Hydraulic Quick Vent Closure, in order to vent the CRDMs within the pressure/temperature limits of the CRDM vent path or as dictated by personnel safety.

2.2.3 The RCS flowrate through the core shall be ≥2800 gpm whenever a reduction in RCS boron concentration is being made, in all modes. The minimum flowrate of 2800 gpm provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual throughout the RCS and in the core during boron concentration reductions. A flow rate of at least 2800 gpm will circulate an equivalent RCS volume of 12,110 cubic feet in approximately 30 minutes. The reactivity change rate associated with boron concentration reduction will be within the capability for operator recognition and control. This is also the flowrate stipulated in the Technical Specification Bases for having a Decay Heat Removal Loop in operation.

2.2.4 The following temperature limits apply when filling the RCS:

Minimum RCS Temperature	50°F
Minimum Steam Generator Shell Temperature	50°F
Minimum Fill Water Temperature	50°F
Maximum RCS Temperature	140°F
Maximum Steam Generator Shell Temperature	140°F
Maximum Fill Water Temperature	140°F

For Steam Generator Shell temperatures below 100°F, RCS temperature shall be within 50°F of the Steam Generator Shell temperatures.

When the Reactor Vessel Closure Head is tensioned to hydro test values, minimum fill water temperature is 70°F.

2.2.5 When batching concentrated Boric Acid to the RCS, do not pump through the RCP Seals, but through the normal RCS makeup line. The acid addition should be followed with fill water to flush the line prior to reestablishing fill through the RCP Seals.

2.2.6 Nuclear Instrumentation should be monitored closely during a fill with fuel in the core. If an unexplained rise in neutron count rate occurs, filling shall immediately stop and the cause determined.

2.2.7 Fill water boron concentration shall be maintained such that the Shutdown Margin is maintained within the limits specified in the COLR. Applicability: MODES 3, 4, and 5. (TS 3.1.1) MODE 6 (TS 3.9.1)

2.2.8 RCS and fill water samples shall be taken as directed by DB-OP-06904, Shutdown Operations.

2.2.9 The RCP and Motor must be coupled prior to initiating seal injection. This must be done to prevent hydraulically thrusting the shaft seal. The upward thrust of the shaft may cause the seal stationary faces to be pushed to their upper axial limits, resulting in failure of the seal. This Limit and Precaution does not apply during performance of Section 4.8, Gravity Fill from the BWST through High Pressure Injection to the RCP Seals as long as pressure at the seals is maintained less than 35psig(reference DB-MM-09012 Caution 8.3).

2.2.10 When filling and venting the RCS, be aware that the upper RCP recirculation impeller tapered seat rests on the upper pump cavity casing when a RCP motor is decoupled and will block the vent/drain pathways to the respective RCP upper volute volume. When filling there is a potential for trapped air to remain within the upper pump volute, such that movement of the impeller could vent this area causing RCS level changes. There is also a potential for creating a siphon effect across the generator levels via the RCS vessel because of a solid system.

7.0 PREPARATIONS FOR FUEL HANDLING OPERATIONS

Limits and Precautions

7.1 In MODE 6, the boron concentration of all filled portions of the RCS and the Refueling Canal shall be maintained uniform and sufficient to ensure that the requirements of T.S. 3.9.1 are met.

7.2 Any system which might reduce the boron concentration by causing dilution will either be isolated from the RCS and Refueling Canal, or its operation monitored. Attachment 2 provides a list of isolated sources.

7.3 Do not fill the Refueling Canal by addition of water to the RCS after the Reactor Vessel Head has been removed. Filling the Refueling Canal in this manner has the potential of spreading contamination from the Reactor Vessel into the Refueling Canal area.

INITIALS/DATE Prerequisites

____/____ 7.4 The Reactor Coolant System level is at 78 to 82 inches.

____/____ 7.5 The Reactor Coolant System is vented to CTMT Atmosphere.

Prerequisites completed by ______________________________ Date ____________

Procedure

____/____ 7.6 Verify a Class B cleanliness inspection has been performed and if unacceptable, a documented evaluation completed for the Refueling Canal Deep End walls and floor. Circle one:

Acceptable Unacceptable with Evaluation

____/____ 7.7 Verify all tools, equipment and materials are removed from the deep end of the Refueling Canal or are properly stored in the appropriate racks.

____/____ 7.8 Notify Mechanical Maintenance to perform the following:

7.8.1 Verify F181, REFUELING CANAL TRASH RACK SCREEN, has been removed.

7.8.2 Verify the six inch blank flange has been installed on Refueling Canal end of the drain line to the Reactor Vessel Cavity.

7.9 Danger Tag closed the following valves: (refer to Limit and Precaution 2.1.13).

____/____ • SF1, FUEL TRANSFER TUBE 2 ISOLATION

____/____ • SF2, FUEL TRANSFER TUBE 1 ISOLATION

____/____ 7.10 Verify the Fuel Transfer Tube Blind Flanges have been removed in accordance with DB-MM-09186, Fuel Transfer Tubes Blind Flanges Removal and Reinstallation.

____/____ 7.11 Verify the Refueling Canal Deep End Perforated Drain Cover is installed to prevent debris from entering the drain piping.

3.2 Implementation

3.2.1 DB-NE-00100, Fuel Handling Administration

3.2.2 DB-NE-03292, Refueling Prerequisites and Periodic Checks

3.2.3 DB-NE-06101, Fuel/Control Component Shuffle

3.2.4 DB-NE-06302, Manual Movement of Control Components

3.2.5 DB-NE-06471, Dry Fuel Storage Unloading

3.2.6 DB-NE-06472, Dry Fuel Storage Loading

3.2.7 DB-OP-06021, Spent Fuel Pool Operating Procedure

4.0 DEFINITIONS

4.1 INDEPENDENT VERIFICATION - The process used to obtain a separate and independent check, by an individual not involved in the initial positioning, to ensure the Fuel Handling Bridge is actually in the position specified. The individual performing the position check must have minimum interaction with the personnel performing the initial positioning.

4.2 VISUAL VERIFICATION - The process of visually checking the position of a device or component in the condition or position specified.

4.3 FUEL MOVEMENT SEQUENCE SHEETS - Tables developed and approved by Nuclear Engineering that are used to track the initial and final locations of Fuel Assemblies and Control Components during the performance of core offload, core reload, or core shuffle. The Fuel Handling Director's table will be used to direct the sequence of fuel handling evolutions. A copy of the Fuel Handling Director's table will also be used by the individual in the Control Room monitoring Nuclear Instrumentation to provide a second check of the evolutions in progress. Selected portions of the Fuel Handling Director's table are provided at each of the bridges being used for the fuel handling evolution in progress.

4.5 PARTIAL MOVEMENT OF FUEL OR CONTROL COMPONENTS - The process of performing a portion of a line in the Fuel Movement Sequence Sheets to allow optimal use of two fuel handling bridges in the refueling canal. For example, the Auxiliary Bridge picks up a control component and then moves out of the way, allowing the Main Bridge to pickup and move a Fuel Assembly. Expected partial movements may be identified on the Fuel Movement Sequence sheets.

20. The plant is operating at 100% power with all systems in normal alignment for this power level.

Rising Condenser Pressure is noted.

In accordance with DB-OP-02518, High Condenser Pressure, SFRCS is actuated using the Initiate and Isolate push buttons at ____(1)____ inches HGA in order to ____(2)____.

A. (1)10
(2) ensure a source of feedwater remains available for the Steam Generators.

B. (1)10
(2) protect the Condenser from Turbine Bypass Steam Flow

C. (1)17
(2) ensure a source of feedwater remains available for the Steam Generators.

D. (1)17
(2) protect the Condenser from Turbine Bypass Steam Flow

Answer: A

Explanation/Justification:

A. Correct – The main Feedwater Pumps trip at 12.5 in HGA, but top of scale for Control Room indicators is 10 inches HGA. SFRCS is actuated at 10 inches to ensure a source of FW is available.
B. Incorrect – The Turbine Bypass valves will auto close at 17 in HGA to protect the condenser.
C. Incorrect – The reason is correct, but the setpoint is not correct. The main Feedwater Pumps trip at 12.5 in HGA.
D. Incorrect - The Turbine Bypass valves will auto close at 17 in HGA to protect the condenser. SFRCS actuation is not required for this feature.

Sys #	**System**	**Category**	**KA Statement**
000051	Loss of Condenser Vacuum	Generic	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.

K/A# 2.2.44 **K/A Importance** 4.2 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02518 R06, High Condenser Pressure step 4.5 and Attachment 2.

Question Source: New **Level Of Difficulty: (1-5)** 2.5

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.5 / 43.5 / 45.12)

Objective:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.4 <u>IF</u> **AT ANY TIME** Condenser Pressure reaches **7.5 inches HgA,** <u>THEN</u> perform the following: ___ 1. <u>IF</u> Reactor Power is greater than or equal to 40% power (ARTS) <u>THEN</u> Trip the Reactor <u>AND</u> <u>GO TO</u> DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture. ___ 2. <u>IF</u> Reactor Power is less than 40% power (ARTS) <u>THEN</u> Trip the Turbine. <u>REFER TO</u> DB-OP-02500, Turbine Trip.	
4.5 <u>IF</u> **AT ANY TIME** Condenser Pressure reaches **10 inches HgA,** <u>THEN</u> perform the following: ___ 1. Trip the Reactor. ___ 2. Initiate <u>AND</u> Isolate SFRCS using MANUAL ACTUATION Switches. ___ 3. <u>GO TO</u> DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.	

Purpose:

To provide direction to the Operator upon rising or higher than normal Condenser pressure due to air in-leakage. This elevated pressure will not be a result of weather conditions. It will be primarily the result of mechanical or operational factors indicated by Condenser pressure alarm or equipment actuation (for example, Mechanical Hogger starting at 4.5 inches of HgA.) Normal plant responses to weather conditions resulting in Condenser pressures above those normally expected are addressed by DB-OP-06231, Vacuum System Operating Procedure.

Technical Specifications:

None

USAR:

10.4.2 Main Condenser Vacuum System

System Descriptions:

SD-026B, Condenser Vacuum

Discussion:

The Condenser Vacuum System is comprised of the Mechanical Hogger, Steam Hogger, Steam Jet Air Ejector (SJAE), and Filter System. During normal operation, the SJAE is used to remove non-condensable gases from the Main Condenser and discharge them to the higher pressure outside environment. The Steam Hogger is used during initial start-up when large volumes of air must be removed to establish initial vacuum to 10 inches HgA, at which point the SJAE is placed in service. Both the Steam Hogger and the SJAE will then combine to draw vacuum to approximately 3 inches HgA, at which point the Steam Hogger is shut down and the Mechanical Hogger is placed on standby. The Mechanical Hogger automatically starts upon increasing Main Condenser pressure of greater than 4.5 inches HgA.

This procedure is applicable when Condenser pressure is higher than normal for the existing Generator output and weather conditions, but below the Main Turbine high pressure trip setpoint of 7.5 inches HgA. Rising Circulating Water temperature caused by ambient temperature will result in a loss of Condenser efficiency causing Condenser pressure to rise. Operation of the unit up to 5.5 inches HgA is permissible in accordance with DB-OP-06231, Vacuum System Operating Procedure, when caused by such weather conditions if Turbine load is greater than 50% and the Manager - Plant Operations has given approval.

Early detection of increasing Condenser pressure may indicate a rising pressure in either the LP or HP Condenser section with no corresponding rise in the other section. This condition may exist due to the relatively low severity of the source's contribution to rising pressure and the physical separation of the Condenser sections accomplished by the interconnect water seal. A continuing rise in pressure of the affected section would result in a subsequent "loss" of this seal and an equalization of the pressure between sections. It has been calculated that a 2 inches HgA differential between the HP and LP Condenser, will cause the interconnect water seal to be lost.

A high Condenser pressure condition could be a result of any of the following causes:

- Malfunction of the Steam Jet Air Ejector
- Loss of Condenser Circulating Water Pumps or Circulating Water flow
- Malfunction of Main Turbine Gland Seal Steam System
- Condenser Pressure Control Valve PCV 1061 not controlling properly
- Condenser air in-leakage problem resulting from:
    - Sticky check valve in air off take
    - An open drain valve
    - An open valve or leak in a steam line or drain line under vacuum
    - A hole in the Condenser Expansion Joint and loss of water seal
    - Loss of water seal in the vacuum breaker valve stems
    - Vacuum Breakers open
    - Flash Tank vacuum
    - Broken sight glass level indicators for a system under a vacuum

These conditions could result in a possible Turbine Trip and a Reactor Trip, depending upon the plant load, the amount of vacuum lost and mode of ICS control of Reactor, Feedwater and Turbine. Although protection of the secondary plant equipment is of immediate concern, primary consideration must be given to providing adequate heat removal from the Reactor Coolant System.

At 10 inches HgA (top of scale on Control Room HP and LP Condenser Pressure indicators), the reactor is tripped and SFRCS initiated and isolated in anticipation of a loss of all Main Feedwater that will occur at 12.5 inches HgA when both Main Feedwater Pumps will trip. Main Steam dumping capability is transferred from the Turbine Bypass Valves to the Atmospheric Vent Valves upon a high Condenser pressure of greater than 17 inches HgA, or either MSIV being less than 90% open.

Continuous operation of the Turbine Generator at low vacuum (high pressure) is to be avoided. Operation in this manner could cause overheating of the LP Turbine elements with possible rotor or blade damage due to distortion or excessive vibration. Normally, CD 517 EXHAUST HOOD SPRAY CONTROL VALVE, will open at 125°F, attempting to alleviate the high temperature condition. This will be indicated by a computer point of the valve position (Z570). If an Exhaust Hood temperature of 125°F is exceeded, steps should be taken to determine advisability of continued Turbine operation. A temperature of 175°F in the Exhaust Hood will actuate an alarm. A Main Turbine Trip will be initiated if Exhaust Hood temperature exceeds 225°F or Condenser Pressure reaches 7.5 inches HgA.

21. The plant is operating at 100% power with a 10 gpd tube leak in SG1.

- NO planned radioactive liquid releases are in progress.
- RE4686, Storm Sewer Outlet alarms and indicates above its HIGH alarm setpoint.

This alarm indicates leakage from which of the following systems?

A. Miscellaneous Liquid Radwaste System.

B. Clean Liquid Radwaste System

C. Demineralized Water System.

D. Condensate Polishing System.

Answer: D

Explanation/Justification: Later

A. Incorrect – Plausible because this is a radioactive system, however this system is located in the Auxiliary Building. Leakage from this system would go to a floor drain or sump and be transported to the Misc Waste Drain Tank, not the storm sewer. There is no connection between the Misc Waste Drain Tank and the Storm Sewer.

B. Incorrect – Plausible because this is a radioactive system, however this system is located in the Auxiliary Building. Leakage from this system would go to a floor drain or sump and be transported to the Misc Waste Drain Tank, not the storm sewer. There is no connection between the Misc Waste Drain Tank and the Storm Sewer.

C. Incorrect - Plausible because leak from this system can reach the storm sewer, but the system is not radioactive and would not cause an alarm on the Storm Sewer Radiation Monitor.

D. Correct – With SG Tube Leak, activity levels in the condensate polishers will rise. Leakage from this system could reach the storm sewer via the Turbine Building Drains.

Sys #	System	Category	KA Statement
000059	Accidental Liquid Radwaste Release	AK2. Knowledge of the interrelations between the Accidental Liquid Radwaste Release and the following:	Radioactive-liquid monitors

K/A# AK2.01 **K/A Importance** 2.7 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02531 R19 Attachment 7 page 3 of 4

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR 41.7 / 45.7)

Objective:

ATTACHMENT 7: BACKGROUND INFORMATION

Feedwater Drains will transfer to the Condenser automatically during the shutdown when the heaters go on high level control. CD550B, Hotwell High Level Return Valve, is normally isolated and will contain the contaminated condensate in the Hotwell until draining or level reduction of the Hotwell is required.

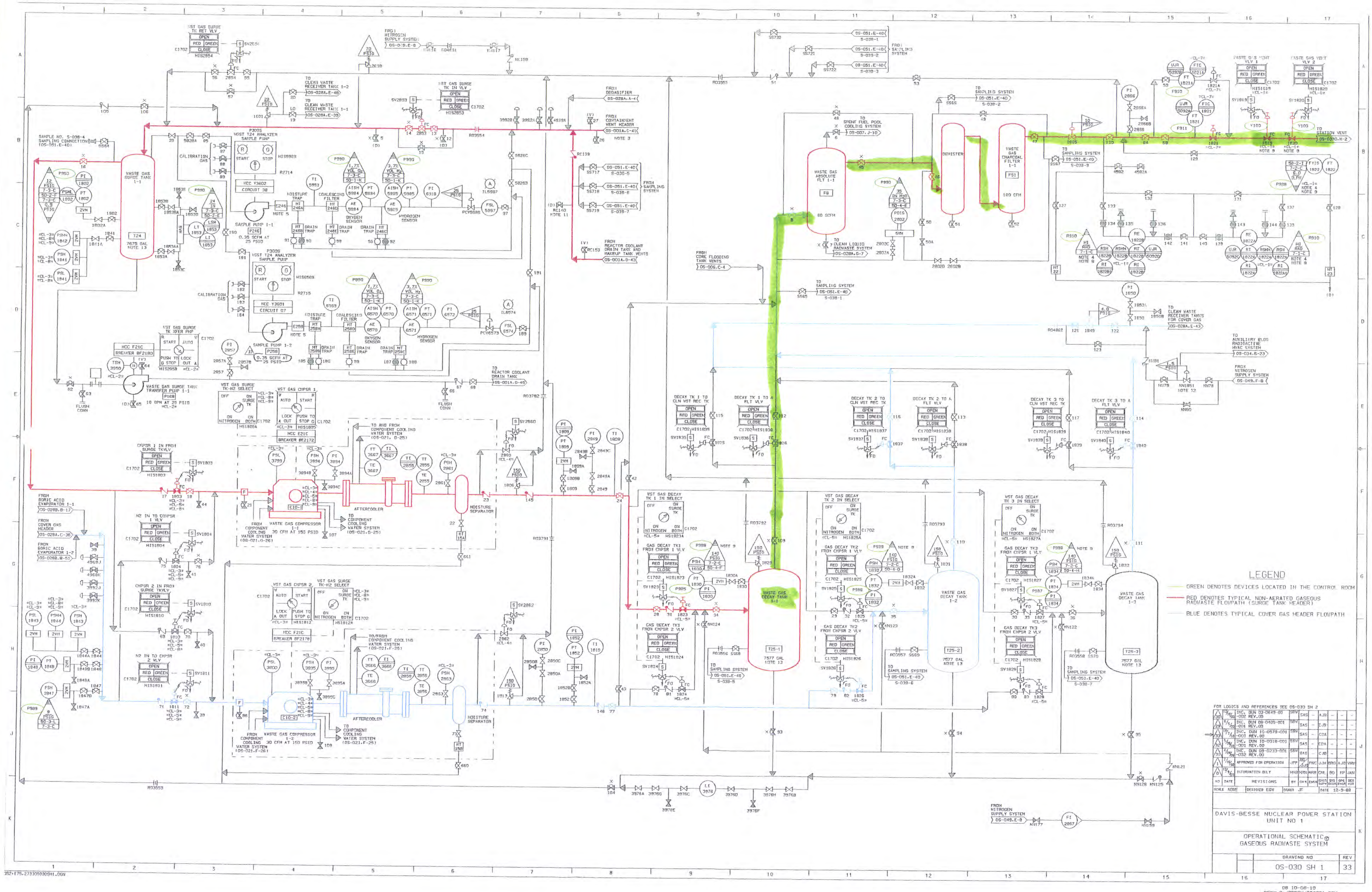
Assuming a 50 gpm Steam Generator Tube leak with a 10°F per hour cooldown rate for the entire cooldown, approximately 115,000 gallons of Reactor Coolant System water will accumulate in the secondary side of the plant during a cooldown from 582°F to 200°F (approximately 3000 gallons per hour). The Borated Water Storage Tank and Clean Waste Receiver Tanks will be the primary sources for Reactor Coolant System makeup. Faster Cooldown Rates will reduce the total leakage to the secondary.

. The projected volume can be accommodated by one or more of the following methods:

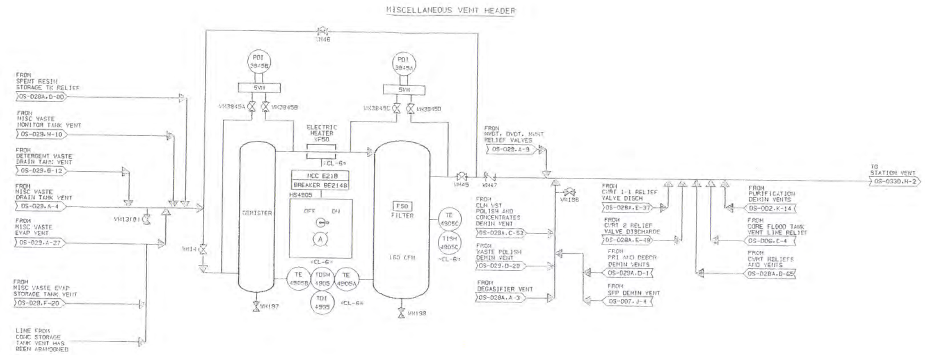
- Allowing the Condenser Hotwell level to fill above normal levels.
- Draining or rejecting the Hotwell to the Condensate Storage Tanks as necessary to prevent overfill of the Condenser Hotwell.
- Draining the Condenser Hotwell to the Condensate Polishing Demin Holdup Tanks via the West Condenser Pit Sump
- Draining the Condensate Polishing Demin Holdup Tanks to the Miscellaneous Drain Tank to create additional storage area in the Condensate Polishing Demin Holdup Tanks.

Using the Condensate Storage Tanks will require that their levels be reduced by draining to the Turbine Building sumps or Settling Basin to allow this inflow from the Hotwell. The initial CST drain should include all of the anticipated volume for this method so that draining contaminated CST inventory later in the event will not be necessary.

The vacuum system vent filter is placed in service when Xe-133 exceeds 6.5E-3 μCi/cc. This will minimize the amount of radioactivity released to the environment through the Steam Jet Air Ejectors vent line. Xe-133 is used because Chemistry cannot sample the Steam Jet Air Ejectors for I-131 due to the presence of moisture. The ratio of I-131 to Xe-133 is known and hence, Xe-133 can be used to determine the I-131 concentration.



NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DES VDR
30	12/16/08	INC. DUN 03-0649-00 -002 REV.00	SBW	SAS	-	AJR	-	-	-
29	6/5/09	INC. DUN 08-0405-001 -001 REV.00	SBW	SAS	-	CJB	-	-	-
33	10/7/10	INC. DUN 10-0579-001 -001 REV.00	SBW	SAS	-	CDA	-	-	-
32	5/26/10	INC. DUN 10-0018-001 -001 REV.00	SBW	SAS	-	CDA	-	-	-
31	4/24/09	INC. DUN 09-0233-001 -002 REV.00	SBW	SAS	-	CJB	-	-	-
1	7/16/90	APPROVED FOR OPERATION	JPP	JBG/JJS	PNC	JJH	BRG	AJO	VHV
0	12/9/88	INFORMATION ONLY	HHB	MRN	HRB	CML	BG	MP	JAN



NOTES

1. FOR GENERAL NOTES, PIPING SYMBOLS, INSTRUMENTATION SYMBOLS AND OPERATIONAL SCHEMATIC INDEX, SEE INDEX SHEET DWG OS-000.
2. ALL VALVES ARE PREFIXED WITH "WG" UNLESS OTHERWISE NOTED.
3. CONTAINMENT HEADER SOURCES ARE:
   A. PRESSURIZER QUENCH TANK VENT
   B. STEAM GENERATOR VENTS
   C. PRESSURIZER VENT
   D. CRD VENT HDR
   E. RCP SEAL CAVITIES
4. SETPOINT IS SPECIFIED BY RADIOLOGICAL CONTROLS IN THE DAVIS-BESSE RADIATION MONITOR SETPOINT MANUAL.
5. AIR COOLED SAMPLE COOLER.
6. VALVE LINE-UP DEPICTS WASTE GAS COMPRESSOR #1 SELECTED TO THE WASTE GAS SURGE TANK AND WASTE GAS COMPRESSOR #2 SELECTED TO NITROGEN (COVER GAS). NEITHER COMPRESSOR IS RUNNING AND NO RELEASE IS IN PROGRESS. THE ACTUAL FIELD LINE UP MAY VARY AND IS CONTROLLED BY PROCEDURES.
7. DELETED
8. ANNUNCIATOR 7-1-C WILL ALARM ON HIGH PROCESS RADIATION AS SENSED BY RSH1822A (ZONE C-16) OR RSH1822B (ZONE C-14) SEE NOTE 4.
9. ANNUNCIATOR 7-2-C WILL ALARM ON LOW FLOW AS SENSED BY FYIS1822 (ZONE B-17) WHEN VALVE 1819 (ZONE B-16) OR 1820 (ZONE B-17) IS NOT FULLY CLOSED. ANNUNCIATOR 7-2-C WILL ALSO ALARM ON HIGH PRESSURE AS SENSED BY PSH1830 (ZONE G-9) IN WASTE GAS DECAY TANK 1-1 OR HIGH PRESSURE AS SENSED BY PSH1832 (ZONE G-11) IN WASTE GAS DECAY TANK 1-2 OR HIGH PRESSURE AS SENSED BY PSH1834 (ZONE G-14) IN WASTE GAS DECAY TANK 1-3.
10. DELETED
11. VALVE RC140 (ZONE C-7) IS BURIED WITHIN A CONCRETE WALL.
12. INLET, OUTLET AND BYPASS NITROGEN VALVE POSITIONS FOR THE FOLLOWING REGULATORS ARE DETERMINED BY NORMAL PLANT OPERATIONS:

19	VALVE	ZONE
19	NN1851	E-15

13. WHERE NOTED THE TANK CAPACITY IS NOMINAL. WHERE APPLICABLE, SEE DB-PF-06705 (TANK LEVEL CALIBRATION CURVES) FOR INDICATED LEVEL VS. VOLUME RELATIONSHIP. (REF: PCAQR 96-0976).

ANNUNCIATOR TABLE

ANNUNCIATOR	ANNUNCIATOR ENGRAVING
7-1-C	WST GAS SYS OUT RAD HI
7-2-C	WST GAS DECAY TKS TRBL
7-3-C	WST GAS SYSTEM TRBL
50-1-K	WGST O_2/H_2 HI
50-2-E	WST GAS SURGE TK LIQ LVL HI
50-2-F	WST GAS SURGE TK PRESS HI LO
50-2-I	WST GAS SYS RAD MNTR FLOW
50-3-L	DISPLACED COVER GAS PRESS HI
50-4-E	WST GAS A FLT DP HI
50-4-F	WST GAS DECAY TK 1 PRESS HI
50-4-G	WST GAS DECAY TK 2 PRESS HI
50-4-H	WST GAS DECAY TK 3 PRESS HI

CONTROL LOGICS

CL-1 WASTE GAS VENT VALVE 1819 (ZONE B-16) AND VALVE 1820 (ZONE B-17) WILL CLOSE WHEN THE RADIOACTIVITY UPSTREAM FROM THE VALVES EXCEEDS THE SETPOINT (SEE NOTE 4) AS SENSED BY RSHH1822A OR RSHH1822B (ZONES C-16 AND C-14).

CL-2 WASTE GAS SURGE TANK TRANSFER PUMP 1-1 (ZONE E-2) WILL TRIP WHEN THE MOTOR WINDING TEMPERATURE ≥257° F AS SENSED BY TSH3950 (ZONE E-2).

CL-3 WASTE GAS COMPRESSOR 1-1 (ZONE F-4) WILL AUTOMATICALLY START WHEN THE HANDSWITCH HIS1805 (ZONE E-4) IS IN THE "AUTO" POSITION, COMPRESSOR DISCHARGE PRESSURE IS <145 PSIG FOR ≥2 MIN AS SENSED BY PSH2861 (ZONE F-6), LEAK DETECTION PRESSURE IS <8 PSIG AS SENSED BY PSH3894 (ZONE F-4) AND CONDITION I, II OR III EXISTS:

I. SELECTOR SWITCH HS1805A (ZONE E-3) IS IN THE "ON SURGE TK" POSITION AND WASTE GAS SURGE TANK PRESSURE IS ≥5 PSIG OR ≥7 PSIG AS SENSED BY PSH1841 OR PSHH1842 (ZONE C-1) RESPECTIVELY OR COVER GAS HEADER PRESSURE IS ≥7 PSIG AS SENSED BY PSHH1844 (ZONE H-1).

THE COMPRESSOR WILL AUTOMATICALLY STOP WHEN THE START SIGNALS DO NOT EXIST AND WASTE GAS SURGE TANK PRESSURE IS ≤2.5 PSIG AS SENSED BY PSL1841 (ZONE D-1).

II. SELECTOR SWITCH HS1805A IS IN THE "ON NITROGEN" POSITION AND COVER GAS HEADER PRESSURE IS ≥5 PSIG OR ≥7 PSIG AS SENSED BY PSH1843 OR PSHH1844 (ZONE H-1) RESPECTIVELY OR WASTE GAS SURGE TANK PRESSURE IS ≥7 PSIG AS SENSED BY PSHH1842.

THE COMPRESSOR WILL AUTOMATICALLY STOP WHEN THE START SIGNALS DO NOT EXIST AND COVER GAS HEADER PRESSURE IS ≤2.5 PSIG AS SENSED BY PSL1843 (ZONE H-1).

III. SELECTOR SWITCH HS1805A IS IN THE "ON BOTH" POSITION AND WASTE GAS SURGE TANK PRESSURE IS ≥5 PSIG OR ≥7 PSIG AS SENSED BY PSH1841 OR PSHH1842 RESPECTIVELY OR COVER GAS HEADER PRESSURE IS ≥5 PSIG OR ≥7 PSIG AS SENSED BY PSH1843 OR PSHH1844 RESPECTIVELY.

THE COMPRESSOR WILL AUTOMATICALLY STOP WHEN THE START SIGNAL DOES NOT EXIST AND WASTE GAS SURGE TANK AND COVER GAS HEADER PRESSURE IS ≤2.5 PSIG AS SENSED BY PSL1841 AND PSL1843 RESPECTIVELY.

THE COMPRESSOR WILL AUTOMATICALLY TRIP WHEN ANY OF THE FOLLOWING CONDITIONS EXISTS:
- COMPRESSOR INLET VALVES 1803 (ZONE F-2) AND 1804 (ZONE G-2) ARE FULLY CLOSED FOR ≥30 SEC. (SEE *CL-8* AND *CL-9* RESPECTIVELY).
- COMPRESSOR OIL PRESSURE IS ≤5 PSIG FOR ≥30 SEC AS SENSED BY PSL3799 (ZONE F-4).
- LEAK DETECTION PRESSURE IS ≥8 PSIG AS SENSED BY PSH3894.
- COMPRESSOR DISCHARGE PRESSURE IS ≥145 PSIG AS SENSED BY PSH2861.

LOGIC FOR WASTE GAS COMPRESSOR 1-2 (ZONE J-4) IS SIMILAR.

CL-4 WASTE GAS COMPRESSOR 1-1 RECIRCULATION VALVE 2860 (ZONE C-7) WILL CLOSE WHEN WASTE GAS COMPRESSOR 1-1 (ZONE F-4) STARTS AND OPENS WHEN WASTE GAS COMPRESSOR STOPS (SEE *CL-3*).

LOGIC FOR WASTE GAS COMPRESSOR 1-2 RECIRCULATION VALVE 2862 (ZONE H-7) IS SIMILAR.

CL-5 WASTE GAS DECAY TANK 1-1 INLET VALVE 1823 (ZONE G-9) FROM WASTE GAS COMPRESSOR 1-1 WILL AUTOMATICALLY OPEN WHEN WASTE GAS COMPRESSOR 1-1 IS RUNNING (SEE *CL-3*) AND CONDITION I, II OR III EXISTS:

I. WASTE GAS DECAY TANK 1-1 SELECTOR SWITCH HS1823A (ZONE F-9) IS IN THE "ON SURGE TK" POSITION AND VALVE 1803 (ZONE F-2) IS FULLY OPEN (SEE *CL-8*).

II. SELECTOR SWITCH HS1823A IS IN THE "ON NITROGEN" POSITION, VALVE 1803 IS NOT FULLY OPEN AND VALVE 1804 (ZONE G-2) IS FULLY OPEN (SEE *CL-9*).

III. SELECTOR SWITCH HS1823A IS IN THE "ON BOTH" POSITION AND VALVE 1803 OR 1804 ARE FULLY OPEN.

VALVE 1823 WILL AUTOMATICALLY CLOSE WHEN COMPRESSOR 1-1 IS NOT RUNNING OR WHEN CONDITIONS I, II AND III ARE NOT MET.

LOGIC FOR WASTE GAS DECAY TANK 1-2 AND 1-3 INLET VALVES 1825 (ZONE G-11) AND 1827 (ZONE G-13) RESPECTIVELY IS SIMILAR.

LOGIC FOR WASTE GAS DECAY TANK 1-1, 1-2 AND 1-3 INLET VALVES 1824 (ZONE H-9), 1826 (ZONE H-11) AND 1828 (ZONE H-13) RESPECTIVELY FROM WASTE GAS COMPRESSOR 1-2 IS SIMILAR EXCEPT THAT VALVES 1803 AND 1804 ARE TO BE SUBSTITUTED BY VALVES 1810 (ZONE H-2) AND 1811 (ZONE J-2) RESPECTIVELY FOR CONDITIONS I, II AND III.

CL-6 ELECTRIC HEATER WF50 (ZONE B-26) WILL ENERGIZE WHEN CONDITIONS I, II AND III OR I, II AND IV EXIST:

I. HANDSWITCH HS4905 (ZONE C-25) IS IN "ON".

II. DIFFERENTIAL TEMPERATURE BETWEEN DEMISTER OUTLET AND FILTER INLET IS ≤15 °F AS SENSED BY TDSH4905 (ZONE C-26).

III. FILTER INLET TEMPERATURE IS ≤160 °F AS SENSED BY TISH4905C (ZONE C-27).

IV. FILTER INLET TEMPERATURE IS APPROXIMATELY ≤140 °F AS SENSED BY TISH4905C IF A HIGH INLET TEMPERATURE OF ≥160 °F HAS PREVIOUSLY DE-ENERGIZED THE HEATER.

HEATER WILL DE-ENERGIZE WHEN CONDITIONS I OR III ARE NOT MET OR DIFFERENTIAL TEMPERATURE BETWEEN DEMISTER OUTLET AND FILTER INLET IS ≥20 °F AS SENSED BY TDSH4905.

THE ALARM LIGHT (NOT SHOWN) WILL ILLUMINATE ON TDSH4905 WHEN DIFFERENTIAL TEMPERATURE IS ≤10 °F AS SENSED BY TDSH4905.

CL-7 WASTE GAS OUTLET VALVE 1821 (ZONE B-15) WILL MODULATE IN RESPONSE TO CONTROLLER FIC1821 (ZONE B-15).

LOGIC FOR WASTE GAS OUTLET VALVE 1821A AND CONTROLLER FIC1821A (ZONE A-15) IS SIMILAR.

CL-8 WASTE GAS COMPRESSOR 1-1 INLET VALVE 1803 (ZONE F-2) FROM WASTE GAS SURGE TANK WILL AUTOMATICALLY OPEN WHEN WASTE GAS COMPRESSOR 1-1 IS RUNNING (SEE *CL-3*), WASTE SURGE TANK PRESSURE IS ≥2.5 PSIG AS SENSED BY PSL1841 (ZONE D-1) AND CONDITION I OR II EXISTS:

I. SELECTOR SWITCH HS1805A (ZONE E-3) IS IN THE "ON SURGE TK" OR "ON BOTH" POSITION AND WASTE GAS SURGE TANK PRESSURE IS ≥5 PSIG AS SENSED BY PSH1841 (ZONE C-1) WHEN COVER GAS HEADER PRESSURE IS <7 PSIG AS SENSED BY PSHH1844 (ZONE H-1) OR WASTE SURGE TANK PRESSURE IS ≥7 PSIG AS SENSED BY PSHH1842 (ZONE C-1).

II. SELECTOR SWITCH HS1805A IS IN THE "ON NITROGEN" POSITION AND WASTE GAS SURGE TANK PRESSURE IS ≥7 PSIG AS SENSED BY PSHH1842.

VALVE 1803 WILL AUTOMATICALLY CLOSE WHEN WASTE GAS COMPRESSOR 1-1 IS NOT RUNNING, WASTE SURGE TANK PRESSURE IS ≤2.5 PSIG AS SENSED BY PSL1841 OR WHEN CONDITIONS I OR II ARE NOT MET.

LOGIC FOR WASTE GAS COMPRESSOR 1-2 INLET VALVE 1810 (ZONE H-2) FROM WASTE GAS SURGE TANK IS SIMILAR.

CL-9 WASTE GAS COMPRESSOR 1-1 INLET VALVE 1804 (ZONE G-2) FROM NITROGEN COVER GAS HEADER WILL AUTOMATICALLY OPEN WHEN WASTE GAS COMPRESSOR 1-1 IS RUNNING (SEE *CL-3*), COVER GAS HEADER PRESSURE IS ≥2.5 PSIG AS SENSED BY PSL1843 (ZONE H-1) AND CONDITION I OR II EXISTS:

I. SELECTOR SWITCH HS1805A (ZONE E-3) IS IN THE "ON NITROGEN" OR "ON BOTH" POSITION AND COVER GAS HEADER PRESSURE IS ≥5 PSIG AS SENSED BY PSH1843 (ZONE H-1) WHEN WASTE GAS SURGE TANK PRESSURE IS <7 PSIG AS SENSED BY PSHH1842 (ZONE C-1) OR COVER GAS HEADER PRESSURE IS ≥7 PSIG AS SENSED BY PSHH1844 (ZONE H-1).

II. SELECTOR SWITCH HS1805A IS IN THE "ON SURGE TK" POSITION AND COVER GAS HEADER PRESSURE IS ≥7 PSIG AS SENSED BY PSHH1844.

VALVE 1804 WILL AUTOMATICALLY CLOSE WHEN WASTE GAS COMPRESSOR 1-1 IS NOT RUNNING, COVER GAS HEADER PRESSURE IS ≤2.5 PSIG AS SENSED BY PSL1843 OR WHEN CONDITIONS I OR II ARE NOT MET.

LOGIC FOR WASTE GAS COMPRESSOR 1-2 INLET VALVE 1811 (ZONE J-2) FROM NITROGEN COVER GAS HEADER IS SIMILAR.

REFERENCES

DRAWINGS

M-038A	E-568 SH 18B
M-038B	E-568 SH 21
M-038C	E-568 SH 22A
M-324N-85	E-568 SH 22B
M-324N-82	E-568 SH 22C
M-324N-86	E-568 SH 23A
M-402-3	E-568 SH 23B
E-568 SH 8A	E-568 SH 26A
E-568 SH 8B	E-568 SH 26B
E-568 SH 10A	E-568 SH 27A
E-568 SH 10B	E-568 SH 27B
E-568 SH 17A	E-568 SH 27C
E-568 SH 17B	E-568 SH 40C
E-568 SH 17C	E-568 SH 41A
E-568 SH 18A	E-568 SH 41B

NO	DATE	REVISIONS	BY	CH'D	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DES MGR
17	5/17/00	INC DCN OS-030-57 PER DDR 00-1475 AND GEN. UPDATE ADD ZONE REF. FOR PSH1834 IN NOTE 9	SBW	JDR	-	AGM	-	-	-
16	2/1/00	INC DCN OS-030-56 PER DCR 99-0001	SBW	JDR	-	RJC	-	-	-
19	7/26/05	INC DCN OS-030-62 PER MOD 97-0050-00 REV.0	SBW	JDR	-	AGM	-	-	-
18	1/30/04	GEN. UPDATE PER LTR DBE 04-00072 (REMOVE PROCEDURE LIST)	SBW	JDR	-	JBG	-	-	-
1	2/15/90	APPROVED FOR OPERATION	AGM	JBG/JJS	PHC	JJH	BRG	AJO	VHV
0	12/3/88	INFORMATION ONLY	HHB	MRH	JRB	CML	BG	NP	JAN

SCALE NONE | DESIGNED EGW | DRAWN WAN | DATE 12-9-88

DAVIS-BESSE NUCLEAR POWER STATION
UNIT NO 1

OPERATIONAL SCHEMATIC ©
GASEOUS RADWASTE SYSTEM

DRAWING NO OS-030 SH 2 | REV 19

DB: 07-28-05
DFN= /OPSCH/OS30S2.DGN

22. Waste Gas Decay Tank 1 is being discharged to the station vent IAW DB-OP-03012, Radioactive Gaseous Batch Release. WG1821, Waste Gas To Station Vent Flow Control is being utilized for this batch release.

The following valid alarms and indications are received:

- RE1822A Waste Gas System Radiation Monitor alarms WARN & HIGH
- RE1822A Waste Gas System Radiation Monitor indicates offscale high

No automatic actions have occurred.

Based on these conditions, which of the following valves FAILED to automatically CLOSE?

1. WG1819, Waste Gas To Station Vent Isolation
2. WG1820, Waste Gas To Station Vent Isolation
3. WGl821, Waste Gas To Station Vent Flow Control
4. WG1836, Waste Gas Decay Tank 1 To Station Vent Control

A. 1 & 2 only

B. 1 & 4 only

C. 2 & 3 only

D. 3 & 4 only

Answer: A

Explanation/Justification:

A. Correct – RE1822A trip should have caused both the Waste Gas to Station Vent Isolations to Close.

B. Incorrect – Plausible because RE1822A trip should have caused WG1819 to close and since WG1836 a control valve is in the release flowpath, it is plausible that the controller should have closed as it well.

C. Incorrect – Plausible because RE1822A trip should have caused WG1820 to close and since WG1821 a control valve is in the release flowpath, it is plausible that the controller should have closed it as well.

D. Incorrect – Plausible because if the RE1822A trip would use a controller to provide isolation, it is logical that WG1821 and WG1836 would close to provide isolation.

Sys #	System	Category	KA Statement
000060	Accidental Gaseous-Waste Release	AA2. Ability to operate and / or monitor the following as they apply to the Accidental Gaseous Radwaste:	Valve lineup for release of radioactive gases

K/A# AA2.06 **K/A Importance** 3.6* **Exam Level** RO

References provided to Candidate None **Technical References:** OS-030 Sheet 1 (B-16) and Sheet 2 CL-1

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR 41.7 / 45.5 / 45.6)

Objective:

23. DB-OP-02012, STM GEN/SFRCS ALARM PANEL 12 ANNUNCIATOR procedure directs Radiation Protection to be notified to take local surveys of the Main Steam Line area when annunciator 12-1-A, MN STM LINE 1 RAD HI comes into alarm.

Which of the following is the reason for this direction?

A. To evaluate for initiating conditions into RA-EP-02861, Radiological Incidents

B. To obtain data to support leak rate calculation for DB-OP-02522, Small RCS Leaks

C. To project off site doses from the Station Vent in accordance with RA-EP-02240, Offsite Dose Assessment.

D. To verify affected SG diagnosis in accordance with DB-OP-02531, Steam Generator Tube Leak.

Answer: D

Explanation/Justification:

A. Incorrect – Plausible because high radiation levels would be an initiating condition for the radiological incidents off normal procedure but this alarm is to support indications of a steam generator tube leak

B. Incorrect – Plausible because there is a leak rate calculation that uses RE indications in the calculation but it uses steam jet air ejector discharge RE1003A & B.

C. Incorrect – Plausible Steam Generator Tube Leaks will cause a release of radioactive material, but checking radiation levels in the Main Steam Line area will not allow determination of dose from the station vent.

D. Correct – DB-OP-02012 directs checking symptoms in accordance with DB-OP-02531 along with alarm verification to access entry conditions into the steam generator tube leak abnormal procedure.

Sys #	System	Category	KA Statement
000061	ARM System Alarms	AK3. Knowledge of the reasons for the following responses as they apply to the Area Radiation Monitoring (ARM) System Alarms:	Guidance contained in alarm response for ARM system

K/A# AK3.02 **K/A Importance** 3.4 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02012 R10 Page 4 Step 3.4

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR 41.5,41.10 / 45.6 / 45.13)

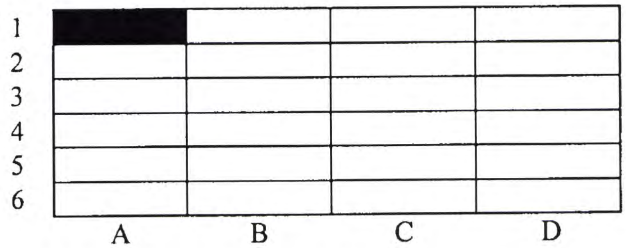
Objective:

STM GEN/SFRCS ALARM PANEL 12 ANNUNCIATORS

12-1-A

R783
MN STM
LINE 1
RAD HI

Panel 12



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ACTUATING DEVICE(S)	SETPOINTS
1. RSH 609	1. Setpoint in the Radiation Setpoints Manual

1.0 SYMPTOMS

1.1 Annunciator Alarm (12-1-A) MN STM LINE 1 RAD HI

1.2 High radiation level in Main Steam Line 1

2.0 IMMEDIATE ACTIONS

None

3.0 SUPPLEMENTARY ACTIONS

3.1 Confirm the high reading on RI 609 at Control Room Radiation Monitoring Panel C5765E.

3.2 Notify R.P. to verify the alarm by taking local surveys.

3.3 Check for the following in accordance with DB-OP-02522, Small RCS Leaks:

3.3.1 High RCS Makeup rate

3.3.2 Decreasing RCS pressure

3.3.3 Decreasing Pressurizer level

3.3.4 SJAE radiation.

3.4 IF the Radiation Alarm is verified
AND RCS leak is indicated by any of the above,
THEN GO TO DB-OP-02531, Steam Generator Tube Leak.

24.
- Plant is in mode 6
- The Refueling Canal is greater than 23 feet
- Fuel Handling is in progress in Containment

Identify the ONE situation below that represents a condition that would require the handling of irradiated fuel in CTMT to be stopped:

A. Equipment Hatch is removed. A Maintenance team is assigned to install the hatch but is not present.

B. Maintenance removes SP 17B6, SG1 Main Steam Safety Valve in the Main Steam Line room AND SG 1 Secondary Manway is open for inspection.

C. An operator is signed into the Containment Closure Control log for MU66D, Reactor Coolant Pump 1-2 Seal Injection Flow Isolation and is draining its piping for a Local Leakrate Test

D. BOTH air lock doors of the CTMT personnel hatch are opened. An Operator is assigned to be responsible for closing ONE door.

Answer: B

Explanation/Justification:

A. Incorrect – Plausible if the candidate does not know the equipment hatch can be open during fuel handling since it was previously required closed. They may also assume the team must be staged which is not correct.

B. Correct– This creates a path from Containment to atmosphere.

C. Incorrect – Plausible since this will create a path between CTMT and atmosphere but is administratively controlled by the CTMT Closure Control log

D. Incorrect – Plausible if the Candidate knows this is outside of the EVS boundary but does not know this is allowed by procedure

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Sys #	System	Category	KA Statement
000069	Loss of Containment Integrity	AA1. Ability to operate and / or monitor the following as they apply to the Loss of Containment Integrity:	Fluid systems penetrating containment

K/A# AA1.03 **K/A Importance** 2.8 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06904 R42 Note 11.1, OS-008 SH 1 R35

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR 41.7 / 45.5 / 45.6)

Objective:

11.0 CONTAINMENT CLOSURE CONTROL

NOTE 11.1

- Containment closure is the action to secure the containment and its associated structures, systems and components as a functional barrier to fission product release under existing plant conditions. Containment closure control provides the methodology to quickly secure the containment. The intent of the following is to provide the control room operator with the ability to isolate the containment from the control room and to provide guidance to allow hatches and other penetrations to be functional as soon as possible using Attachment 8 to assign designated personnel.

- Penetrations providing direct access from the containment atmosphere to the atmosphere outside containment may be open during operations involving movement of irradiated fuel within containment provided the administrative controls provided in this section are maintained.

11.1 General Requirements

11.1.1 Deviations from total containment closure as defined in the following steps should be documented with the following three methods.

NOTE 11.1.1.a

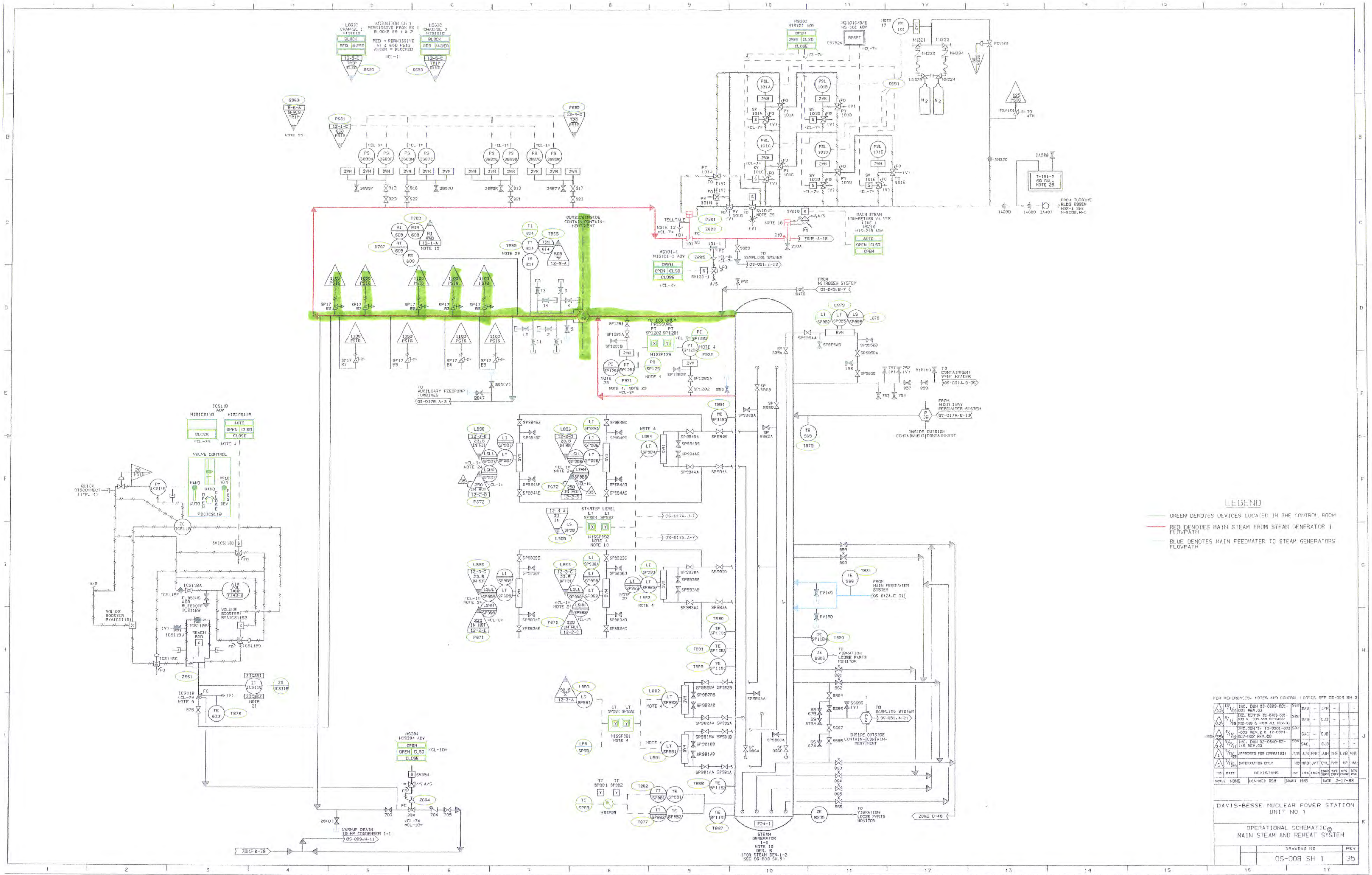
Secondary Systems openings (OTSG manways) are not shown on M-023.

a. Containment airlocks, equipment hatch, penetrations, and secondary system openings status should be maintained on a controlled copy of P&ID M-023 encased in plastic.

b. Containment airlocks, equipment hatch, penetrations, and secondary system openings status should be maintained on the SPDS computer display.

c. Personnel assignments and closure actions will be documented on Attachment 8, CTMT Closure.

11.1.2 If the Equipment Hatch is off, then the SFP Negative Pressure Area is extended to inside Containment. The cumulative void area of the SFP Negative Pressure Area will be the sum of the areas tracked by this procedure and the areas of the penetrations tracked in DB-OP-00018, Inoperable Equipment Tracking Log. LCO 3.7.13 for SFP EVS allows the SFP Negative Pressure boundary to be opened under administrative control. The Containment Closure Control provisions of this procedure satisfy the administrative control requirements for LCO 3.7.13, as long as a dedicated individual is stationed at the opening during the handling of irradiated fuel in the SFP building.



NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DES MGR
33	12/1/09	INC. DUN 09-0683-001-001 REV.03	SBW	SAS	-	JPH	-		-
32	5/1/09	INC. DUN'S: 02-0403-001-033 & -035 AND 02-0403-002-018 & -019 ALL REV.00	SBW	SAS	-	CJB	-	-	-
35	9/14/12	INC. DUN'S: 12-0301-002-002 REV.2 & 12-0301-007-002 REV.00	SBW	SAC	-	CJB	-	-	-
34	5/25/11	INC. DUN 02-0540-02-149 REV.00	SBW	SAC	-	CJB	-	-	-
1	3/12/09	APPROVED FOR OPERATION	JWG	JJS	PNC	JJH	INF	LVB	VHH
0	2/17/89	INFORMATION ONLY	HB	HRB	JVT	CNL	PMM	HP	JAN

SCALE NONE | DESIGNED RSH | DRAWN HHB | DATE 2-17-89

25. The following plant conditions exist:

The plant is at 90% power

ICS is in a normal lineup

The following alarms occurs:

- 8-4-A, MFPT 1 TRIP alarms
- 10-1-A, MFP 1 DISCH HI PRESS TRIP alarms
- 13-4-C, DEAR STRG TK LVL
- 14-3-D, ICS MFP LOSS OR LO DEAR RUNBACK alarms

Main Generator load is lowering and stabilizes at approximately 700 MWe with #1 Deaerator level at 9 feet.

Based on these plant conditions, what procedures and associate actions are **required**?

A. Trip the reactor and enter DB-OP-02000 in accordance with DB-OP-02014, MSR/ICS Alarm Panel 14 Annunciators

B. Stabilize the plant at the current power level in accordance with DB-OP-06401, ICS Procedure, section for plant stabilization following a runback

C. Place SG/RX Demand Station in HAND and perform runback to 55% power in accordance with DB-OP-02010, Feedwater Alarm Panel 10 Annunciators

D. Place Feedwater Loop Demands and the Rod Control Panel in MANUAL and stabilize Reactor power and Tave in accordance with DB-OP-02526, Primary to Secondary Heat Transfer Upset

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Answer: C

Explanation/Justification:

A. Incorrect – Plausible because DB-OP-02014 directs tripping reactor if deaerator level approaches low off scale

B. Incorrect – Plausible because DB-OP-06401 provides direction for stabilization following a runback, however reactor power was not reduced below runback setpoint for loss of a MFP.

C. Correct – DB-OP-02010 for MFPT trip provides this direction for a MFPT Trip

D. Incorrect – Plausible because DB-OP-02526, Primary to Secondary Heat Transfer Upset provides these directions for plant stabilization upon a plant upset

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Sys #	System	Category	KA Statement
BW/A01	Plant Runback	AA2. Ability to determine and interpret the following as they apply to the (Plant Runback)	Facility conditions and selection of appropriate procedures during abnormal and emergency operations.

K/A# AA2.1 **K/A Importance** 3.0 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02010 R17 Page 4

Question Source: BANK 75948 **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** (CFR: 43.5 / 45.13)

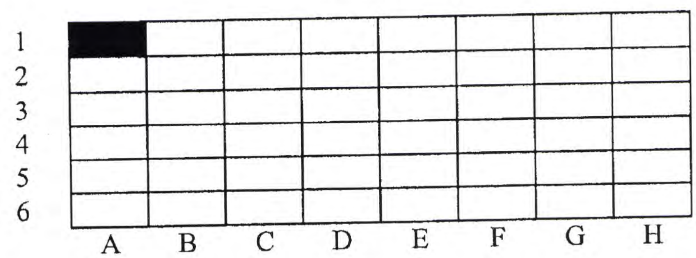
Objective:

FEEDWATER ALARM PANEL 10 ANNUNCIATORS

Panel 10

10-1-A

Q628
MFP 1
DISCH
HI PRESS
TRIP



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ACTUATING DEVICE(S)	SETPOINTS
1. PSH 506, MFP Discharge Pressure Switch High	1. 1500 psig

1.0 SYMPTOMS

1.1 Annunciator Alarm (8-4-A) MFPT 1 TRIP

1.2 Annunciator Alarm (14-3-D) ICS MFP LOSS OR LO DEAR RUNBACK

1.3 MFPT 1 trip due to high MFP discharge pressure

2.0 IMMEDIATE ACTION

None

3.0 SUPPLEMENTARY ACTIONS

3.1 IF ICS was NOT in TRACK,
THEN verify ICS is or has runback at 20%/minute to 55% power,
OTHERWISE place HIC ICS13, SG/RX DEMAND station in HAND,
AND perform the runback at 20%/minute to 55% power. (ULD DEMAND as read on DAAS-514 Mwe)

3.2 IF ICS was in TRACK,
THEN verify ICS is or has been runback to 55% power by manual operation of the ICS station(s) in HAND.

3.3 IF the pressurizer spray valve was operated,
THEN verify RC2, PRESSURIZER SPRAY VALVE is in AUTO,
AND closed.

3.4 Perform a NIP/HBP comparison for the current power level.

3.5 REFER TO DB-OP-06902, Power Operations, for guidance to operate plant equipment for the current power level.

26. The Plant is at 50% power with a shutdown in progress. Entry into Mode 5 to perform maintenance is planned
The following annunciator alarms come in:

- (14-2-D) ICS/NNI 118VAC PWR TRBL
- (14-4-E) ICS INPUT MISMATCH
- (14-4-F) ICS INPUT TRANSFER

Other indications:

- Loss of blue light on SASS instrument's selector switches.
- SCR Bank, RC PRESSURE CONTROL, Hand/Auto Station Lights Both ON

Assuming the condition can not restored to normal which of the following actions must be taken?

A. Operation of DHR Train 1 will be required vice the normal DHR Train 2 for cooldown.

B. Control Atmospheric Vent Valves, ICS11A and ICS11B in manual for cooldown.

C. Transfer the EHC Control Panel to manual for turbine control.

D. Close MU 85, Letdown Flow Control Inlet Isolation to MU 6 to isolate Letdown.

Answer: A

Explanation/Justification:

A. Correct – must diagnose loss of NNI X AC and identify appropriate response. Although the Decay Heat Cooler SFAS Valves, DH13A and DH14A, solenoids are DC powered their controls along with various DH Train 2 indications and alarms will be out of service since NNI X AC lost.
B. Incorrect – Plausible because this is the response for loss of ICS power.
C. Incorrect – Plausible because this is a response for loss of NNI-X DC power.
D. Incorrect – Plausible because this is a response for loss of NNI-Y AC power.

Sys #	System	Category	KA Statement
BW/A02	Loss of NNI-X	AK2. Knowledge of the interrelations between the (Loss of NNI-X) and the following:	Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility.

K/A# AK2.2 **K/A Importance** 3.8 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02532 R10 Step 4.1.13

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7 / 45.7)

Objective:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1.12 Assess impact on Group 38 for calculation of Heat Balance Power. REFER TO the following: ___ • Post Maintenance Test Manual AND ___ • DB-NE-03230, RPS Daily Heat Balance Check.	
___ 4.1.13 **IF AT ANY TIME** NNI-X AC power is NOT restored prior to reaching COLD SHUTDOWN, THEN use DH Train 1 for further RCS cooldown.	
___ 4.1.14 **IF AT ANY TIME** NNI-X AC power is restored, THEN return the NNI switch lineup to the preferred lineup. REFER TO DB-OP-06407, Non Nuclear Instrumentation System Operating Procedure.	
___ 4.1.15 Return to Normal Operation. REFER TO DB-OP-00000, Conduct of Operations.	

27. Following a Reactor Trip, a severe overcooling has caused a loss of Adequate Subcooling Margin.

Once the Reactor is confirmed as shutdown using the Immediate Operator Actions, based on the priorities provided by DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture, which the following is implemented **FIRST** to mitigate this event

A. Section 5, Loss of Subcooling Margin

B. Section 7, Overcooling

C. Specific Rule 2, Loss of Subcooling Margin

D. Specific Rule 4, Steam Generator Control

Answer: C

Explanation/Justification:

A. Incorrect – As provided in the Bases and Deviation Document for DB-OP-02000, The hierarchy in DB-OP-02000 between the various sections is as follows: 1. Immediate Actions 2. Specific Rules 3. Procedure Sections 4. Attachments. Rules are implemented prior to sections.

B. Incorrect – As provided in the Bases and Deviation Document for DB-OP-02000, The hierarchy in DB-OP-02000 between the various sections is as follows: 1. Immediate Actions 2. Specific Rules 3. Procedure Sections 4. Attachments. Rules are implemented prior to sections.

C. Correct – As provided in the Bases and Deviation Document for DB-OP-02000, The hierarchy in DB-OP-02000 between the various sections is as follows: 1. Immediate Actions 2. Specific Rules 3. Procedure Sections 4. Attachments. Rules are implemented prior to sections. Rules are implemented in numerical order

. Incorrect - As provided in the Bases and Deviation Document for DB-OP-02000, The hierarchy in DB-OP-02000 between the various sections is as follows: 1. Immediate Actions 2. Specific Rules 3. Procedure Sections 4. Attachments. Rules are implemented prior to sections. Rules are implemented in numerical order

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Sys #	System	Category	KA Statement
BW/E13	EOP Rules	EA1. Ability to operate and / or monitor the following as they apply to the (EOP Rules)	Desired operating results during abnormal and emergency situations.

K/A# EA1.3 **K/A Importance** 3.4 **Exam Level** RO

References provided to Candidate None **Technical References:** Bases and Deviation Document for DB-OP-02000 R19, Prioritization of DB-OP-02000 Sections.

Question Source: New **Level Of Difficulty: (1-5)** 2

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** (CFR: 41.7 / 45.5 / 45.6)

Objective:

Prioritization of DB-OP-02000 Sections

General

The hierarchy in DB-OP-02000 between the various sections is as follows:

1. Immediate Actions
2. Specific Rules
3. Procedure Sections
4. Attachments

Direction provided in DB-OP-02000 assumes the Reactor has been Shutdown. This verification is completed by performing the Immediate Actions. Once the Reactor has been shutdown, Specific Rules are implemented whenever the conditions that require implementation are met. For example, Specific Rule 2 is entered and the actions completed anytime Subcooling Margin is lost. Once the Specific Rules are completed, appropriate procedure sections are entered based on symptoms identified.

For example, while at power, a Large Break Loss of Coolant accident occurs. The Reactor trips on Low RCS Pressure. Immediate Actions are completed to verify the Reactor is Shutdown. Specific Rule 2, Loss of Subcooling Margin is then implemented and the Reactor Coolant Pumps are shutdown. Section 5, Loss of Subcooling Margin is then implemented to provide mitigation actions. Section 5, Loss of Subcooling Margin also contains direction to shutdown the Reactor Coolant Pumps as defense in depth in the unlikely event the Specific Rule direction was inadvertently not performed.

Specific Rule Prioritization

If an event occurs where multiple Specific Rules are applicable, the order number of the specific rule provides prioritization for the sequence to apply the Specific Rules.

For example, if a severe overcooling resulted in a loss of Subcooling Margin, Specific Rule 2, Loss of Subcooling Margin is applied before Specific Rule 5, Pressurized Thermal Shock. This is not intended to imply that parallel activities are not permissible. It is acceptable to simultaneously apply specific Rule 2 turning off the Reactor Coolant Pumps, and Rule 5 limiting Reactor Coolant System repressurization.

Symptom Prioritization

If an event occurs where multiple Sections of DB-OP-02000 are applicable, the order number of the Section provides prioritization for the sequence to apply the Sections. Inadequate Core Cooling (ICC) could develop if the mitigation strategies provided in Section 5, 6, 7, or 8 are not successful. Once ICC conditions are identified (superheated incore thermocouples) guidance provided in Section 9.0 takes priority over other symptom mitigation direction.

For example, if a severe Steam Generator Tube Rupture results in a Loss of Subcooling Margin, Section 5, Loss of Subcooling Margin is applied before Section 8, Steam Generator Tube Rupture.

28. The plant is operating at 70% power with all systems in normal alignment for this power level. All four Reactor Coolant Pumps are in service.

Motor current for the 1-1 RCP is noted to be 290 amps.

(1) Which of the following describes the current status of the RCP motor current reading?

(2) What action is **required**, if any, for this condition?

A. (1)This motor current reading is lower than normal.
(2) RCP 1-1 shutdown is required.

B. (1)This motor current reading is lower than normal.
(2) RCP 1-1 shutdown is **NOT** required.

C. (1)This motor current reading is higher than normal.
(2) RCP 1-1 shutdown is **NOT** required.

D. (1)This motor current reading is higher than normal.
(2) RCP 1-1 shutdown is required.

Answer: C

Explanation/Justification:

A. Incorrect – At normal operating RCS temperatures and pressures, normal RCP Motor Current is approximately 260 amps. The Operating Limits requiring shutdown are less than 200 amps or greater than 370 amps per DB-OP-02515, Reactor Coolant Pump and Motor Abnormal Operations.

B. Incorrect – At normal operating RCS temperatures and pressures, normal RCP Motor Current is approximately 260 amps. The Operating Limits requiring shutdown are less than 200 amps or greater than 370 amps per DB-OP-02515, Reactor Coolant Pump and Motor Abnormal Operations

C. Correct – At normal operating RCS temperatures and pressures, normal RCP Motor Current is approximately 260 amps. The Operating Limits requiring shutdown are less than 200 amps or greater than 370 amps per DB-OP-02515, Reactor Coolant Pump and Motor Abnormal Operations

D. Incorrect – At normal operating RCS temperatures and pressures, normal RCP Motor Current is approximately 260 amps. The Operating Limits requiring shutdown are less than 200 amps or greater than 370 amps per DB-OP-02515, Reactor Coolant Pump and Motor Abnormal Operations

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Sys #	System	Category	KA Statement
003	Reactor Coolant Pump System (RCPS)	A3. Ability to monitor automatic operation of the RCPS, including:	Motor current

K/A# A3.02 **K/A Importance** 2.6 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02515 R11, Reactor Coolant Pump and Motor Abnormal Operations step 4.6.1

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7 / 45.5)

Objective:

4.6 RCP Motor Problems

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.6.1 Check that RCP Motor conditions are within operational limits:	**IF AT ANY TIME** RCP Motor conditions exceed operational limits, THEN perform one of the following:
∘ RCP Motor **Vibration** Annunciator resets (6-1-A thru D) AND RCP vibration is less than 2 mils. **1-1** V788 **1-2** V808 **2-1** V828 **2-2** V838	___ ∘ IF the Reactor is Critical with 4 RCPs operating, THEN perform Attachment 1, Reactor Coolant Pump Shutdown to stop the affected RCP. **(Command SRO Directed).**
∘ Bentley-Nevada (SPDS) **Shaft Displacement** X AND Y axis is less than 29 mils.	∘ IF the Reactor is Critical with 3 RCPs operating, THEN perform the following: ___ a. Trip the Reactor. ___ b. Stop the affected RCP ___ c. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.
∘ Any Motor **Bearing Temp** (Upper-Upthrust-Downthrust-Lower) less than 190°F: **1-1** T789, T790, T785, T787 **1-2** T809. T810, T805, T807 **2-1** T829, T830, T825, T827 **2-2** T849, T850, T845, T847	___ ∘ IF the Reactor is Shutdown, THEN stop the affected RCP.
∘ Motor **Oil Level** is NOT in alarm OR motor bearing temperatures stable if oil level is in alarm.	
∘ Motor **Stator Temperature** is less than 300°F: **1-1** T788 **1-2** T808 **2-1** T828 **2-2** T848	
∘ Motor **Current** is between 200 and 370 Amps.	

29. The following plant conditions exist:

- Mode 1 at 15% power

The following event occurs:

- RCP 1-1 is shutdown by the crew due to excessive vibrations.
- No other operator actions are taken.

Which one of the following represents the condition of the plant, once stabilized?

A. Tave will be selected to Loop 1.

B. Loop 1 FW flow will be 2.4 times greater than Loop 2 FW flow

C. Loop 2 FW flow will be 2.4 times greater than Loop 1 FW flow.

D. Tave will be selected to Loop 2.

Answer: D

Explanation/Justification:

A. Incorrect – In accordance with DB-OP-02515 R11, RCP and Motor Abnormal Attachment 1 for Stopping a RCP Step 5. SASS will align Tave to the loop with 2 RCPS in service.

Incorrect – Plausible because the normal response at 72% power when an RCP would be shutdown is for FW Flow to Loop with the highest RCS flow to be 2.4 time greater than the remaining loop. A trip from 15% with SG on Low Level limits negates flow control. The SG Will be on Level Control.

C. Incorrect – Plausible because the normal response at 72% power when an RCP would be shutdown is for FW Flow to Loop 2 to be 2.4 time greater. A trip from 15% with SG on Low Level limits negates flow control. The SG Will be on Level Control

D. Correct – In accordance with DB-OP-02515 R11, RCP and Motor Abnormal Attachment 1 for Stopping a RCP Step 5. SASS will align Tave to the loop with 2 RCPS in service.

Sys #	System	Category	KA Statement
003	Reactor Coolant Pump System (RCPS)	K3. Knowledge of the effect that a loss or malfunction of the RCPS will have on the following:	RCS

K/A# K3.01 **K/A Importance** 3.7 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02515 R11, RCP and Motor Abnormal Attachment 1 for Stopping a RCP

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7 / 45.6)

Objective:

ATTACHMENT 1: REACTOR COOLANT PUMP SHUTDOWN
Page 1 of 1

The purpose of this attachment is to provide direction for stopping a Reactor Coolant Pump during 4 pump operation with the Reactor Critical. Due to the coordination required between the ATC and BOP operators, the attachment is directed by the Command SRO.

The Command SRO will direct performance of this Attachment.

____ 1. Reduce reactor power to 72 percent or less.
REFER TO DB-OP-02504, Rapid Shutdown.

____ 2. IF time permits,
THEN place SG Load Ratio (ΔTc) in Auto.
Refer to DB-OP-06401, Integrated Control System Operating Procedure.

____ 3. Stop the affected RCP.

____ 4. Verify proper Feedwater flow ratios of 2.4 to 1. (Feedwater flow should be approximately 5.74 MPPH to the SG with 2 RCPs vs. 2.38 MPPH to the SG with one RCP at 72 percent power – Approximately 70% to 30% ratio for other power levels).

____ 5. Verify Tave control transferred to the RC loop with two RCPs.

____ 6. Check RCS flow is greater than the flow required by TS 3.4.1, DNB Limits.
REFER TO DB-OP-03006, Miscellaneous Instrument Shift Checks. (Computer Point F744)

____ 7. Notify I&C to reduce the RPS High Flux Trip setpoints within 10 hours.
REFER TO TS 3.4.4, RCS Loops – Modes 1 and 2.

30. The plant is operating at 100% power with all systems in normal alignment for this power level.

Makeup Pump 2 is in service.

Which of the following conditions would cause MU3971 Makeup Pump 2 Suction Valve to transfer from the Makeup Tank to the BWST assuming lock is **NOT** depressed for the valve?

A. SFAS Level 2

B. Makeup Tank Level less than 10 inches

C. Loss of NNI X AC Power

D. Loss of D2P and DBP

Answer: B

Explanation/Justification: KA Statement is for design features and/or interlocks on the letdown system for the letdown tank bypass valve. The closed valve for Davis Besse would be the MU Pump Suction Valves. These valves can be aligned to take a suction on the Makeup Tank or on the BWST. In the BWST position, the Makeup Tank is effectively bypassed.

A. Incorrect – No automatic feature exists, however plausible because this action would protect BWST inventory for use by ECCS Systems.

B. Correct – Low Makeup Tank Level of 10 inches will cause an auto transfer from the MU Tank to the BWST..

C. Incorrect – Plausible because the MU3971 Auto Transfer from the BWST to the MU Tank is lost when NNI X AC power is lost.

D. Incorrect – Plausible because the MU3971 Auto Transfer from the BWST to the MU Tank is lost when D2P and DBP power is lost

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Sys #	System	Category	KA Statement
004	Chemical and Volume Control System	K4. Knowledge of CVCS design feature(s) and/or interlock(s) which provide for the following:	Control interlocks on letdown system (letdown tank bypass valve)

K/A# K4.14 **K/A Importance** 2.8* **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02002 R08 page 16 note 3.5

Question Source: New **Level Of Difficulty: (1-5)** 2

Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR: 41.7)

Objective:

NOTE 3.5

If the Makeup Tank level decreases to 10 inches, MU 3971, MU PUMP 2 SUCTION THREE-WAY, and MU 6405, MU PUMP 1 SUCTION THREE-WAY, will automatically position to provide Makeup Pump suction from the BWST. MU 3971 and MU 6405 must be positioned to the BWST within 45 seconds from the time Makeup Tank level reaches 10 inches or the Makeup Pumps will automatically trip.

3.5 IF the Makeup Tank level decreases to 10 inches,
THEN verify the following:

3.5.1 MU 3971, MU PUMP 2 SUCTION THREE-WAY, switches to the BWST.

3.5.2 MU 6405, MU PUMP 1 SUCTION THREE-WAY, switches to the BWST.

NOTE 3.6 and 3.7

Failure of either Make-Up Tank level transmitter low will cause repositioning of both MU Pump suction valves to the BWST. This can be defeated by pulling fuse 3R FU1 in Panel RC4802. LT-MU16-1 or 2 failure low causes a low MUT level trip signal to MU Pump 2 or 1 respectively if not aligned to the BWST, after a 45 second time delay. The low level pump trips can be defeated by the installation of jumpers as detailed below.

3.6 IF LT-MU16-1 has failed low,
THEN perform the following:

3.6.1 Install jumper in RC4602, TB23R/24R, terminals 1 and 2.

3.6.2 Pull fuse 3R FU1 in Panel RC4802.

3.6.3 Place HIS 3971 and HIS 6405 to the MUT position.

3.6.4 Monitor level.

3.7 IF LT-MU16-2 has failed low,
THEN perform the following:

3.7.1 Install jumper in RC2825, TB22L, terminals 1 and 2.

3.7.2 Pull fuse 3R FU1 in Panel RC4802.

3.7.3 Place HIS 3971 and HIS 6405 to the MUT position.

3.7.4 Monitor level.

31. The following plant conditions exist:

- The plant is shutdown for maintenance in MODE 5.
- The RCS is vented to Containment Atmosphere.
- Shutdown cooling is provided by DHR Train 2.
- The RCS is 30 inches above the centerline of the RCS hotlegs.
- The plant has been shutdown for 10 days and RCS temperature is 100 °F.
- DH14A, Decay Heat Cooler 2 Outlet Valve is full open
- DH13A, Decay Heat Cooler,2 Bypass Valve is full closed

The following event occurs:

- DH14A, Decay Heat Cooler 2 Outlet Valve fully closes.

Based on these conditions, what is the time to RCS boil?

(Reference Attached)

A. 24 minutes

B. 31 minutes

C. 35 minutes

D. 155 minutes

Answer: C

Explanation/Justification:

A. Incorrect – Plausible if the Candidate misreads the curve. 24 minutes would be the time to boil if the initial temperature was 140°F.

B. Incorrect – Plausible if the Candidate misreads the curve. 31 minutes would be the time to boil if the initial temperature was 100°F but the candidate used the Low RCS level of 6 inches above Hot Leg Center Line. 30 inches is a low RCS level, but not for this curve.

C. Correct – From DB-PF-06703 R20, Page 57 CC6.3c, the correct time to boil is 35 minutes.

D. Incorrect – Plausible if the Candidate uses CC6.3d, time to boil to top of core which will be provided.

Sys #	System	Category	KA Statement
005	Residual Heat Removal System (RHRS)	K6. Knowledge of the effect of a loss or malfunction on the following will have on the RHRS:	RHR heat exchanger

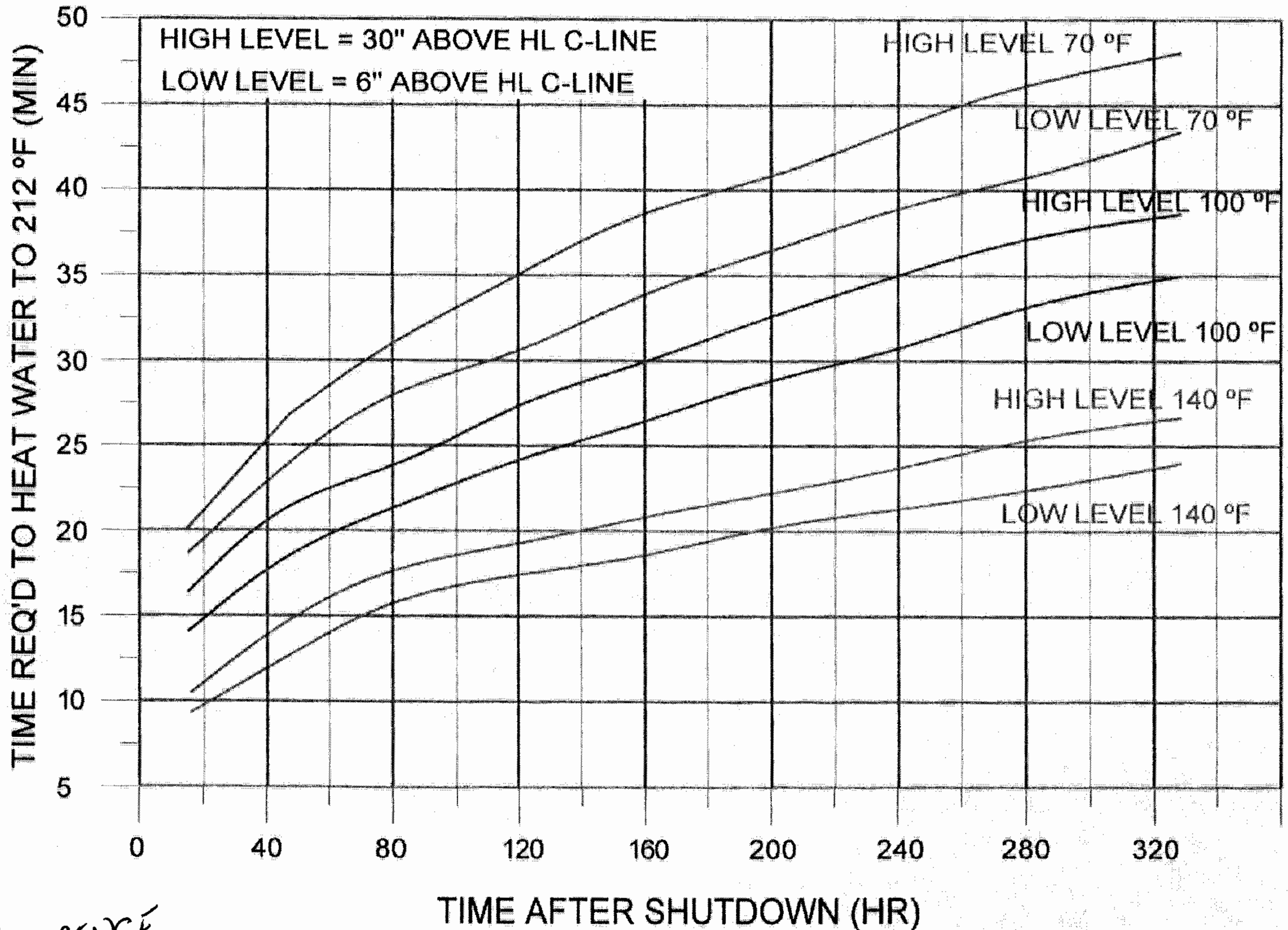
K/A# K6.03 **K/A Importance** 2.5 **Exam Level** RO

References provided to Candidate DB-PF-06703 Rev 20 CC6.3.c and CC6.3.d **Technical References:** DB-PF-06703 Rev 20 CC6.3.c and CC6.3.d

Question Source: BANK 29427 **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Application **10 CFR Part 55 Content:** (CFR: 41.7 / 45.7)

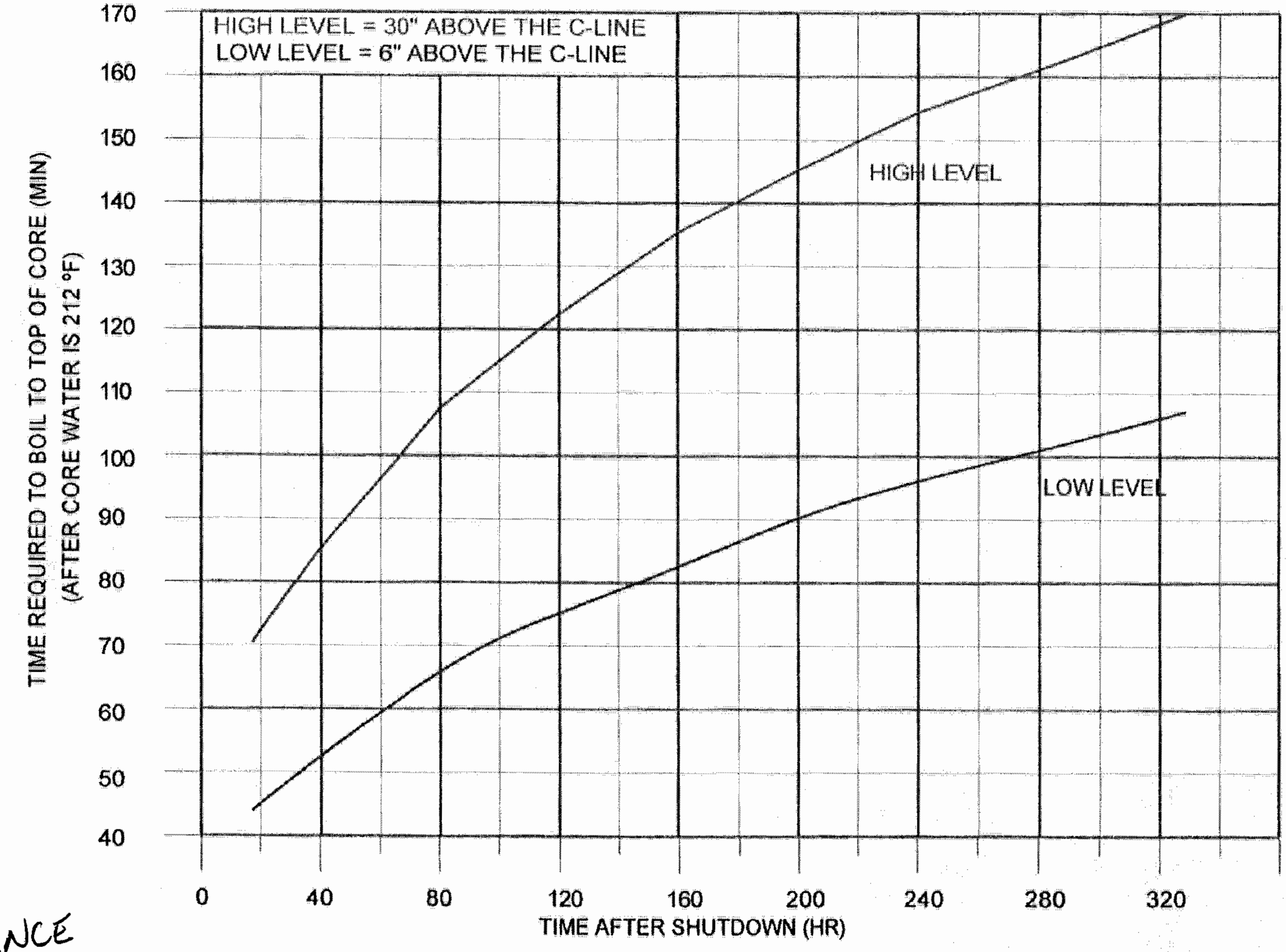
Objective:



TIME TO HEAT RV WATER TO 212 °F AS A FUNCTION OF DECAY HEAT, INIT RV TEMP. & INIT RV LEVEL

REFERENCE PROVIDED TO CANDIDATE

TIME TO BOIL TO TOP OF CORE AS A FUNCTION OF INIT LEVEL & DECAY HEAT



REFERENCE PROVIDED TO CANDIDATE

C6.3d

32. Which ONE of the following is the reason a break in the 14 inch line between the reactor vessel and CF 30, CFT 1-2 TO REACTOR CHECK VALVE, will not result in exceeding the peak allowable cladding temperature of 2200 °F?

A. Leak is at an elevation that will not uncover the core.

B. The Core Flood line flow restrictor at the Reactor Vessel limits the size of the leak from the Reactor Coolant System.

C. 14 inches is less than the size required to cause a large break LOCA.

D. One train of Core Flood meets all postulated loss of coolant accidents.

Answer: B

Explanation/Justification:

A. Incorrect – Plausible if the candidate assumes the injection lines enter the vessel above the top of the core so the core won't uncover

B. Correct – CFTs are not redundant therefore the flow restrictor limits leak size to allow one CFT to limit peak clad temperature

C. Incorrect – Plausible if Candidate does not know what break size is classified as a large break LOCA

D. Incorrect – Plausible because most safety systems have 2 fully redundant trains, only one of which is required to meet ECCS Criteria. Both Core Flood Tanks are required to meet ECCS Criteria.

Sys #	System	Category	KA Statement
006	Emergency Core Cooling System (ECCS)	K6. Knowledge of the effect of a loss or malfunction on the following will have on the ECCS:	Core flood tanks (accumulators)

K/A# K6.02 **K/A Importance** 3.4 **Exam Level** RO

References provided to Candidate None **Technical References:** SD-040 R4 page 1-4 step 1.2.3.2

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.7 / 45.7)

Objective:

1.2.2.2 Dynamic Loading

The Core Flooding System shall be able to perform the function of injecting borated water to the Reactor Vessel assuming a simultaneous occurrence of:

a. A Design Basis LOCA, and

b. The Maximum Possible Earthquake.

1.2.2.3 Classification

As required by Safety Guide 26 (March 72), the piping was purchased as ASME Section III, Class 2 because it is part of an Emergency Core Cooling System. The Core Flood Tanks were purchased per the 1968 ASME Section III, Class "C" code that is the equivalent of Class 3 in post 1971 codes.

1.2.3 System Configuration and Interface Requirements

1.2.3.1 Containment Isolation

Each Core Flooding System line penetrating the containment vessel shall be supplied with appropriate containment isolation valves.

For purposes of determining Containment Vessel isolation requirements, the Core Flooding Tank is not considered to be a closed system inside containment but rather as part of the RC pressure boundary (Ref. 4.2.7 and 4.2.6). Therefore, 10CFR50 Appendix A Criterion 55 is applicable to the Core Flooding System lines, which penetrate containment.

1.2.3.2 Two Train System

The Core Flooding System configuration shall consist of two trains, each consisting of a CFT connected through a separate line to separate reactor vessel core flooding nozzles. These two trains are not redundant because both CFS trains are required for the large break LOCA.

The reactor vessel core-flooding nozzle has a venturi flow restriction to limit flow through the nozzle. During a CFT line break between the reactor vessel and the first check valve in the line, one CFT and one LPI/DH train will be unavailable. With an additional single failure assumption (Emergency Diesel Generator supplying unaffected LPI/DH pump) injection is limited to one CFT and one HPI pump. The flow restriction is required to limit flow out of the core such that injection from the operable CFT and HPI pump is adequate. (Ref. 4.1.6, 4.2.4)

1.2.3.3 Single Failure

Both trains of the Core Flooding System shall be able to perform the emergency core cooling function of injecting borated water into the Reactor Vessel assuming a single failure.

Except for the check valves, LOCA analyses assume no active failure will prevent the Core Flooding System from performing its ECCS function. Both Core Flooding System trains are available for discharging to the Reactor Vessel, except for a Core Flooding Tank Discharge line break. With the exception of the check valves, no active components can fail and thus prevent this function. (Ref. 4.1.6, 4.2.4).

When the plant was being constructed, design considerations for passive components were under development. (Refer to 10CFR50 Appendix A for definition of single failure.) The assumption was made that failures of the Core Flooding System did not need to be assumed and the system was licensed as such.

33.
- The PORV is leaking
- The Quench Tank Circulating Pump is isolated for maintenance
- Reactor Coolant System pressure is 2155 psig

The Quench Tank Relief Valve failing open will cause level to rise in the:

A. Waste Gas Surge Tank

B. Reactor Coolant Drain Tank

C. Containment Normal Sump

D. Clean Waste Receiver Tank

Answer: C

Explanation/Justification:

A. Incorrect – Plausible since the Quench Tank can be lined up to vent to the Waste Gas Header
B. Incorrect – Plausible since a majority of the RCS relief valves relieve to the RCDT
C. Correct – because the Quench Tank relieves to the Normal Sump
D. Incorrect – Plausible since RCS discharge would be considered clean waste

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Sys #	System	Category	KA Statement
007	Pressurizer Relief Tank/Quench Tank System (PRTS)	K3. Knowledge of the effect that a loss or malfunction of the PRTS will have on the following:	Containment

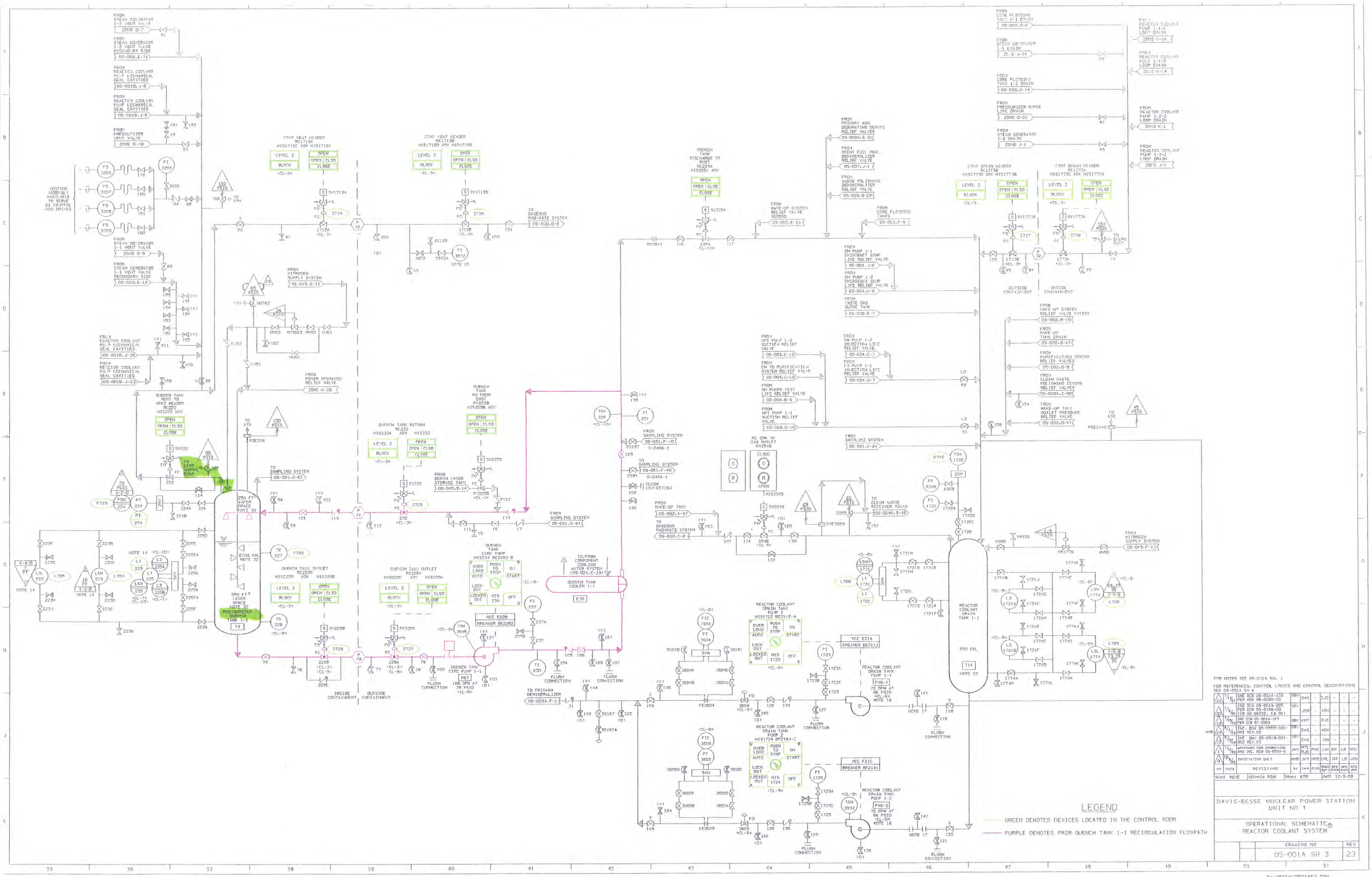
K/A# K3.01 **K/A Importance** 3.3 **Exam Level** RO

References provided to Candidate None **Technical References:** Ops Schematic OS-001A Sheet 3

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.7 / 45.6)

Objective:



NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DES MGR
21	7/13/07	INC DCN OS-001A-138 PER MOD 95-0050-00	SBV	SAS	-	SJO	-	-	-
20	7/6/05	INC DCN OS-001A-205 PER ECR 05-0186-00 (CR 02-06232, CA 01)	SBV	JOR	-	ACH	-	-	-
19	1/03/00	INC DCN OS-001A-163 PER DCR 93-0003	SBV	KNF	-	RJC	-	-	-
23	8/5/09	INC. DUN 09-0955-001-001 REV.00	SBV	SAS	-	AGM	-	-	-
22	5/26/09	INC. DUN 09-0518-001-002 REV.00	SBV	SAS	-	JJH	-	-	-
1	1/16/90	APPROVED FOR OPERATION AND INC. DCN OS-001A-3	JHO	MYL RJC	PHC	JJH	EM	LB	VMW
0	12/9/88	INFORMATION ONLY	HMB	JVT	HRB	CML	GM	LB	JAN

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34. Reactor Power is 75% and stable.

- Component Cooling Water (CCW) Pump 1 is running
- Component Cooling Water (CCW) Pump 2 is in standby
- Component Cooling Water (CCW) Pump 3 is aligned to side 1 as spare

The following occurs:

- CCW Pump 1 trips
- CCW Pump 2 does not start

The Reactor Operator attempts to start CCW Pump 1 and 2 from the control room and neither pump starts

Based on these conditions, identify the ONE statement below that identifies the **required** action(s) to be implemented

A. Reduce Reactor Power to 72% in preparation for shutdown of an RCP.

B. Trip the Reactor and trip all RCPs.

C. Commence a Rapid Shutdown and monitor the Reactor Coolant Pumps.

D. Monitor the Reactor Coolant Pumps and place the spare Component Cooling Water Pump 3 in service.

Answer: B

Explanation/Justification:

A. Incorrect – Plausible since this would be the actions for loss of CCW to one RCP when reaching the required RCP trip parameters

B. Correct – CCW abnormal procedure directs tripping the Reactor and all 4 RCPs in the event of the running and standby pumps being unable to be started

C. Incorrect – Plausible because reducing power would reduce heat loading and the candidate may assume it is not required to trip the RCP or the Reactor until required trip parameters are reached.

D. Incorrect – Plausible if the candidate assumes the spare CCW pump may be able to be placed in service prior to reaching required RCP trip parameters

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Sys #	System	Category	KA Statement
008	Component Cooling Water System (CCWS)	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the CCWS, and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Loss of CCW pump

K/A# A2.01 **K/A Importance** 3.3 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02523 R09 step 4.3.1 page 28

Question Source: New **Level Of Difficulty: (1-5)** 2.5

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Objective:

4.3 Operating Component Cooling Water Pump Failure

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.3.1 Verify the standby CCW Pump starts.	IF the standby CCW Pump fails to start, THEN perform the following: ___ a. Check breaker targets on previously running CCW pump breaker. ___ b. IF NO targets are present THEN attempt to start the previously running CCW pump. c. **IF AT ANY TIME** the running AND standby CCW Pumps can not be started, THEN perform the following: ___ 1. Trip the Reactor. ___ 2. Trip ALL RCPs. ___ 3. IF an EDG is running without CCW cooling, THEN stop the affected EDG using the local **Emergency Shutdown Pushbutton**. ___ 4. GO TO DB-OP-02000. RPS, SFAS, SFRCS Trip, or SG Tube Rupture.

35. The Plant is in Mode 1

In accordance with Technical Specifications, which one of the following conditions requires action to be completed in **less than 30 minutes** to remain in compliance with Technical Specifications requirements?

A. Pressurizer Level is greater than 228 inches.

B. One Pressurizer Code Safety Valve setpoint is set greater than 2525 psig.

C. No power is available to the Pressurizer Power Operated Relief Valve.

D. The Block Valve for the Pressurizer Power Operated Relief Valve is closed.

Answer: B

Explanation/Justification:

A. Incorrect – Plausible because when this condition is encountered in the simulator, the candidates take prompt action to restore Pressurizer Level to within limits.

B. Correct – Per Technical Specifications Pressurizer Safety Valves to be Operable requires a setting of less than or equal to 2525 psig. A setpoint greater than 2525 renders the valve inoperable. Action is required within 15 minutes per TS 3.4.10 Condition A.

C. Incorrect – Plausible since this condition renders the PORV inoperable and required action within one hour to close the PORV Block valve per TS 3.4.11 Condition B.

D. Incorrect – Plausible since this condition would render the PORV inoperable and requires action per TS 3.4.11 Condition B.

Sys #	System	Category	KA Statement
0	Pressurizer Pressure Control System (PZR PCS)	Generic	Knowledge of less than or equal to one hour Technical Specification action statements for systems.

K/A# 2.2.39 **K/A Importance** 3.9 **Exam Level** RO

References provided to Candidate None **Technical References:** TS 3.4.10 Condition A (Amendment 279)

Question Source: New **Level Of Difficulty: (1-5)** 3.5 - 4

Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR: 41.7 / 41.10 / 43.2 / 45.13)

Objective:

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.10 Pressurizer Safety Valves

LCO 3.4.10 Two pressurizer safety valves shall be OPERABLE with lift settings $\leq$ 2525 psig.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One pressurizer safety valve inoperable.	A.1 Restore valve to OPERABLE status.	15 minutes
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> Two pressurizer safety valves inoperable.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.10.1	Verify each pressurizer safety valve is OPERABLE in accordance with the Inservice Testing Program. Following testing, lift settings shall be within ± 1%.	In accordance with the Inservice Testing Program

36. Essential Bank 2 Pressurizer heater bank control switch is in the ON position. If RCS pressure is stable at the normal operating point, and Pressurizer level decreases to 37", which ONE of the following explains the status of the Essential Bank 2 heaters?

The heater bank is ________________

A. energized because manual control overrides the Pressurizer low-low level heater cutoff.

B. de-energized because the Pressurizer low-low level heater cutoff overrides manual control.

C. energized because Pressurizer level is above the low-low level heater cutoff setpoint

D. de-energized because normal RCS pressure is above the heater bank cycle setpoint.

Answer: A

Explanation/Justification:

A. Correct – In automatic, the design of the Pressurizer Heaters removes power on LOW LOW pressurizer Level (40 inches). Operating the Pressurizer in manual (ON) overrides this design feature.

B. Incorrect – Plausible if the candidate does not understand that the "ON" position for the heaters overrides the Low level cutoff.

C. Incorrect – Plausible if the candidate does not know the setpoint for low low pressurizer level and thinks it is less than 40 inches. A pressurizer level of 37 inches is still above the top of all Pressurizer heaters

D. Incorrect – Plausible if the candidate does not understand the interlock but knows this bank of heaters is off at normal RCS Pressure.

Sys #	**System**	**Category**	**KA Statement**
10	Pressurizer Pressure Control System (PZR PCS)	K4. Knowledge of PZR PCS design feature(s) and/or interlock(s) which provide for the following:	Prevention of uncovering PZR heaters

K/A# K4.02 **K/A Importance** 3.0 **Exam Level** RO

References provided to Candidate None

Technical References: DB-OP-06003 R29 Attachment 7
PZR Heater Control Panel Placard
DB-OP-02513 R11 4.6.4 RNO

Question Source: BANK 37164

Level Of Difficulty: (1-5) 3

Question Cognitive Level: High - Comprehension

10 CFR Part 55 Content: (CFR: 41.7)

Objective:

ATTACHMENT 7: PRESSURIZER PRESSURE AND LEVEL SETPOINTS

Page 1 of 1

PRESSURE SETPOINTS (PRS RC2A1)		LEVEL SETPOINTS (LRS RC14)	
		INCHES	
		327	Upper Connection for Level Transmitter
PSIG			
2500	Pressurizer Safety Valves Open	320	Maximum Level Indication
2450	Pressurizer Safety Valves Reseat		
2450	Electromatic Relief Valves Open	275	High-High Level Alarm
2400	Electromatic Relief Valves Closed	226	High Level Alarm
2205	Spray Valve Opens		
2155	Normal Operating Pressure, Spray Valve Closes, Heater Bank 2 (2A) goes off	220	Normal Operating Level
2140	Heater Bank 3 off	200	Low level alarm
2135	Heater Bank 2 (2A) on		
2125	Heater Bank 4 (2B) off	40	Low-Low Level Alarm Pressurizer heater interlock
2120	Heater Bank 3 on	26	Start to uncover heaters
2105	Heater Bank 4 (2B) on		
2055	RCS Low Pressure Alarm		

4.6 Failure of Selected Pressurizer Level or Temperature Instruments

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.6.1 Place MU32 in HAND.	
___ 4.6.2 Adjust demand on MU32 to obtain desired Makeup Flow or Pressurizer Level.	
4.6.3 Compare Pressurizer level and temperature instruments and select a functional alternate level or temperature instrument. Level (HSRC14) ___ • LT RC14-1 (L772) ___ • LT RC14-2 (L774) ___ • LT RC14-3 (L773) Temperature (HSRC15) ___ • TT RC15-1 (T776) ___ • TT RC15-2 (T777)	
___ 4.6.4 IF a functional instrument is selected, THEN return MU32 to AUTO.	IF a functional instrument can not be selected OR is not available to provide compensated Pressurizer Level, THEN perform the following: ___ • Adjust demand on MU 32 to obtain desired Pressurizer Level. REFER TO DB-PF-06703, Curve CC4.1 Actual-vs- Indicated Pressurizer Level (147 inches uncompensated = 228 inches compensated) ___ • IF Pressurizer Heaters are interlocked off due to low indicated Pressurizer Level, THEN manually operate Pressurizer Heaters as necessary to maintain desired RCS Pressure.

37. The following plant conditions exist:

The plant is operating at 100% power.
RPS Channel 1 is in Manual Bypass.

The following event occurs:

- RCS Pressure exceeds the RPS High RCS Pressure Trip setpoint
- RPS Channels 2 and 4 Trip
- RPS Channel 3 fails to trip

How will the CRD Breakers respond to these conditions?

A. No CRD Trip Breakers will open.

B. Only the “A” and “C” breakers will open.

C. Only the “B” and “D” breakers will open.

D. All CRD Trip Breakers will open.

Answer: D

Explanation/Justification: Note: Actuation of an RPS Channel trips the respective CRD Breaker by removing DC control power from the breaker. This DC Control Power is internally generated in the Reactor Protective System, not supplied from an external source..

A. Incorrect – Plausible if the candidate believes the logic of RPS is the same as the Steam Feed Rupture Control System where Channels 1 and 3 are actuation channel 1 and Channels 2 and 4 are actuation channel 2. If only a single actuation channel trips, a full SFRCS actuation does not occur.

B. Incorrect – Plausible if the Candidate does not understand the relationship between RPS Channels and CRD Breakers. RPS Channels 1, 2, 3, 4, supply CRD Breaker B, A, D, C respectively.

C. Incorrect – Plausible if the Candidate does understand the relationship between RPS Channels and CRD Breakers. RPS Channels 1, 2, 3, 4, supply CRD Breaker B, A, D, C respectively but does not understand the logic of RPS as noted in distractor 1 above.

D. Correct – IAW DB-OP-06403, Attachment 4, Page 59, Relays KB and KD remain energized and their correstonding contacts in each RPS cabinet remain closed, howver the KA and KC relays de-energize. The corresponding KA and KC contacts open in each cabinet interrupting DC Control Power to the associated CRD Breaker and causing the breakers to trip.

Sys #	System	Category	KA Statement
012	Reactor Protection System (RPS)	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the RPS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Loss of dc control power

K/A# A2.07 **K/A Importance** 3.2* **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06403 R19, Attachment 4, Page 59

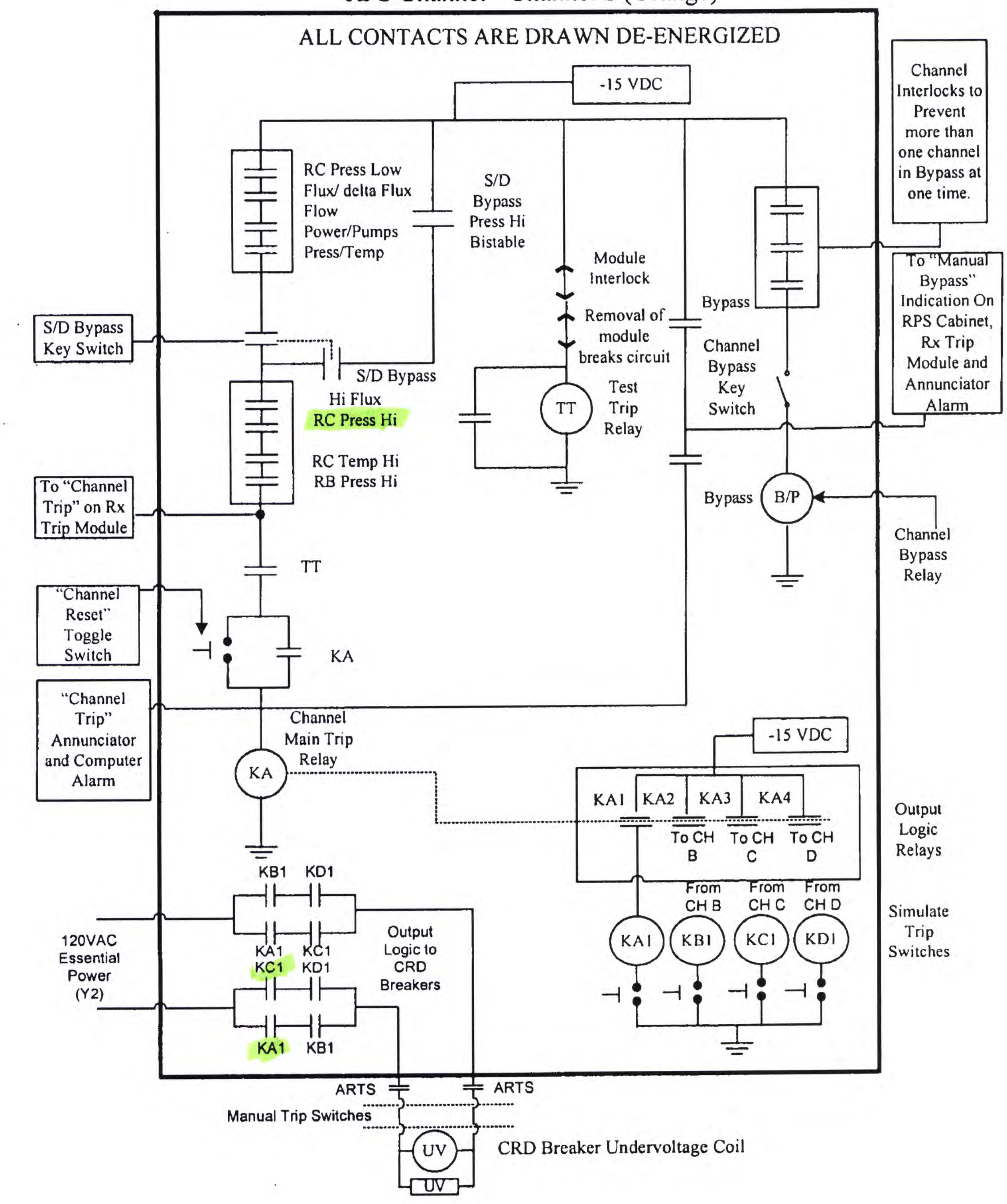
Question Source: New **Level Of Difficulty: (1-5)** 2.5

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** (CFR: 41.5 / 43.5 / 45.3 / 45.5)

Objective:

ATTACHMENT 4: TYPICAL SIMPLIFIED SCHEMATIC OF A RPS CHANNEL (2)

RPS Channel - Channel 2 (Orange)



38. The plant was operating at 75% power with all systems in normal alignment for this power level.

The following plant conditions **NOW** exist:

- SG 1 pressure is 880 psig.
- SG 2 pressure is 150 psig.
- Reactor Coolant System pressure is 1700 psig and steady.
- Reactor Coolant System temperature is 530 °F and steady.
- Containment pressure is 19 psia and lowering.
- All systems function as designed.

With NO operator action, what will be the control level setpoint for SG 1?

A. 49 inches

B. 55 inches

C. 124 inches

D. 130 inches

Answer: D

Explanation/Justification:

A. Incorrect – Plausible if the Candidate does not diagnose an SFAS level 2 trip or SG 2 isolation on low pressure since this is normal level for a SFRCS actuation without SG low pressure trip

B. Incorrect – Plausible if the Candidate knows level is controlled at 55" by the opposite side pump on SG low pressure SFRCS trip but doesn't diagnoses the SFAS level 2 trip or know setpoint is raised to high on a SA2

C. Incorrect – Plausible since this is the normal level for SFRCS actuation on an SFAS 2 with no SG isolation. Diagnoses SA2 but not SFRCS low pressure.

D. Correct – SFAS level 2 on CTMT pressure (18.7psia) will raise the setpoint to high and AFP 2 will control level at 130" with AFP 1 setpoint at 124" due to SG 2 SFRCS low pressure trip (630psig)

Sys #	System	Category	KA Statement
013	Engineered Safety Features Actuation System (ESFAS)	K1. Knowledge of the physical connections and/or cause effect relationships between the ESFAS and the following systems:	AFW System

K/A# K1.07 **K/A Importance** 4.1 **Exam Level** RO

References provided to Candidate None **Technical References:** OS-17A SH1 R26 CD-1, DBBP-TRAN-0034 R06 page 8&9

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective:

ATTACHMENT 2: LICENSED OPERATOR MEMORY LIST

STEAM FEED RUPTURE CONTROL SYSTEM	
Name	**Setpoint (nominal)**
Manual	Pushbutton specific
Steam Generator Low Level	23.5 inches
Loss of 4 RCP's	RCP Contact Monitors
Steam Generator High Level	250 inches
Steam to Feed Reverse Differential Pressure	125 PSID
Main Steam Low Pressure	630 PSIG

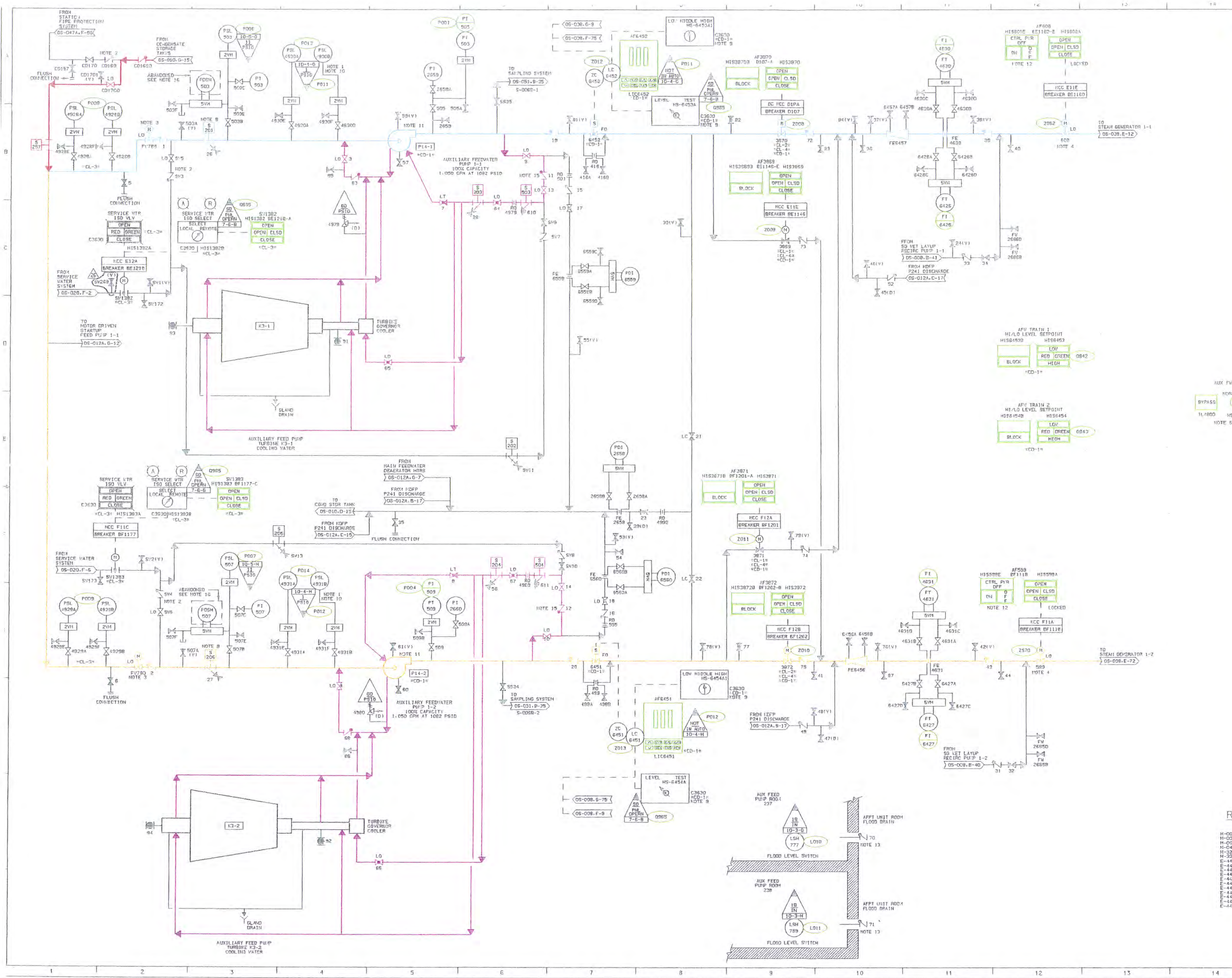
* Logic is 2 of 2 at the Input and Actuation level, Actuation Channel Specific: Logic Ch 1 & 3 are Actuation Channel 1, Logic Ch 2 and 4 are Actuation Channel 2. Actuation Channels start their respective train of AFW.

SFRCS Logic Channel Number	Logic Power Supply	Output Power Supply
1	Y1	Y1
2	Y2	Y2
3	YE2	D1P
4	YF2	D2P

ATTACHMENT 2: LICENSED OPERATOR MEMORY LIST
Page 4 of 11

SAFETY FEATURES ACTUATION SYSTEM	
Name	**Setpoint (nominal)**
RCS Pressure Low	1600 PSIG
RCS Pressure Low-Low	470 PSIG
Containment Pressure High	18.7 PSIA
Containment Pressure High-High	40 PSIA
BWST Low Low Level Transfer Permissive	9 FEET

SFAS Logic Channel Number	Logic Power Supply	Power Supply for DC Powered Components (i.e. solenoid operated valves)
1	Y1	D1P
2	Y2	D2P
3	Y3	D1P
4	Y4	D2P



CONTROL DESCRIPTION

CD-1: LIC6452 (ZONE A-8) IS TO BE USED TO CONTROL THE STEAM GENERATOR 1-1 LEVEL IN EITHER AN AUTOMATIC, MANUAL OR TEST MODE. IN THE AUTO MODE, LIC6452 AUTOMATICALLY CONTROLS THE SG LEVEL BY MODULATING VALVE 6452 POSITION (ZONE B-7). IF A STEAM AND FEEDWATER RUPTURE CONTROL SYSTEM (SFRCS) TRIP OCCURS, THE SG LEVEL WILL BE CONTROLLED AT 49 IN ON THE STARTUP RANGE. IF AN SFRCS AND AN SFAS LEVEL 2 TRIP IS PRESENT, THE SG LEVEL WILL BE CONTROLLED AT 124 IN ON THE STARTUP RANGE. HIS6453 (ZONE D-12) IS A HIGH-LOW SELECTOR SWITCH WHICH ALLOWS SELECTION OF EITHER THE 124 IN (GREEN) OR 49 IN (RED) SETPOINT. AN SFAS LEVEL 2 TRIP WILL CAUSE THIS SWITCH TO AUTOMATICALLY SELECT THE 124 IN LEVEL SETPOINT. THIS SFAS SIGNAL CAN BE BLOCKED USING HIS6453B (ZONE D-12) AND THE 49 INCH SETPOINT CAN BE RESELECTED USING HIS6453. IF A ≤ 630 PSI SFRCS OCCURS, VALVE 3870 (ZONE B-9) WILL CLOSE AND VALVE 3869 (ZONE C-9) WILL OPEN (SEE *CL-1*, *CL-2* AND *CL-4*) AND AUXILIARY FEEDWATER PUMP 1-1 (ZONE B-5) WILL FEED STEAM GENERATOR 1-2 TO 55 INCHES, OR TO 130 INCHES IF A LEVEL 2 SFAS COINCIDENTLY OCCURS. THE OTHER AFP REMAINS IN STANDBY AT HIGH SPEED STOP (3600 RPM) ON RECIRCULATION.

IN THE MANUAL MODE, LIC6452 WILL ALARM ANNUNCIATOR 10-4-G AND CAN ADJUST THE SG LEVEL BY THE "RAISE" OR "LOWER" PUSHBUTTONS ON THE LEVEL CONTROLLER LIC6452.

THE TESTING OF AUXILIARY FEEDWATER CONTROL CHANNEL 1 IS ACCOMPLISHED THROUGH THE LEVEL/TEST SELECTOR SWITCH HS6453A (ZONE B-8). IN ORDER TO TEST CHANNEL 1 HS6453A MUST BE PLACED IN THE "TEST" POSITION. THIS WILL ALARM THE "UNIT REMOTE SD PANEL IN OPERATION" ANNUNCIATOR (9-6-C). LIC6452 IS THEN ADJUSTED TO SELECT TESTING OF THE CHANNEL 1 AFW OR MDFP TARGET ROCK VALVES, 6452 OR FV6459 (OS-012A, C-16) RESPECTIVELY, BY DEPRESSING THE LIC6452 "TAG" PUSHBUTTON (NOT SHOWN) TO SELECT "TEST ONLY" FOR THE DESIRED VALVE. THE "DUMMY" SG LEVELS USED IN THE TEST ARE SOFTWARE CONFIGURED AS 0.0, 100.0 AND 250.0 INCHES AS SELECTED BY THE "LOW", "MIDDLE" OR "HIGH" POSITIONS ON HS6453A1 (ZONE A-8).

THE DESCRIPTION FOR LIC6451 (ZONE H-8), ANNUNCIATOR 10-4-H AND VALVES 6451 (ZONE G-7) AND FV6460 (OS-012A, B-16) IS SIMILAR.

NOTES

1. ANNUNCIATOR 10-4-G WILL ALARM WHEN SUCTION PRESSURE IS ≤1 PSIG FOR ≥60 SECONDS FOR PSL4930A OR PSL4930B (ZONE A-4). ANNUNCIATOR 10-4-H WILL ALARM WHEN SUCTION PRESSURE IS ≤1 PSIG FOR ≥60 SECONDS FOR PSL4931A OR PSL4931B (ZONE G-4).
2. VALVE INTERNALS HAVE BEEN REMOVED FROM VALVES SV3 (ZONE B-2), SV4 (ZONE G-2) AND CD169 (ZONE A-2).
3. VALVES FW786 AND FW790 (ZONES B-2 AND G-2) WILL BE OPERATED AS MANUAL VALVES. ALL ELECTRICAL INDICATION AND CONTROL CIRCUITY FOR THESE VALVES HAVE BEEN REMOVED. IN ADDITION TO VERIFYING THE VALVE POSITION, THE RED STEM LOCK MUST ALSO BE VERIFIED.
4. FOR VALVES 608 AND 599 (ZONES B-12 AND G-12), ONLY THE LOCAL HANDWHEELS AND LOCAL PUSHBUTTON STATIONS OF THESE MOTOR OPERATED VALVES ARE LOCKED. OPERATION FROM THE CONTROL ROOM IS NOT LOCKED.
5. ALL VALVES ARE PREFIXED WITH "AF" UNLESS OTHERWISE NOTED.
6. WHENEVER THE AF SYSTEM IS INOPERABLE, THE OPERATOR IS TO PLACE "AUX FW" SELECTOR SWITCH HS4800 (ZONE E-14) IN "NOT OPER" AS INDICATED BY THE "BYPASS" LIGHT (ZONE E-14).
7. FOR GENERAL NOTES, PIPING SYMBOLS, INSTRUMENTATION SYMBOLS, AND OPERATIONAL SCHEMATIC INDEX, SEE INDEX SHEET DWG OS-000.
8. STRAINER SCREEN HAS BEEN REMOVED.
9. THE FOLLOWING SELECTOR SWITCHES ARE LOCATED INSIDE OF THE AUXILIARY SHUTDOWN PANEL C3630:

COMPONENT	ZONE	COMPONENT	ZONE
HS6453A	B-8	HS6454A	J-8
HS6453A1	A-8	HS6454A1	G-8

10. FOR OPERATION OF PSL4930A, PSL4930B, PSL4931A AND PSL4931B (ZONES A-4 AND G-4) SEE OS-017B *CL-1* AND *CL-2*.
11. FOR OPERATION OF AUXILIARY FEEDWATER PUMPS 1-1 AND 1-2 (ZONES B-5 AND G-5) SEE OS-017B *CD-1*.
12. IN ORDER TO REPOSITION THE FOLLOWING VALVES, CONTROL POWER MUST BE ENERGIZED BY DEPRESSING THE "ON" PUSHBUTTON AT THEIR RESPECTIVE CONTROL POWER ON/OFF HANDSWITCH.

VALVE	ZONE	HANDSWITCH	ZONE
599	G-12	HIS599E	G-11
608	B-12	HIS608E	A-12

ONCE THE VALVE HAS BEEN REPOSITIONED, CONTROL POWER IS DEENERGIZED BY DEPRESSING THE "OFF" PUSHBUTTON.

13. AUXILIARY FEED PUMP TURBINE UNIT ROOM FLOOD DRAINS (ZONES J-10 AND K-10) WILL FLOW INTO THE CLEAN WASTE RECEIVER TANK ROOM SUMP 1-3 (OS-053, B-21).
14. SYSTEM IS LINED UP FOR AUTOMATIC AUXILIARY FEEDWATER PUMP OPERATION IN ACCORDANCE WITH APPLICABLE PROCEDURES.
15. CHECK VALVE INTERNALS HAVE BEEN REMOVED FROM AF11 AND AF12 (ZONES B-7 AND G-7).
16. INSTRUMENT IS ISOLATED FROM THE SYSTEM PROCESS AT THE MANIFOLD.

ANNUNCIATOR TABLE

ANNUNCIATOR	ANNUNCIATOR ENGRAVING
7-6-B	REMOTE SHUTDOWN PANEL IN OPERATION
10-3-G	AFP 1 ROOM LVL HI
10-3-H	AFP 2 ROOM LVL HI
10-4-G	AFP 1 TRBL
10-4-H	AFP 2 TRBL
10-5-G	AFP 1 SUCT PRESS LO
10-5-H	AFP 2 SUCT PRESS LO

LEGEND

GREEN DENOTES DEVICES LOCATED IN THE CONTROL ROOM

RED DENOTES COMMON AUXILIARY FEEDWATER FLOWPATH

BLUE DENOTES AUXILIARY FEEDWATER TRAIN 1

ORANGE DENOTES AUXILIARY FEEDWATER TRAIN 2

PURPLE DENOTES AUXILIARY FEED PUMP AND TURBINE COOLING WATER FLOWPATH

REFERENCES

DRAWINGS

FOR CONTROL LOGICS SEE OS-017A SH 2

DAVIS-BESSE NUCLEAR POWER STATION
UNIT NO 1

OPERATIONAL SCHEMATIC
AUXILIARY FEEDWATER SYSTEM

DRAWING NO: OS-017A SH 1 | REV: 26

39. The plant is in Mode 1 at 100% power with Service Water Returns aligned to the Cooling Tower.

A Large Break Loss of Coolant Accident occurs.

All equipment responds as designed.

Which of the Service Water System conditions below would result in inadequate service water flow to the Containment Air Cooler to remove the heat from Containment for this design bases event?

A. A loss of air to the in service CAC Outlet Temperature Control Valves.

B. The Service Water non-seismic header ruptures.

C. Train 1 SW flow is inadvertently aligned to CAC 1 and CAC3.

D. SW 2931, CLNG TOWER MAKEUP is inadvertently closed.

Answer: C

Explanation/Justification:

A. Incorrect – Plausible because the loss of air to the CAC Outlet Temperature Control Valves will cause the valves to fail open and allow full flow, but this is the expected condition for the LOCA event when SFAS Actuates.

B. Incorrect – Plausible because a rupture of the non-seismic header would divert Service Water flow from essential component, however in this condition, SW1395 and SW1399 would isolate the non-essential header.

C. Correct – In modes 1,2 and 3 service water must be isolated to the spare CAC to ensure flow through the two in service CACs is adequate to support post LOCA cooling requirements

D. Incorrect – Plausible since this is the inservice SW return flowpath, however the SW return flowpaths for the Intake Structure and the Forebay would open on high return pressure of 50 psig to provide a safety grade flowpath.

Sys #	System	Category	KA Statement
022	Containment Cooling System (CCS)	A1. Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CCS controls including:	Cooling water flow

K/A# A1.04 **K/A Importance** 3.2 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06016 R29 Step 2.2.4 page 4

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** (CFR: 41.5 / 45.5)

Objective:

1.0 PURPOSE

This procedure provides instruction for the operation of the Containment Air Cooling System.

2.0 LIMITS AND PRECAUTIONS

2.1 Administrative

2.1.1 Two Containment Air Cooling Trains shall be OPERABLE during MODES 1, 2, 3 and 4, in accordance with TS 3.6.6.

2.2 Equipment

2.2.1 Containment Air Cooler Fan speed should NOT be changed without waiting five minutes after stopping the fan before restarting. This precaution may be disregarded during an emergency condition at the discretion of the Shift Manager.

2.2.2 The Containment Air Cooler Fan Emergency Control Transfer Switch shall NOT be switched from NORMAL to LOCAL when the fan is operating in fast speed.

2.2.3 Containment Air Cooler Fan 3 power supply shall NOT be transferred without stopping the fan.

2.2.4 During MODES 1, 2, and 3, it is necessary to isolate service water to the standby Containment Air Cooler. With flow through the third Containment Air Cooler there would be inadequate service water flow in the two running Containment Air Coolers to meet post-LOCA cooling requirements.

2.2.5 During a LOCA, the temperature in Containment may reach 260°F resulting in a motor overload condition. The Containment Air Cooler Fans shall NOT be tripped on a motor overload during a LOCA.

2.2.6 During normal operation the maximum allowed motor bearing temperature is 160°F, as indicated by the following computer points:

(T295) CTMT CLR FAN 1 MTR F/E BRG OT
(T299) CTMT CLR FAN 2 MTR F/E BRG OT
(T303) CTMT CLR FAN 3 MTR F/E BRG OT
(T296) CTMT CLR FAN 1 MTR O/B BRG OT
(T300) CTMT CLR FAN 2 MTR O/B BRG OT
(T304) CTMT CLR FAN 3 MTR O/B BRG OT.

The respective fan shall be stopped if motor bearing temperature exceeds 160°F during normal operation.

The TSC shall be notified if the respective fan motor bearing temperature exceeds 160°F during a LOCA. TSC notification is to determine whether the CAC should remain in service or be shutdown.

40. The Plant is at 50% Power with #1 Makeup Pump out of service.

The following occurs:

ANNUNCIATOR ALARMS:

- SEAL INJ FLOW LO, 6-5-C
- SEAL INJ TOTAL FLOW, 6-6-C
- PZR LVL LO, 4-2-E

CTRM INDICATIONS:

- #2 Makeup Pump discharge pressure reads 0 psig
- MU32, PZR LEVEL CONTROL, indicates 100% demand
- MU19, RCP SEAL INJ FLOW CONTROL, indicates 100% demand
- PZR level is 155 inches

The crew has entered the appropriate Abnormal Operating Procedure.

What actions are **required** based on plant conditions?

A. Trip the Reactor. GO TO DB-OP-02000, RPS, SFAS, SFRCS TRIP, or SG Tube Rupture.

B. Commence a plant shutdown. GO TO DB-02504 Rapid Shutdown.

C. Trip Reactor Coolant Pumps 1-2 and 2-2. GO TO DB-OP-02515, Reactor Coolant Pump and Motor Abnormal Operation.

D. Place MU32 in hand. GO TO DB-OP-02513 Pressurizer Abnormal Operation.

Answer: A

Explanation/Justification:

A. Correct – Minimum level for Tave 582°F is 160 inches below which requires tripping the Reactor. This is the mitigating strategy for a loss of all Makeup Pumps. Tripping at 160 inches will ensure a minimum inventory is maintained in the Pressurizer and then depressurize to allow use of HPI to recover Pressurizer level.

B. Incorrect – Plausible if Candidate knows a shutdown is required but does not recognize PZR level less than 160 inches requires a reactor trip.

C. Incorrect – Plausible because MU Pump 2 is lost and reactor power is less than the 55% setpoint when 1 RCP is running in each loop.

D. Incorrect – Plausible because MU32 is 100% open and a pressurizer control failure may be diagnosed

---

Sys #	System	Category	KA Statement
004	Chemical and Volume Control System	Generic	Ability to recognize abnormal indications for system operating parameters that are entry-level conditions for emergency and abnormal operating procedures.

K/A# 2.4.4 **K/A Importance** 4.5 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02512 R14 step 4.1.3 page 8

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.10 / 43.2 / 45.6)

Objective:

4.0 SUPPLEMENTAL ACTIONS – LOSS OF RCS MAKEUP

4.1 Loss of RCS Makeup Pump(s)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.1.1 Isolate Letdown using MU2B.	___ Isolate Letdown using MU3 OR MU2A.
___ 4.1.2 Verify CCW is being supplied to the RCPs. REFER TO Attachment 1, Verification Of CCW Flow To Reactor Coolant Pumps.	IF the loss of CCW AND Seal Injection flow to all RCPs is confirmed, THEN perform the following: ___ a. Trip the Reactor. ___ b. Stop ALL RCPs. ___ c. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture. (The intent is to complete immediate and supplemental actions of DB-OP-02000 and go to DB-OP-02515, Reactor Coolant Pump and Motor Abnormal Operation).
4.1.3 **IF AT ANY TIME** PZR level is less than the minimum required level in accordance with Curve CC 4.3, Minimum Pressurizer Level vs. RC Temperature of DB-PF-06703, Miscellaneous Operation Curves (minimum level for Tave 582°F is 160 inches), THEN perform the following: ___ a. Trip the Reactor. ___ b. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.	

41. The plant is operating at 100% power

- EDG 2 has been started in accordance with DB-OP-06316, Emergency Diesel Generator Operating Procedure using the IDLE Start pushbutton and is running at 450 rpm.

The following event occurs:

- All Undervoltage Relays on D1 are actuated.
- All proper automatic actions occur.

Which of the following automatic and/or manual actions will be **required** to re-energize D1 bus?

A. The EDG field will flash automatically.
The EDG will accelerate to 900 RPM,
then AD101 EDG 2 Output Breaker will auto close.

B. The EDG will accelerate to 900 RPM.
The Idle Release Pushbutton must be depressed to flash the EDG field,
then AD101, EDG 2 Output Breaker must be manually closed.

C. The operator must depress the Idle Release Pushbutton before EDG 2 will accelerate to 900 RPM.
The EDG field will automatically flash,
then AD101, EDG 2 Output Breaker will auto close.

D. The operator must manually raise EDG 2 speed to 900 rpm.
The EDG field will flash automatically and the EDG output breaker,
AD101 EDG 2 Output Breaker must be manually closed.

Answer: A

Explanation/Justification:

A. Correct -The Idle Start/Stop Circuitry inhibits the voltage regulator by applying field shorting. An automatic start signal will release the Idle Start relay, accelerate the EDG, and enable the voltage regulator. The EDG output breaker would then auto close to restore power to D1 Bus.

B. Incorrect - The Idle Start/Stop Circuitry inhibits the voltage regulator by applying field shorting. An automatic start signal will release the Idle Start relay, accelerate the EDG, and enable the voltage regulator. Depressing the Idle release will not be necessary to flash the field.

C. Incorrect - The Idle Start/Stop Circuitry inhibits the voltage regulator by applying field shorting. An automatic start signal will release the Idle Start relay, accelerate the EDG, and enable the voltage regulator. Depressing the Idle release will not be necessary to accelerate the EDG.

D. Incorrect - The Idle Start/Stop Circuitry inhibits the voltage regulator by applying field shorting. An automatic start signal will release the Idle Start relay, accelerate the EDG, and enable the voltage regulator. Operator action to raise EDG speed will not be required. In addition, Operator action will not be necessary to close the EDG Output Breaker. The EDG output breaker would auto close to restore power to D1 Bus.

Sys #	**System**	**Category**	**KA Statement**
062	AC Electrical Distribution System	K1. Knowledge of the physical connections and/or cause/effect relationships between the ac distribution system and the following systems:	ED/G

K/A# K1.02 **K/A Importance** 4.1 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06316 R54, EDG Operating Procedure Step 2.2.12.

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.2 to 41.9)

Objective:

- If the limits on no-load/low-load or idle speed operation are reached, load should be raised gradually to approximately 2100 KW for a minimum of 30 minutes in order to raise combustion temperature and slowly vaporize unburned oil in the exhaust. This will minimize the chance of exhaust manifold fires.

2.2.3 Do not exceed 2600 KW or 450 Amps or 1950 KVARS load on the EDG except for emergency loads or when specified for testing. Refer to:

- Attachment 14 for a list of calculated AC Load Parameters and EDG Load Rating Limits.

- IF EDG JACKET OUT TEMP exceeds 190°F,
  THEN EDG load shall be limited per DB-PF-06703, Miscellaneous Operation Curves, Curve CC13.7, EDG Engine Rating at Elevated Temperature.

2.2.4 Minimize the time the EDG is loaded to less than 2100 KW to minimize wear on Turbocharger gears.

2.2.5 If the Plant is in MODE 5 or 6, power factor of 0.8 may not be achievable due to light bus loading and resultant high voltage. This condition is acceptable.

2.2.6 In the event the EDG must be returned to service during the 10 minute idle stop cycle, the remote START pushbutton on local Panel C3615 or C3616 or Control Room Panel C5715 must be depressed and held for 15 seconds.

2.2.7 During the idle stop cycle, the START pushbutton on Engine Control Panel C3621 or C3622 is bypassed and can not be used to return the EDG to service.

2.2.8 To stop the EDG except for an emergency shutdown, the unit should be unloaded prior to depressing the STOP pushbutton.

2.2.9 If the EDG does not reach 200 RPM within 7 seconds of receiving a start signal, then the FAIL-TO-START Relay will time out and shut down the EDG. The local lockout relay RESET pushbutton on C3615 or C3616 must be depressed to clear the condition.

2.2.10 If the EDG being started does not require the 10-second start to approximately 900 RPM, the EDG should be Idle Started-Idle Released, to prolong the life and reliability of the Diesel Generators. Idle Release should occur once engine oil pressure has stabilized and water temperature has reached 120°F.

2.2.11 Under normal conditions the EDG should be gradually loaded in steps with a period of 30 to 90 seconds per step, the total time being between 5 to 15 minutes until the desired load is reached. This allows for engine components time to heat up evenly, reducing thermal stresses on the components.

2.2.12 The Idle Start/Stop Circuitry inhibits the voltage regulator by applying field shorting. An automatic start signal, an idle release, Control Room start pushbutton, or EDG Relay Panel start pushbutton will release the Idle Start Relay, accelerate the EDG, and enable the voltage regulator.

42. The Plant has experienced a Loss Of Coolant Accident with SFAS Levels 1 and 2 initiating. All equipment responded as designed.

Subsequently, a Loss of Off-Site Power occurs and Bus F1 is lost when the #2 EDG ~~starts and~~ restores power to Bus D1.

The Loss Of Coolant Accident continues to degrade with SFAS Levels 3, and 4 initiating

Without Operator action, what is the current status of the Containment Spray Train 2?

Containment Spray Pump 2 is ______(1)______.

CS1531, Containment Spray 2 Discharge Valve is ______(2)______.

A. (1) Off
(2) Closed

B. (1) Running
(2) Closed

C. (1) Off
(2) Open

D. (1) Running
(2) Open

Answer: C

Explanation/Justification:

A. Incorrect – Plausible if the candidate believes CS1531 opens on the SFAS Level 4 actuation, but does realize the Containment Spray Pumps is a 480 volt load and is lost when F1 is lost.

B. Incorrect – Plausible if the candidate believes CS1531 opens on the SFAS Level 4 actuation, but fails to realized the Containment Spray Pump is a 480 load as unlike the other SFAS Actuated Pumps that are supplied from 4160 essential power.

C. Correct CS1531 opens on the SFAS Level 2 actuation and is therefore unaffected when F1 loses power. Since the Containment Spray pump is supplied from F1, it will be off when F1 is lost.

D. Incorrect – Plausible is the candidate understands CS1531 opens on the SFAS Level 2 actuation, but fails to realized the Containment Spray Pump is a 480 load as unlike the other SFAS Actuated Pumps that are supplied from 4160 essential power.

Sys #	**System**	**Category**	**KA Statement**
026	Containment Spray System (CSS)	K2. Knowledge of bus power supplies to the following:	MOVs

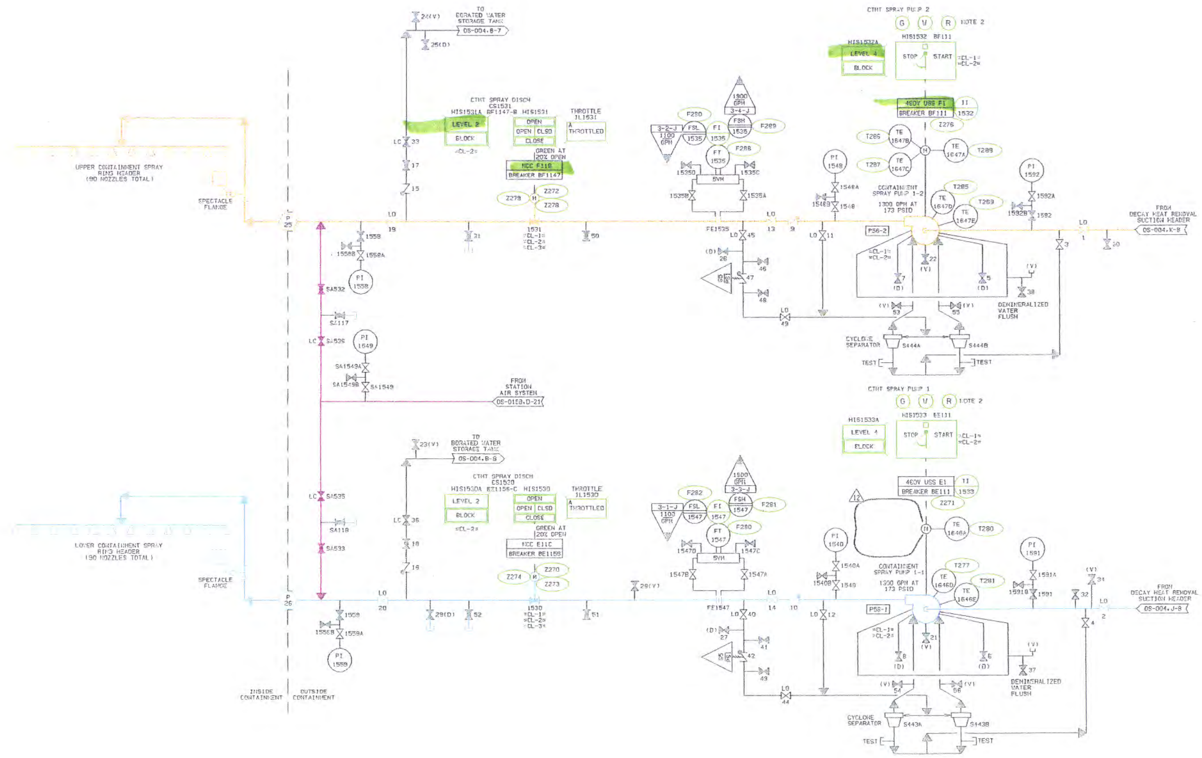
K/A# K2.02 **K/A Importance** 2.7* **Exam Level** RO

References provided to Candidate None **Technical References:** OS-005 R12

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7)

Objective:



CONTROL LOGICS

#CL-1# CONTAINMENT SPRAY PUMP 1-1 (ZONE H-9) WILL START PROVIDED ITS HANDSWITCH HIS1533 (ZONE F-9) IS IN "START" AND CONTAINMENT SPRAY PUMP 1-1 OUTLET VALVE 1530 (ZONE H-6) IS NOT CLOSED. SEE #CL-2#.

LOGIC FOR PUMP 1-2 (ZONE E-9) AND VALVE 1531 (ZONE E-6) IS SIMILAR.

#CL-2# WITH REGARD TO THE CONTAINMENT SPRAY SYSTEM, THE FOLLOWING ACTIONS WILL OCCUR DURING A SAFETY FEATURES ACTUATION SYSTEM (SFAS) SIGNAL:

COMPONENT	SIGNAL	ZONE	ACTION	REMARKS
LEVEL 2				
VALVE 1530	SA251A	H-6	OPENS	BLOCK PUSHBUTTON
VALVE 1531	SA252A	E-6	OPENS	BLOCK PUSHBUTTON
LEVEL 4				
PUMP 1-1	SA411A	H-9	STARTS	BLOCK PUSHBUTTON
PUMP 1-2	SA412A	E-9	STARTS	BLOCK PUSHBUTTON

TO STOP A CONTAINMENT SPRAY PUMP OR TO CLOSE A CONTAINMENT SPRAY VALVE DURING AN SFAS, EACH COMPONENT'S "BLOCK" PUSHBUTTON MUST BE DEPRESSED FIRST.

#CL-3# TO OPEN CONTAINMENT SPRAY PUMP 1-1 OUTLET VALVE 1530 (ZONE H-6) FULLY, CONTAINMENT EMERGENCY SUMP VALVE DH9B (OS-004, K-4) MUST BE CLOSED.

-VALVE 1530 WILL ONLY OPEN TO THE APPROXIMATELY 57% OPEN POSITION PROVIDED ITS "OPEN" PUSHBUTTON HIS1530 (ZONE G-6) IS DEPRESSED AND VALVE DH9B IS OPEN.
-IF VALVE 1530 >APPROXIMATELY 57% OPEN AND DH9B OPENS, THEN VALVE 1530 WILL CLOSE TO THE APPROXIMATELY 57% OPEN POSITION AUTOMATICALLY.

SEE #CL-1#, #CL-2#. SEE OS-004 #CL-5# FOR DH9A AND DH9B OPERATION.

LOGIC FOR VALVES 1531 (ZONE E-6) AND DH9A (OS-004, J-4) IS SIMILAR.

NOTES

1. ALL VALVES ARE PREFIXED WITH "CS" UNLESS OTHERWISE NOTED.
2. WHITE INDICATING LIGHT (ZONES F-9 AND C-9) WILL ILLUMINATE IF CONTAINMENT SPRAY PUMP 1-1 OR 1-2 (ZONES H-9 AND E-9) HAS A PHASE B OVERCURRENT CONDITION AS SENSED BY 51 RELAY.
3. FOR GENERAL NOTES, PIPING SYMBOLS, INSTRUMENTATION SYMBOLS, AND OPERATIONAL SCHEMATIC INDEX, SEE INDEX SHEET DWG OS-000.
4. WHENEVER THE CS SYSTEM IS INOPERABLE, THE OPERATOR IS TO PLACE HANDSWITCH HS4805 (ZONE D-14) IN "NOT OPER" AS INDICATED BY THE "BYPASS" LIGHT (ZONE D-14).
5. SYSTEM IS LINED UP FOR EMERGENCY STANDBY OPERATION IN ACCORDANCE WITH PROCEDURES.

ANNUNCIATOR TABLE

ANNUNCIATOR	ANNUNCIATOR ENGRAVING
3-1-J	CS PMP 1 DISCH FLOW LO
3-2-J	CS PMP 2 DISCH FLOW LO
3-3-J	CS PMP 1 DISCH FLOW HI
3-4-J	CS PMP 2 DISCH FLOW HI

LEGEND

GREEN DENOTES DEVICES LOCATED IN THE CONTROL ROOM

BLUE DENOTES CONTAINMENT SPRAY TRAIN 1

ORANGE DENOTES CONTAINMENT SPRAY TRAIN 2

PURPLE DENOTES STATION AIR SYSTEM FLOWPATH

REFERENCES

DRAWINGS

M-034
M-320-55
M-320-56
E-528 SH 7A
E-528 SH 7B
E-528 SH 21A
E-528 SH 21B
E-528 SH 54B

NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DES VER
11	2/10/05	INC. DCN 0S-005-16 PER ECR 04-0271-00 AND DCN 0S-005-18 PER ECR 05-0282-00	SBV	BTR	-	NJB	-	-	-
10	1/23/05	INC. DCN 0S-005-15 PER ECR 04-0271-00 AND DCN 0S-005-17 PER ECR 05-0282-00	SBV	RHB	-	JPH	-	-	-
12	3/30/10	INC. DWN 09-0740-001 -010 REV.00	SBV	S/S	-	AGM	-	-	-
1	8/07/85	APPROVED FOR OPERATION AND INC DCN OS-005-1	VAB	JJS	PNC	JAN	LDH	LWB	VMV
0	5/23/88	INFORMATION ONLY	HHB	JVT	HRB	AJD	CSM	GRL	JAN

SCALE NONE | DESIGNED RM | DRAWN ATR | DATE 5-23-88

DAVIS-BESSE NUCLEAR POWER STATION
UNIT NO 1

OPERATIONAL SCHEMATIC ©
CONTAINMENT SPRAY SYSTEM

DRAWING NO OS-005 | REV 12

DFN=F:\OPSCH\OS05.DGN
DB: 03-29-10

43. A Plant Startup is in progress. The plant is operating at 20% power at the end of life. The Main Turbine has been synchronized to the grid.

- Power range NI8 calibration is in progress
- Reactor Demand is in Manual
- Diamond Rod Control Panel is in Auto

A loud noise is heard outside the control room accompanied by the following:

- Reactor Power is rising
- Megawatts are lowering
- Feedwater is rising
- RCS pressure is lowering

Which of the following explains why reactor power is increasing?

A. Positive reactivity is being added due to lowering Tave

B. An Undesired Rod withdrawal is in progress

C. ICS is raising power in response to lowering megawatts

D. I&C has placed NI8 in Test Operate while it was the highest indicating NI

Answer: A

Explanation/Justification:

A. Correct – A steam leak is in progress per DB-OP-02525, Steam Leaks. A lowering Tave will add positive reactivity with a negative moderator coefficient.
B. Incorrect – Plausible because an undesired rod withdraw will raise power but would not include the listed symptoms
C. Incorrect – Plausible because raising power would normally increase megawatts but ULD output tracks megawatts in manual
D. Incorrect – Plausible because ICS power selects the highest auctioneered power and power would increase if the ULD was in auto

Sys #	**System**	**Category**	**KA Statement**
039	Main and Reheat Steam System (MRSS)	K5. Knowledge of the operational implications of the following concepts as the apply to the MRSS:	Effect of steam removal on reactivity

K/A# K5.08 **K/A Importance** 3.6 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02525 R10 Page 5

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 441.5 / 45.7)

Objective:

2.2 Steam Leak Outside Containment

2.2.1 Noise from escaping steam heard in the Control Room or reports of same from personnel outside the Control Room

2.2.2 Reactor power rising due to excessive steam demand combined with Unit megawatt load stable or lowering. In auto, ICS will reduce megawatt load to return reactor power to setpoint.

2.2.3 Raised or rising Feedwater flow

2.2.4 Lowering of RCS Tave, RCS pressure and Pressurizer level

2.2.5 Fire alarms

2.2.6 Abnormally high room temperatures for #2 MPR and/or #4 MPR:

- TI 5015, MECH PEN ROOM 4 TEMP, located on CTRM Panel C5716

2.2.7 Excessive operation of ECCS Room Sump Pumps as indicated on CTRM Panel C5703.

2.2.8 Annunciator Alarms:

- (12-2-A) SG 1 TO AFPT 2 MN STM PRESS LO
- (12-2-B) SG 2 TO AFPT 1 MN STM PRESS LO

2.2.9 Computer Alarms:

- (P011) AFPT 1 STM IN LOW PRESS
- (P012) AFPT 2 STM IN LOW PRESS
- (T879) SG 1 AFW NOZZLE TEMP
- (T895) SG 2 AFW NOZZLE TEMP

2.2.10 Immediate Actions are required,
GO TO Subsection 3.2 – Steam Leak Outside Containment

44. The following plant conditions exist:

- The reactor is operating at 50% rated power.
- One main feedwater pump (MFP) is operating in AUTOMATIC.
- All Feedwater Control Valves are in AUTOMATIC.
- ICS is in full AUTOMATIC mode.

Which one of the following describes feedwater flow control by ICS following a manual reactor trip?

A. Places the MFP at a constant target speed and immediately controls the Feedwater Control Valves position based on feedwater flow error.

B. Places the MFP at a constant target speed and immediately controls the Feedwater Control Valves position based on SG level error.

C. Runs the MFP to a target speed which is then modified by SG feedwater flow error and positions Feedwater Control Valves to a target position until a 2.5 minute timer expires.

D. Runs the MFP to a target speed which is then modified by SG level error and positions Feedwater Control Valves to a target position until SGs are at low level limits or a 2.5 minute timer expires.

---

nswer: D

Explanation/Justification:

A. Incorrect – Rapid Feedwater Reduction will actuate. Feedwater Control valves will control on SG level error, not Feedwater flow error.

B. Incorrect – Rapid Feedwater Reduction will actuate. Feedwater Control valves will control on SG level error, but a timer operates to allow SG level to lower to low level limits

C. Incorrect – Rapid Feedwater Reduction will actuate. Feedwater Control valves will control on SG level error, not Feedwater flow error.

D. Correct – With full automatic ICS operation and SG not initially on low level limit control, a reactor trip will caused the MFP to go to target speed, the SU SG Level controls to target position until SG on Low Level Limit or 2.5 minute timer times out.

Sys #	System	Category	KA Statement
059	Main Feedwater (MFW) System	A1. Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the MFW controls including:	Feed Pump speed, including normal control speed for ICS

K/A# A1.07 **K/A Importance** 2.5* **Exam Level** RO

References provided to Candidate None **Technical References:** Lesson Plan OPS-SYS-I512 R06 page 13 & 14

Question Source: BANK 38076 **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.5 / 45.5)

Objective:

- RCS Flow

h. Feedwater Control valves

(1) Controlled by one of three control signal when in automatic.

- Level Error control
  - o Operate Level Compared to Hi Level Limit of 90.0%. Prevents overfill of S/G (carryover) and flooding aspirating port. 12-3-A(B)
  - o S/U Level compared to Low Level Limit of (40"). 14-5-E(F)
  - o Either alarm states that the S/G is on LLL or HLL control.
- It does NOT mean that actual Steam Generator level is at set point but level error control is in effect.
- Flow Error control
  - o Flow error is used to control the Feedwater valves when power is >28.5%.
- Rapid Feedwater Reduction
  - o Reduces feedwater to prevent overcooling the RCS and emptying the Pressurizer.
  - o Requirements to activate:
- at least one MFP Reset
- RFR Switch "on"
- All FW control valves AUTO (RFR will continue if a valve is taken out of AUTO after RFR actuates.)
- Trip confirm < 23.5% by highest power range NI.
  - o RFR Valve Effect:
- Closes main valve
- S/U valve to 17% open (I&C sets) Equivalent to about 4% load
  - o Returns to Level error:
- S/G on low level limit

OR

- 2.5 minute timer expired.
  - o RFR FW Pump effect:
- 4600 RPM speed
- MFP to target speed modified by level error

- o Requirements to Release RFR, valves only:
- 2.5 minute timer expired

OR

- S/G on LLL

i. Main Feedwater Block Valve Control — Trip Confirm <23.5% hi Ø auctioneered.

(1) Reactor trip closes FW 779 and FW 780.

j. Feedwater Pump control

(1) Normal automatic control signal is developed from two inputs

- Total Feedwater demand for a course control of MFP speed.
- Lowest auctioneered Feedwater valve ΔP signal for fine control of MFP speed.

(2) Feedwater Pump 1 controller has a bias to allow matching of MFP flows while they are running in parallel.

(3) Post trip the MFP is controlled at a target speed.

5. Reactor Control Subsystem — SLIDES 49-51 (Refer back to Slide 46 as needed)

a. Function

(1) Converts a demand signal to a rod command signal.

(2) Maintain a constant T-ave of 582oF above 28.5%.

(3) Produces insert and withdraw commands that go to the Control Rod Drive system to control Reactor power.

(4) Varies the total Reactor's heat output so unit generation demand is satisfied while maintaining Reactor Coolant Average Temperature at set point.

b. Controls by Operator (Hand/Auto Stations) — Show Simulator Graphics Rx DMD

(1) Hand/Auto Reactor Demand Reference:

- Manual causes FW control of T-ave if permissible. — GP 01

  EO 03

- Minimum Setpoint 28.5% from SG/Reactor Demand. — 23.5% for 3 RCP's and T-ave Control at Reactor Dmd Limiter.

45. The plant is at 70% Power.

- Annunciator 10-1-C, MFPT 1 Lube Oil Press Lo alarms
- PI1206, Header pressure indicates 3.6 Psig
- Neither the Preferred or Standby #1 MFPT Main Oil Pump are running.
- Both MFP Turbines are operating at approximately 4400 rpm.

The plant remains stable at 70% power.

Which of the following actions are **required**?

A. Trip #1 MFPT only if PI1206, #1 MFPT Lube Oil Header pressure lowers to 3 psig.

B. Start MFPT 1 Emergency Bearing Oil Pump and then Trip #1 MFPT.

C. Start the Motor Driven Feedwater Pump and Trip #1 MFPT.

D. Reduce Reactor power to 60% in preparation for loss of #1 MFPT.

Answer: B

Explanation/Justification:

A. Incorrect – Plausible if the MFPT emergency bearing oil pump auto started and 3 psig was the MFPT trip setpoint

B. Correct – DB-OP-02010 directs starting the MFPT emergency bearing oil pump and tripping MFPT 1 if bearing header goes below 4.0 psig which is the auto trip setpoint

C. Incorrect – Plausible since MFPT 1 should be tripped starting the MDFP will provide additional inventory to the SG which may facilitate maintaining SG Level.

D. Incorrect – Plausible since 60% is the high discharge pressure of MFPT runback target.

Sys #	System	Category	KA Statement
059	Main Feedwater (MFW) System	A4. Ability to manually operate and monitor in the control room:	MFW turbine trip indication

K/A# A4.01 **K/A Importance** 3.1* **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02010 R17 pages 8 & 9

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7 / 45.5 to 45.8)

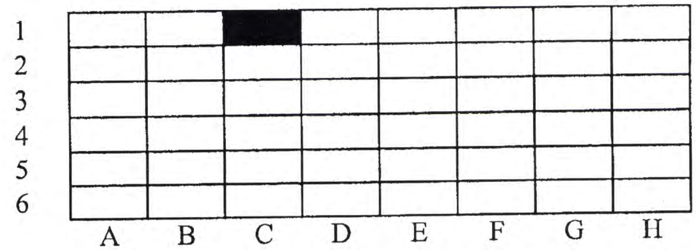
Objective:

FEEDWATER ALARM PANEL 10 ANNUNCIATORS

Panel 10

10-1-C

P651
MFPT 1
LUBE OIL
PRESS LO



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ACTUATING DEVICE(S)		SETPOINTS	
1.	PSL 1228	1.	7.0 psig

1.0 SYMPTOMS

1.1 Low lube oil pressure to MFPT 1 bearings

2.0 IMMEDIATE ACTIONS

None

3.0 SUPPLEMENTARY ACTIONS

3.1 Determine if Bearing Pressure is actually Low using PI 1206, HDR PRESS, in the Control Room.

> NOTE 3.2
>
> The standby Main Oil Pump will automatically start at 170 psig Hydraulic Oil pressure as indicated at local PI 1194, HYDRAULIC OIL PRESSURE.

3.2 IF Bearing Pressure is Low,
THEN verify automatic start of standby MFPT 1 Main Oil Pump:

- HIS 1195, MAIN PUMP 1
- HIS 1198, MAIN PUMP 2

3.3 IF the Standby Pump is running
AND bearing pressure returns to normal,
THEN stop the previously running pump.

NOTE 3.4

The Emergency Bearing Oil Pump will automatically start at 36 psig Control Oil pressure as indicated at local PI 2650, CONTROL OIL PRESSURE.

3.4 IF the standby Main Oil Pump does NOT start,
AND Bearing Header Pressure decreases to less than 4 psig as indicated at PI 1206, HDR PRESS,
THEN perform the following:

3.4.1 Start MFPT 1 Emergency Bearing Oil Pump using HIS 1209, EMER BEARING OIL PUMP.

3.4.2 Trip MFPT 1 using HS 797, TURBINE TRIP.

3.4.3 IF ICS Runback occurs
THEN REFER TO DB-OP-06401, Integrated Control System Operating Procedure.

3.5 Locally check for oil leaks around MFPT 1 which may indicate the cause for low Bearing Oil Header Pressure.

3.6 Ensure proper oil level in MFPT 1 Lube Oil Tank using LI 2214, MFPT 1 OIL TANK LEVEL.

NOTE 3.7

The duplex basket strainer will indicate NEEDS CLEANING at 12 psid or greater. At 15 psid, Computer Point (P655) MFPT 1 LUBE OIL FLT DP will alarm.

3.7 IF the duplex basket strainer indicates NEEDS CLEANING,
THEN shift strainers. REFER TO DB-OP-06224, Main Feed Pump and Turbine.

4.0 REFERENCES

4.1 Developmental

4.1.1 M-018, Turbine Lube Oil System

4.2 Implementation

4.2.1 DB-OP-06224, Main Feed Pump and Turbine

4.2.2 DB-OP-06401, Integrated Control System Operating Procedure

46. The Plant is at 100% power.

- The zone 3 Equipment Operator reports the piping at AF608, Auxiliary Feedwater to Steam Generator Line 1 Stop, is hot to the touch and Auxiliary Feedwater (AFW) Train 1 is Steam Bound

Which of the following statements is the correct impact of this condition on Emergency Feedwater and the action **required**?

A. Auxiliary Feedwater Train 1 remains Operable. Designate an Operator to maintain AFW Train 1 Operable during venting to refill AFW Train 1.

B. AFW Train 1 and the Motor Driven Feed Pump are Inoperable. Initiate actions to commence a Reactor shutdown within one hour.

C. AFW Train 1 and AFW Train 2 are Inoperable. Start the Motor Driven Feed Pump in the Auxiliary Feedwater mode to condense the steam bubble at AF608.

D. AFW Train 1 and AFW Train 2 and the Motor Driven Feed Pump will be rendered Inoperable due to closing AF608. Take action immediately to restore Operability

---

Answer: D

Explanation/Justification: Note: At DB, the Auxiliary Feedwater and Main Feedwater System do not share physical connections since they feed the Steam Generators via separate headers. In order to use the KA, a back leakage from the Steam Generator question was used into the Auxiliary Feedwater System.

A. Incorrect –Plausible because the candidate may assume the piping is only hot at the containment isolation and therefore not affect the AFW Pumps. Operator action is allowed under some condition, but the short duration of the AFW time response would not permit operator actions.

B. Incorrect –Plausible because a low SG Pressure condition will align AFW Train 1 and 2 to Feed SG 1 via AF608. Also, the MDFP could be used to provide cool water from the Condensate Storage Tank to mitigate this condition.

C. Incorrect – Plausible because without a low SG Pressure condition, only AFW Train 1 and the MDFP would use the AF608 flowpath

D. Correct – Because a low SG Pressure condition, AFW Train 1 and 2 and the MDFP could use the AF608 flowpath. As a result, all three would be inoperable with AFW Train 1 steam bound.

Sys #	System	Category	KA Statement
061	Auxiliary / Emergency Feedwater (AFW) System	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the AFW; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Back leakage of MFW

K/A# A2.06 **K/A Importance** 2.7 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06233 R35 Steps 2.1.6 & 4.9.5.a.3 and TS 3.7.5 Condition E

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Objective:

1.0 PURPOSE

To provide instructions for operating the Auxiliary Feedwater System during Normal, Infrequent or Special, and Emergency modes of operation.

2.0 LIMITS AND PRECAUTIONS

2.1 Administrative

2.1.1 Auxilary Feedwater System operability requirements are given in TS 3.7.5, Emergency Feedwater (EFW).

2.1.2 Condensate Storage Tank operability requirements are given in TS 3.7.6, Condensate Strorage Tanks (CSTs).

2.1.3 Whenever any portion of the Auxiliary Feedwater System is INOPERABLE, the Reactor Operator shall turn on IL-4800, AUX FW, using HS-4800 on SFAS Panel C-5717.
The light shall remain LIT until the Auxiliary Feedwater System is made OPERABLE.

2.1.4 When AF21 or AF22 are open to operate either AFW pump on recirc to the Condensate Storage Tank while in MODES 1, 2, or 3 an operator shall be stationed at the respective valve and will be in direct communications with the Control Room while either valve is open.

2.1.5 Whenever Door 215 is required to be open for an extended period of time an individual in the AFP room shall be assigned the responsibility to close and latch the door after personnel have exited in the event an emergency occurs in either of the AFP rooms.
Attachment 8, Door 215 Operation, provides this information.

2.1.6 Closing AF599* and / or AF608* in MODE 1 > 40% RTP renders all three EFW trains inoperable.
Closing AF599* and / or AF608* in MODE 1 ≤ 40% RTP and in MODES 2 or 3 renders both AFW trains inoperable.
In MODE 1 ≤ 40% RTP and in MODES 2, 3, and 4, the MDFP remains OPERABLE provided AF599 and AF608 are capable of being realigned to the open position. (Reference TS 3.7.5)

* Controlled in accordance with DB-OP-00008, Operation and Control of Locked Valves

NOTE 4.9.5

- Limit and Precaution 2.1.6 discusses the impact on EFW OPERABILITY of closing AF608 in MODES 1, 2, or 3.
- Operators assigned to vent AFW piping should be at their assigned station prior to closing AF608. Minimize the time AF608 is closed.

4.9.5 Isolate Train 1 AFP Discharge Line For venting steam pressure and refilling from CST:

a. Perform the following in the Control Room:

_______ 1. Verify AF3870, AUXILIARY FEED PUMP 1 TO STEAM GENERATOR 1 STOP, is open, using HIS3870.

_______ 2. Restore Control Power to AF608*, AUXILIARY FEEDWATER TO STEAM GENERATOR 1 LINE STOP, using HIS608E.

_______ 3. Close AF608*, AUXILIARY FEEDWATER TO STEAM GENERATOR 1 LINE STOP using HIS608A.

NOTE 4.9.6

The Trip Throttle valve is closed to prevent an AFP from starting during venting.

_______ 4.9.6 Unseal AND close ICS38C, AFPT 1 TRIP THROTTLE.

a. Check the following:

_______ • Computer Point Z001, AFPT 1 STOP/GOV/STM IN ISO VLVS, indicates "TRBL".

_______ • Annunciator, AFP 1 TRBL (10-4-G), is LIT.

* Controlled in accordance with DB-OP-00008, Operation and Control of Locked Valves

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One EFW train inoperable for reasons other than Condition A in MODE 1, 2, or 3.	B.1	Restore EFW train to OPERABLE status.	72 hours
C. One AFW train inoperable due to one inoperable steam supply. AND MDFP train inoperable.	C.1	Restore the steam supply to the AFW train to OPERABLE status.	48 hours
	OR		
	C.2	Restore the MDFP train to OPERABLE status.	48 hours
D. Required Action and associated Completion Time of Condition A, B, or C not met. OR Two EFW trains inoperable for reasons other than Condition C in MODE 1, 2, or 3.	D.1	Be in MODE 3.	6 hours
	AND		
	D.2	Be in MODE 4.	12 hours
E. Three EFW trains inoperable in MODE 1, 2, or 3.	E.1	--------------NOTE--------------- LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one EFW train is restored to OPERABLE status. ------------------------------------- Initiate action to restore one EFW train to OPERABLE status.	Immediately

47. Inverter YVA supplies power to Uninterruptable Bus YAU.

(1) What is the power supply to Inverter YVA when the static transfer switch is in Normal

(2) What is the power supply if the static transfer switch transfers to Alternate?

A. (1) Non-essential 480 VAC
(2) Non-essential 120 VAC

B. (1) Non-essential 480 VAC
(2) Essential 120 VAC

C. (1) 250 VDC
(2) Non-essential 120 VAC

D. (1) 250 VDC
(2) Essential 120 VAC

Answer: C

Explanation/Justification: Inverter YVA supplies the uninterruptable 120 vdc bus YAU.

A. Incorrect – Plausible because YVA does not use essential power. Both choices use non-essential power.

B. Incorrect – Plausible because YAU is an important plant power supply for fire protection, communications, ICS, NNI etc. It is logical this power would be essential when transferred to alternate.

C. Correct – This is the configuration for Inverter YVA as provide in the System Operating Procedure for normal lineup

D. Incorrect – Plausible because YAU is an important plant power supply for fire protection, communications, ICS, NNI etc. It is logical this power would be essential when transferred to alternate. Also 250 VDC is feed from the Safety Related Station Batteries 1P and 1N.

Sys #	System	Category	KA Statement
062	AC Electrical Distribution System	A3. Ability to monitor automatic operation of the ac distribution system, including:	Operation of inverter (e.g., precharging synchronizing light, static transfer)

K/A# A3.04 **K/A Importance** 2.7 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06319 R25, page 2 & 192

Question Source: BANK 32192 **Level Of Difficulty: (1-5)** 4

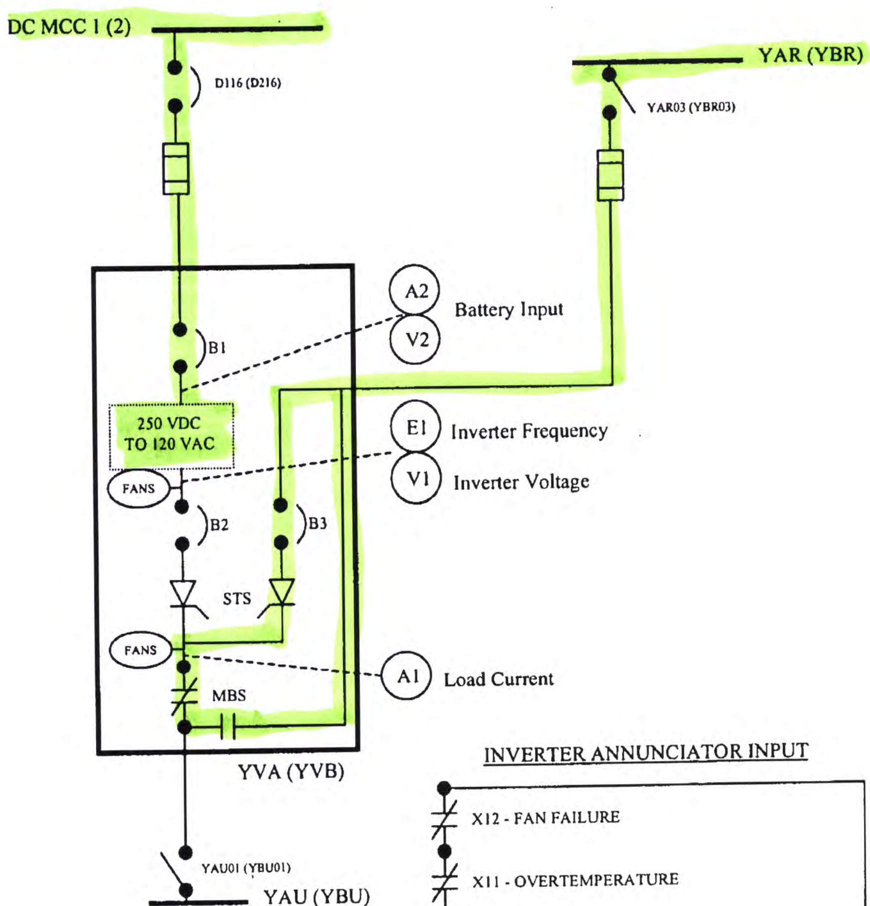
Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR: 41.7 / 45.5)

Objective:

INSTRUMENT AC SYSTEM PROCEDURE

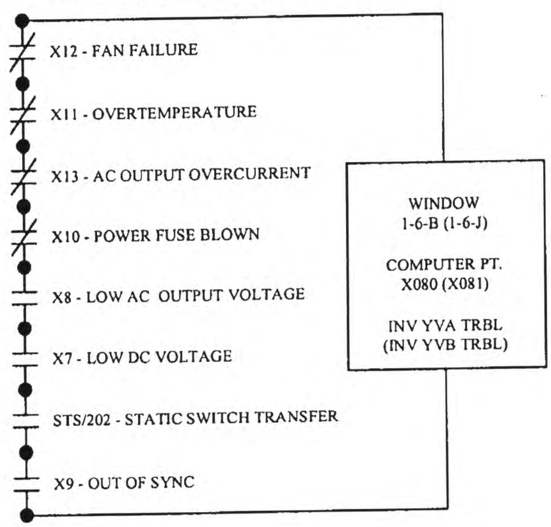
TABLE OF CONTENTS

ATTACHMENT 16: NON-ESSENTIAL PANELS YVA (YVB) POWER SOURCES DRAWING

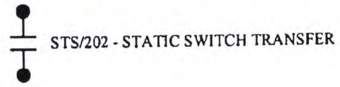


BREAKERS AND SWITCHES
B1: Battery Input
B2: Inverter Output
B3: Alternate Source AC Input to Static Switch
STS: Static Transfer Switch
MBS: Manual Bypass Switch

INVERTER ANNUNCIATOR INPUT



COMPUTER INPUT X082 (X083)



48. The Plant has experienced a complete loss of AC Power. Performance of DB-OP-02521, Loss of AC Bus Power Sources, is in progress.

At 1 hour following the beginning of the event AC power is still lost with required actions of DB-OP-02521 to reduce battery discharge rate completed.

(1) What is the current DC alignment

AND

(2) How long will it be before DC power is no longer available?

A. (1) Batteries 1P, 1N, 2P and 2N are in service.
(2) less than 2 hours

B. (1) Batteries 1P and 1N are in service. Batteries 2P and 2N are in standby.
(2) approximately 8 hours

C. (1) Battery 1N is in service. Batteries 1P, 2P and 2N are in standby.
(2) approximately 16 hours.

D. (1) Battery 1P is in service. Batteries 1N, 2P and 2N are in standby.
(2) greater than 24 hours

Answer: D

Explanation/Justification: DC Bus Load shedding is performed to reduce Discharge Rate and therefore extend battery life.

A. Incorrect – Plausible because the batteries are designated as having a 1500 amp-hour rating based on an 8 hour discharge rate.
B. Incorrect – Plausible if it is assumed there are 250V loads required to remain energized following load shedding
C. Incorrect – Plausible since one battery (1P) will remain in service and 32 hours is a multiple of 8.hours
D. Correct – DB-OP-02521 will direct reducing 1P to minimum required loading and completely unloading the remaining three batteries to be used in series to extend battery capacity. This is a new configuration that extends the time to meet minimum DC Bus Loads.

Sys #	System	Category	KA Statement
063	DC Electrical Distribution System	A1. 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

K/A# A1.01 **K/A Importance** 2.5 **Exam Level** RO
References provided to Candidate None **Technical References:** DB-OP-02521 R20 Attachment 17 page 128
Question Source: New **Level Of Difficulty: (1-5)** 4
Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.5 / 45.5)
Objective:

Attachment 2 - This attachment provides the specific direction for reenergizing Bus D1. The SBODG and Off-site power are preferred over the EDGS since the actions already taken to return the EDGS to service have not been successful. Load limits are provided if the SBODG or the EDGS are used.

Attachment 3 - This attachment performs two functions. The first function is to resolve and clear a lock out on CI bus - Once the lock out is resolved, this attachment provides methods to restore power to C1. This method was selected to reduce the number of procedural transfers from attachment to attachment that would be required to restore power.

Attachment 4 - This attachment performs two functions. The first function is to resolve and clear a lock out on DI bus - Once the lock out is resolved, this attachment provides methods to restore power to D1. This method was selected to reduce the number of procedural transfers from attachment to attachment that would be required to restore power.

Attachment 5 - This attachment is used to reduce the load on the station batteries. This attachment is started after approximately 15 minutes to ensure the attachment is completed within 30 minutes of the loss of battery charger power. The attachment has 3 sections. Section 1 addresses a loss of both DCMCC 1 AND DCMCC2 Battery Chargers. Historically, Battery Load shed was intended to ensure station essential DC Loads remain available for at least one hour following a loss of all AC power. Refer to Calculation C-EE-002.01-016 "Station Battery Discharge Analysis for Beyond Design Bases Events" for additional information. Based on INPO L1 IER 11-4, the load shed method was altered to provide additional battery life. Sections 2 and 3 of this attachment address a loss of power to the chargers associated with C1 and D1 respectively. The intent of these sections is to reduce loading on the DCMCC 1 or 2 by transferring YAU/YBU off the batteries and on to the non essential supplies. This is only possible if YAR/YBR have power. Without offsite power, YAR/YBR will be de-energized. Refer to Calculation C-EE-002.01-010, DC System Analysis for additional information.

For the extended loss of all AC power, fifteen minutes into the beyond design basis event, operators will begin to load shed the station batteries. The load shedding is performed to conserve energy in the station batteries. Portions of the load shed are required to be completed within 30 minutes and remaining actions within 60 minutes of event initiation. These completion times are used in the Load Shed analysis to determine expected battery life following load shed. It is anticipated that Batter 1P would provide service via Y1 and Y1A for approximately 19 hours followed by Battery 2P providing service via Y2 and Y2A for an additional 20 hours. Battery 1N and 2N are not credited in the calculation since available instrumentation would not provide Steam Generator Level.

49. Reactor Power is 100% with all systems in a normal alignment.

The following events have occurred:

All AC power has been lost.

Following DC Bus load shed per DB-OP-02521, Loss of AC Bus Power Sources, AFW Pump 1 is in service supplying SG 1.

With no operator action, as Battery voltage lowers toward zero, what will be the effect on SG 1 Level?

SG 1 level will:

A. Lower due to AFW Pump Discharge Target Rock valve failing closed

B. Lower due to AFW Pump speed going to the low speed stop

C. Rise due to AFW Pump Discharge Target Rock valve failing open

D. Rise due to AFW Pump speed going to the high speed stop

Answer: C

Explanation/Justification: Loss of all AC Power

A. Incorrect – Plausible because SG level will lower if the target rock valve were to fail closed

B. Incorrect – Plausible because SG level would lower if the turbine went to its low speed stop

C. Correct – Target rock fails open on low voltage and SG will have full flow.

D. Incorrect – Plausible because SG level will rise if the turbine went to its high speed stop

---

Sys #	System	Category	KA Statement
063	DC Electrical Distribution System	A4. Ability to manually operate and/or monitor in the control room:	Battery voltage indicator

K/A# A4.02 **K/A Importance** 2.8* **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02521 R20, Att 17 page 130

Question Source: BANK 79886 **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7 / 45.5 to 45.8)

Objective:

Attachment 7, 8, 9 and 10 - These attachments provide step by step methods to restore power to A, B, C2, or D2 buses. These attachments provide a prioritized list of power sources that can been used to restore power and step by step direction for the restoration.

Attachment 11 - This attachment provides direction to manually control the Auxiliary Feedwater flow to the Steam Generators on a loss of all AC and DC power. The expected response of AFW, upon a loss of all AC and DC Power, will be both trains of AFW running with full AFW flow to both Steam Generators due to the AFW Discharge Target Rock Valves failing open on the loss of DC power. Prompt action is required to prevent overfill conditions on the Steam Generators, which would remove the last system available for core cooling. The goal of this attachment is to establish manual control of the affected Auxiliary Feedwater pumps and maintain Hot Standby conditions until emergency power has been restored to the station equipment necessary to support cooldown efforts. This guidance will be directed first for AFW Train 2 during the initial battery load shed based on removing D2P and Y2 from service. Control of AFW Train 1 will be required when D1P and Y1 are no longer available. Although the power supply for AFW Speed changer is list as D1P for Train 1 and D2P for Train 2, essential 120V AC Power from Y108 for Train 1 and Y208 for Train 2 is also required to remotely adjust AFPT speed from the Control Room. This attachment also directs the use of Attachment 12 to provide portable power to the Non-Nuclear Instrumentation X cabinet.

Attachment 12 – This attachment provides direction to use a temporary power source (gasoline driven generator) to NNI-X to support manual operations of AFW following an event which causes a loss of all AC and DC Power Sources. Supplying NNI-X will allow the Operators to monitor Steam Generator Level while manually controlling AFW Speed per Attachment 11. These instructions are applicable to emergency conditions when their implementation is required to protect the health and safety of the public.

Attachment 13 – This Attachment is an operator aid to assist in identification of applicable Technical Specifications when power is lost to an Essential 4160 volt bus. The attachment provides a list of Technical Specifications (TS)/Technical Requirements Manual (TRM) requirements that should be considered during a loss of both or only one essential 4160 bus. The Technical Specification/Requirement entered will depend upon actual conditions.

50. The following plant conditions exist:

- Emergency Diesel Generator 1 monthly surveillance test is in progress
- Emergency Diesel Generator 1 is paralleled with the C1 bus

The following event occurs:

- A Safety Features Actuation System Level 2 signal occurs

Assuming no operator action is taken and the EDG output breaker opens as designed, how will the #1 Emergency Diesel Generator respond to this SFAS Level 2 signal?

The Emergency Diesel Generator Governor will ______________________

A. transfer to the isochronous mode and all engine trips will be active

B. remain in the droop mode and all engine trips will remain in active

C. remain in the droop mode and non-vital engine trips will be bypassed

D. transfer to the isochronous mode and non-vital engine trips will be bypassed

---

Answer: D

Explanation/Justification:

A. Incorrect – Although the Governor will transfer to Isochronous mode, non-vital engine trips will still be active. This is plausible since the EDG was already running at the time to of the SFAS start signal.

B. Incorrect – This is plausible since the EDG was already running at the time to of the SFAS start signal. In normal parallel operation, the EDG operates in Droop with all engine trips active.

C. Incorrect – This is plausible since the EDG was already running at the time to of the SFAS start signal. In normal parallel operation, the EDG operates in Droop with all engine trips active. Since an SFAS occurred, it is reasonable to assume some normal trips are bypassed.

D. Correct – The Governor will transfer to the Isochronous mode, and non-vital engine trips are bypassed.

Sys #	System	Category	KA Statement
064	Emergency Diesel Generator (ED/G) System	K4. Knowledge of ED/G system design feature(s) and/or interlock(s) which provide for the following:	Governor valve operation

K/A# K4.03 **K/A Importance** 2.5 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06316 step 2.2.12 & Caution 5.2.3

Question Source: BANK 32132 **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7)

Objective:

- If the limits on no-load/low-load or idle speed operation are reached, load should be raised gradually to approximately 2100 KW for a minimum of 30 minutes in order to raise combustion temperature and slowly vaporize unburned oil in the exhaust. This will minimize the chance of exhaust manifold fires.

2.2.3 Do not exceed 2600 KW or 450 Amps or 1950 KVARS load on the EDG except for emergency loads or when specified for testing. Refer to:

- Attachment 14 for a list of calculated AC Load Parameters and EDG Load Rating Limits.
- IF EDG JACKET OUT TEMP exceeds 190°F,
  THEN EDG load shall be limited per DB-PF-06703, Miscellaneous Operation Curves, Curve CC13.7, EDG Engine Rating at Elevated Temperature.

2.2.4 Minimize the time the EDG is loaded to less than 2100 KW to minimize wear on Turbocharger gears.

2.2.5 If the Plant is in MODE 5 or 6, power factor of 0.8 may not be achievable due to light bus loading and resultant high voltage. This condition is acceptable.

2.2.6 In the event the EDG must be returned to service during the 10 minute idle stop cycle, the remote START pushbutton on local Panel C3615 or C3616 or Control Room Panel C5715 must be depressed and held for 15 seconds.

2.2.7 During the idle stop cycle, the START pushbutton on Engine Control Panel C3621 or C3622 is bypassed and can not be used to return the EDG to service.

2.2.8 To stop the EDG except for an emergency shutdown, the unit should be unloaded prior to depressing the STOP pushbutton.

2.2.9 If the EDG does not reach 200 RPM within 7 seconds of receiving a start signal, then the FAIL-TO-START Relay will time out and shut down the EDG. The local lockout relay RESET pushbutton on C3615 or C3616 must be depressed to clear the condition.

2.2.10 If the EDG being started does not require the 10-second start to approximately 900 RPM, the EDG should be Idle Started-Idle Released, to prolong the life and reliability of the Diesel Generators. Idle Release should occur once engine oil pressure has stabilized and water temperature has reached 120°F.

2.2.11 Under normal conditions the EDG should be gradually loaded in steps with a period of 30 to 90 seconds per step, the total time being between 5 to 15 minutes until the desired load is reached. This allows for engine components time to heat up evenly, reducing thermal stresses on the components.

2.2.12 The Idle Start/Stop Circuitry inhibits the voltage regulator by applying field shorting. An automatic start signal, an idle release, Control Room start pushbutton, or EDG Relay Panel start pushbutton will release the Idle Start Relay, accelerate the EDG, and enable the voltage regulator.

CAUTION 5.2.3 next two bullets

- The only EDG trips during a safety start are:
  - Engine Overspeed
  - Generator Differential
  - Overcurrent (trips output breaker only)
  - Manual Emergency Shutdown.
- The Operator is responsible for monitoring EDG operating parameters and notifying the Shift Manager if non-essential trip setpoints are exceeded.

________ • Check that Lube Oil pressure as indicated on PI20161, DIESEL GENERATOR 1-1 ENGINE OIL PUMP OUTLET PRESSURE INDICATOR, is greater than 40 PSIG.

________ • IF EDG Jacket Water Outlet Temperature as read on TI 20167, DG 1 ENGINE OUTLET JACKET WTR TEMPERATURE INDICATOR, exceeds 190°F,
THEN EDG load shall be limited per Miscellaneous Equipment Performance Curve CC 13.7, EDG Engine Rating at Elevated Temperature in DB-PF-06703, Miscellaneous Operation Curves.

________ • Check that Component Cooling Water flow to EDG 1 on FIS1473, DG JKT CLNG WTR HX 1 CC OUT flow indicating switch, is greater than 800 GPM.

51. What type of detector is used for RE1003A, Steam Jet Air Ejector Discharge detector, to monitor for steam generator tube leaks?

A. Scintillation Detector

B. Geiger-Mueller Detector

C. Ion Chamber Detector

D. Fission Chamber

<u>Answer: A</u>

Explanation/Justification:

A. Correct – RE1003A is a Gamma Scintillation detector. A scintillation detector is used for isotope determination via gamma spectrosophy.
B. Incorrect – Plausible because most area radiation monitor detectors are G-M detectors
C. Incorrect – Plausible because the Station Vent Accident Range Monitors, among others, are Ion Chamber Detectors
D. Incorrect – Plausible – Fission Chambers are use to detect neutrons such as Gammametrics Nuclear Instruments.

Sys #	System	Category	KA Statement
073	Process Radiation Monitoring (PRM) System	K5. Knowledge of the operational implications as they apply to concepts as they apply to the PRM system:	Radiation theory, including sources, types, units, and effects

K/A#	K5.01	**K/A Importance**	2.5	**Exam Level**	RO
References provided to Candidate	None			**Technical References:**	SD-017A R03 page 2-2 Step 2.1.1.6 USAR TABLE 11.4- 1 on Page 11.4-20
Question Source:	New			**Level Of Difficulty: (1-5)**	3
Question Cognitive Level:	Low - Fundamental			**10 CFR Part 55 Content:**	(CFR: 41.5 / 45.7)
Objective:					

- RE1003B, Condenser Vacuum Pump Discharge
- RE1822A, Radioactive Waste Gas Discharge
- RE1822B, Radioactive Waste Gas Discharge
- RE4597AA, and RE4597AB, Containment Vessel - Normal and Accident Ranges
- RE4597BA, and RE4597BB, Containment Vessel - Normal and Accident Ranges
- RE4598AA, and RE4598AB, Station Vent Discharge - Normal and Accident Ranges
- RE4598BA, and RE4598BB, Station Vent Discharge - Normal and Accident Ranges
- RE5052A, RE5052B, and RE5052C, Containment Purge Exhaust
- RE5327A, RE5327B, and RE5327C, Control Room Emergency Ventilation Fan Discharge
- RE5328A, RE5328B, and RE5328C, Control Room Emergency Ventilation Fan Discharge
- RE5403A, RE5403B, and RE5403C, Fuel Handling Area Exhaust System
- RE5405A, RE5405B, and RE5405C, Radwaste Area Exhaust System

2.1.1.4 Certain radiation monitors are interlocked with process valves, dampers, pumps, etc., as described in Section 2.5. The logic diagrams showing the operation of these devices are included in system descriptions that include these devices as part of their systems.

2.1.1.5 Process effluent monitors are positioned such that monitor response time and sample transport time do not allow release of undesirable quantities of radioactive effluent prior to closure of the isolation valve.

2.1.1.6 All liquid monitors have gamma scintillation detectors since gamma is the only form of radiation which will escape from the body of the liquid through the pipe wall to be seen by the detector. Detectors that are primarily meant for measuring iodine concentration are also gamma scintillators. All noble gas and particulate detectors are beta scintillators except RE1003A and RE1822A which have gamma scintillation detectors and the containment and station vent accident range monitors which use Geiger-Mueller (G-M) tube detectors for measuring gross gamma radiation. Both the G-M tube and gamma scintillation detectors are highly sensitive to gamma radiation.

2.1.2 Detailed Description

(Source: DB-OP-06412, Reference 4.5.1.1; M-340-91, Reference 4.3.1.1; M-340-101, Reference 4.3.1.2; P&IDs and vendor drawings as individually referenced).

2.1.2.1 Component Cooling Water Monitoring Channels RE1412 and RE1413; Steam Header Monitoring Channels RE600 and RE609 (Source P&ID M-007A and M-036A and Victoreen Drawing 7749-M-340-21, Sh. 1; References 4.1.1.1, 4.1.1.11, and 4.3.1.5)

Identical channels RE600 and RE609 are supplied for monitoring the steam header. A "Snow Plow" type sampler designed to be mounted adjacent to a 36-inch-diameter pipe

TABLE 11.4-1 (Continued)

Liquid, Gas, and Airborne Radiation Monitors

AIRBORNE AND GAS 21

System Designation	Required Measurements	Sensitivity μCi/cc	Range μCi/cc (CPM)	Type Detector	Flowrates (scfm) (monitored process stream)/ (respective unit effluent)	
Vacuum system discharge RE-1003A	gross radio-activity	2.10×10^{-7}	1.09×10^{-7} to 1.09×10^{-1} (10 to 10^{7})	Gamma scintil-lation off-line	0 to 100 15 (norm.)	24
RE-1003B	gross radio-activity	3.27×10^{-7}	3.17×10^{-7} to 3.17×10^{-1} (10 to 10^{7})	Beta scintil-lation off-line	0 to 100 15 (norm.)	
Containment purge exhaust filter						21
RE-5052A	gross radio-activity	2.70×10^{-12}	1.83×10^{-12} to 1.83×10^{-6} (10 to 10^{7})	Moving paper tape particulate filter-detector Beta scintillation	5×10^{4} Norm plus $\underline{8 \times 10^{3}}$ LOCA $*121 \times 10^{5}$	29
RE-5052B	I-131	1.00×10^{-11} (in 12 hours)	1.64×10^{-9} to 1.64×10^{-3} (10 to 10^{7})	Fixed charcoal filter-detec-tor Gamma scintillation	5×10^{4} Norm plus $\underline{8 \times 10^{3}}$ LOCA $*1.21 \times 10^{5}$	
RE-5052C	gross radio-activity	2.00×10^{-7} **	2.76×10^{-7} to 2.76×10^{-1} (10 to 10^{7})	Beta scintil-lation	5×10^{4} Norm plus $\underline{8 \times 10^{3}}$ LOCA $*1.21 \times 10^{5}$	
Control room, emergency ventilation fan discharge RE-5327A RE-5328A	gross radio-activity	2.21×10^{-12}	1.84×10^{-12} to 1.84×10^{-7} (10 to 10^{6})	Moving paper tape particulate filter-detector Beta scintillation	2,900/each system	21

* When this system is employed, its respective effluent stream increases an equivalent amount.

** The sensitivity for the gas channel range is based upon a single isotope rather than a mixture of isotopes. 29

52. The plant is at 100% power with all systems in normal alignment **EXCEPT** Containment Air Cooler 2 is running in SLOW speed for testing

The following event occurs:

- Loss of off-site power.
- EDG 2 fails to start.
- All other systems function as designed.

5 minutes after the loss of off-site power occurred, assuming no Operator action, what will be the position of the following valves?

(1) SW1366 - CTMT Air Cooler 1 Inlet Iso
(2) SW1367 - CTMT Air Cooler 2 Inlet Iso

A. (1) Open
(2) Open

B. (1) Open
(2) Closed

C. (1) Closed
(2) Open

D. (1) Closed
(2) Closed

Answer: C

Explanation/Justification:

A. Incorrect – plausible since refill logic will close SW1366 but would then reopen if CAC 1 was in slow if an SFAS level 2 existed.

B. Incorrect – plausible if Candidate does not know SW1367 is powered from F12A via EDG2 since SW1367 would close and remain closed by refill logic due to CAC 2 was in fast and SW1366 would reopen since CAC 1 was in slow

C. Correct – Refill logic will close SW1366 which must be manually opened since no SFAS signal is present. SW1367 will remain open since power is lost

D. Incorrect – plausible if Candidate does not know SW1367 is powered from F12A via EDG 2 since SW1367 would close and remain closed by refill logic due to CAC 2 was in fast

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Sys #	System	Category	KA Statement
076	Service Water System (SWS)	K2. Knowledge of bus power supplies to the following:	Reactor building closed cooling water

K/A# K2.04 **K/A Importance** 2.5* **Exam Level** RO

References provided to Candidate None **Technical References:** OS-020 Sheet 2, R45 CL11

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7)

Objective:

CONTROL LOGICS

CL-1 WITH REGARD TO THE SERVICE WATER SYSTEM, THE FOLLOWING ACTIONS WILL OCCUR IN THE EVENT OF A SAFETY FEATURES ACTUATION SYSTEM (SFAS) LEVEL 2 SIGNAL:

COMPONENT	SIGNAL	ZONE	ACTION	REMARKS
SW PUMP 1-1	SA241A	J-5	START	BLOCK PUSHBUTTON
SW PUMP 1-2	SA242A	J-11	START	BLOCK PUSHBUTTON
SW PUMP 1-3	SA241B, SA242B	J-7	START	BLOCK PUSHBUTTON
VALVE 1395	SA272F	F-13	CLOSE	BLOCK PUSHBUTTON
VALVE 1399	SA271F	G-13	CLOSE	BLOCK PUSHBUTTON
VALVE 1424	SA241C	C-8	OPEN	BLOCK PUSHBUTTON
VALVE 1429	SA241D, SA242D	C-10	OPEN	BLOCK PUSHBUTTON
VALVE 1434	SA242C	C-13	OPEN	BLOCK PUSHBUTTON

TO STOP A SERVICE WATER PUMP OR CLOSE A SERVICE WATER LINE VALVE DURING A SFAS, EACH COMPONENTS' "BLOCK" PUSHBUTTON MUST BE DEPRESSED FIRST.

CL-2 COOLING WATER HEAT EXCHANGER OUTLET TEMPERATURE CONTROL VALVE 630 (ZONE B-14) MODULATES TO MAINTAIN 85°F IN RESPONSE TO TIC630 (OS-022, H-10).

LOGIC FOR VALVES 631 AND 632 (ZONES B-15 AND B-16) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC631 AND TIC632 (OS-022,H-8 AND H-7) RESPECTIVELY.

CL-3 SERVICE WATER PUMP 1-1 (ZONE J-5) STARTS AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS PROVIDED SERVICE WATER PUMP 1-3 (ZONE J-7) SUPPLY BREAKER IS NOT CLOSED:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

SERVICE WATER PUMP 1-1 WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:

- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY OS-058, J-7)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, J-7)
- BUS UNDERVOLTAGE SENSED BY 27/C1 RELAY (OS-058,G-5)
- 4.16KV BUS C1 LOCKOUT RELAY 86-1/C1 ACTUATES (SEE DWG OS-058 *CD-1*)

SERVICE WATER PUMP 1-2 (ZONE J-11) STARTS AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS PROVIDED SERVICE WATER PUMP 1-3 (ZONE J-7) SUPPLY BREAKER IS NOT CLOSED:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

SERVICE WATER PUMP 1-2 WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:

- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY (OS-058, J-24)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, J-24)
- BUS UNDERVOLTAGE SENSED BY 27/D1 RELAY (OS-058,G-5)
- 4.16KV BUS D1 LOCKOUT RELAY 86-1/D1 ACTUATES (SEE DWG OS-058 *CD-1*)

CL-4 CONTAINMENT AIR COOLER 1-1 SERVICE WATER OUTLET VALVE 1356 (ZONE C-1) MODULATES TO MAINTAIN 35°F IN RESPONSE TO TIC1356 (OS-033A,E-4) ONLY WHEN CONTAINMENT AIR COOLER FAN 1-1 (OS-033A,F-5) IS IN HIGH SPEED.

CONTAINMENT AIR COOLER 1-1 OUTLET VALVE SW1356 OPENS FULLY UPON A SLOW SPEED START SIGNAL TO CONTAINMENT AIR COOLER FAN 1-1. SW1356 WILL REMAIN FULLY OPEN IF CONTAINMENT AIR COOLER 1-1 IS STOPPED FROM SLOW SPEED. SW1356 WILL FULLY CLOSE IF CONTAINMENT AIR COOLER 1-1 IS STOPPED FROM FAST SPEED.

HANDSWITCH HIS1356 (ZONE C-1) WILL CLOSE SW1356 ONLY WHEN CONTAINMENT AIR COOLER 1-1 IS OFF. TEMPERATURE MODULATION MAY ALSO CLOSE SW1356 WHEN CONTAINMENT AIR COOLER 1-1 IS OPERATING IN FAST SPEED AND SW1356 IS CONTROLLING IN AUTO.

LOGIC FOR VALVES 1357 AND 1358 (ZONES C-6 AND C-3) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC1357 AND TIC1358 (OS-033A, E-9 AND E-8) RESPECTIVELY.

CL-5 SERVICE WATER PUMP 1-3 (ZONE J-7) WHEN ALIGNED AS PUMP 1-1 STARTS AUTOMATICALLY PROVIDED ONE OF ITS SUPPLY BREAKERS IS RACKED IN AND THE FOLLOWING CONDITIONS EXIST:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

PUMP WILL TRIP THE SAME AS PUMP 1-1 (SEE *CL-3*).

SERVICE WATER PUMP 1-3 (ZONE J-7) WHEN ALIGNED AS PUMP 1-2 STARTS AUTOMATICALLY PROVIDED ONE OF ITS SUPPLY BREAKERS IS RACKED IN AND THE FOLLOWING CONDITIONS EXIST:

- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

PUMP WILL TRIP THE SAME AS PUMP 1-2 (SEE *CL-3*).

CL-6 SERVICE WATER TO COOLING WATER HEAT EXCHANGER ISOLATION VALVE 1399 (ZONE G-13) WILL CLOSE AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS:

- SFAS SIGNAL (SEE *CL-1*)
- SERVICE WATER PUMP 1-1 (ZONE J-5) OR SERVICE WATER PUMP 1-3 (ZONE J-7) ACTING AS SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE ≤50 PSIG AS SENSED BY PSL1376A (ZONE G-7).

LOGIC FOR VALVE 1395 (ZONE F-13) IS SIMILAR.

CL-7 COMPONENT COOLING HEAT EXCHANGER OUTLET ISOLATION VALVE 1424 (ZONE C-8) WILL MODULATE TO MAINTAIN 95°F IN RESPONSE TO TIC1424 (OS-021,K-7).

LOGIC FOR VALVE 1434 (ZONE C-13) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC1434 (OS-021,D-7).

VALVE 1429 (ZONE C-10) WILL MODULATE TO MAINTAIN 95°F IN RESPONSE TO TIC1429 (OS-021,G-7) PROVIDED THAT BREAKER AD108 (OS-058,H-25) FOR COMPONENT COOLING PUMP 1-3 (OS-021,G-3) IS RACKED IN AND HIS1429A (ZONE B-11) IS IN "AUTO". WHEN BREAKER AD108 IS RACKED OUT AND BREAKER AC108 (OS-058,H-9) IS RACKED IN, HIS1429B (ZONE B-12) "AUTO" PUSHBUTTON MUST BE DEPRESSED.

CL-8 SERVICE WATER STRAINER 1-1 MOTOR (ZONE H-6) WILL START AND SERVICE WATER STRAINER 1-1 DRAIN VALVE 1379 (ZONE K-6) WILL OPEN WHEN ANY OF THE FOLLOWING CONDITIONS EXIST:

I. SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≥116 PSIG AS SENSED BY PSH2917A (ZONE K-5).

II. DIFFERENTIAL PRESSURE ACROSS STRAINER 1-1 IS ≥1.9 PSID AS SENSED BY PDIS1379A (ZONE J-6) AND STRAINER 1-1 HANDSWITCH HV1379 (ZONE H-6) IS IN "AUTO".

III. STRAINER 1-1 HANDSWITCH IS IN "MAN".

SERVICE WATER STRAINER 1-1 WILL STOP WHEN THE APPROPRIATE CONDITION EXISTS:

A. WHEN STRAINER 1-1 IS STARTED BY CONDITION I, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≤98 PSIG AS SENSED BY PSH2917 (ZONE K-5).

B. WHEN STRAINER 1-1 IS STARTED BY CONDITION II, THE STRAINER MOTOR WILL STOP AFTER 2 MINUTES.

C. WHEN STRAINER 1-1 IS STARTED BY CONDITION III, THE STRAINER MOTOR WILL STOP 2 MINUTES AFTER ITS HANDSWITCH IS PLACED IN "AUTO" OR "OFF".

D. WHEN STRAINER 1-1 IS STARTED BY CONDITION II AND WHILE RUNNING, CONDITION I IS SENSED, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≤98 PSIG AS SENSED BY PSH2917 AND THE STRAINER HAS BEEN RUNNING FOR ≥2 MINUTES.

E. WHEN STRAINER 1-1 IS STARTED BY CONDITION III AND WHILE RUNNING, CONDITION I IS SENSED, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≤98 PSIG AS SENSED BY PSH2917 AND ≥2 MINUTES AFTER ITS HANDSWITCH IS PLACED IN "AUTO" OR "OFF".

CONDITION "E" IS SIMILAR WHEN THE STRAINER IS STARTED BY CONDITION I AND WHILE RUNNING, CONDITION III EXISTS.

SERVICE WATER STRAINER 1-1 DRAIN VALVE 1379 WILL CLOSE WHEN IT IS FULL OPEN AND SERVICE WATER STRAINER 1-1 IS STOPPED.

LOGIC FOR STRAINERS 1-2, 1-3 AND 1-4 (ZONES J-12, J-8 AND J-14) IS SIMILAR EXCEPT DISCHARGE PRESSURE SETPOINTS, FOR STRAINERS 1-2 AND 1-3, ARE 105 PSIG, 93 PSIG AND 114 PSIG, 98 PSIG (INCREASING, DECREASING) RESPECTIVELY AND STRAINER 1-4 DOES NOT HAVE DISCHARGE PRESSURE INTERLOCKS AND DIFFERENTIAL PRESSURE ACROSS STRAINER IS ≥2.4 PSID AS SENSED BY PDIS4691 (ZONE J-14) AND DILUTION PUMP STRAINER 1-4 DRAIN VALVE CT4690 (ZONE K-13) WILL CLOSE WHEN IT IS ≥20% OPEN AND DLTN/BACKUP SERVICE WATER STRAINER 1-4 IS STOPPED.

STRAINERS 1-1 (F15-1), 1-2 (F15-2), 1-3 (F15-3) AND 1-4 (F15-4) WILL NOT OPERATE IF A THERMAL OVERLOAD EXISTS FOR THEIR RESPECTIVE MOTOR STARTERS.

CL-9 COOLING WATER HEAT EXCHANGER CIRCULATING WATER VALVE CT2955 (ZONE E-14) OPENS AUTOMATICALLY WHEN PSL2956 (ZONE F-15) SENSES < 30 PSIG, PROVIDED PDS3886 (ZONE A-8) SENSES > 0.3 PSID.

THE VALVE WILL CLOSE AUTOMATICALLY WHEN PDS3886 SENSES <0.3 PSID FOR 2 MINUTES.

CL-10 SERVICE WATER TO INTAKE FOREBAY VALVE 2930 (ZONE B-3) OPENS AUTOMATICALLY WHEN PSH2930 (ZONE B-4) SENSES PRESSURE > 50 PSIG. SERVICE WATER TO INTAKE STRUCTURE VALVE 2929 (ZONE B-2) OPENS AUTOMATICALLY WHEN PSH2929 (ZONE B-3) SENSES > 50 PSIG FOR 20 SECONDS. VALVES 2930 AND 2929 MUST BE MANUALLY CLOSED VIA THEIR RESPECTIVE HANDSWITCHES HIS2930 AND HIS2929 (ZONES A-2 AND A-1).

NOTE: ONE OF ADMINISTRATIVELY CONTROLLED VALVES 2929, 2930, 2931, OR 2932 (ZONE B-4) MUST BE OPEN WITH ITS BREAKER OPEN.

CL-11 FOR A LOOP/LOCA, CONTAINMENT AIR COOLER INLET VALVE 1366 CLOSES UPON POWER RESTORATION. REFILL LOGIC AUTOMATICALLY OPENS SERVICE WATER INLET VALVE 1366 (ZONE E-3) WHEN CONTAINMENT AIR COOLER FAN 1-1 (OS-33A, F-5) STARTS. REFILL LOGIC SEQUENCE IS AS FOLLOWS:

A. WAIT 30 SECONDS AFTER FAN START FOR OUTLET VALVE OPENING OR SW PUMP RESTART FOLLOWING A LOSS OF POWER.
B. PARTIALLY OPEN CONTAINMENT AIR COOLER INLET VALVE TO FILL PIPING AT A REDUCED FLOW RATE.
C. WAIT 180 SECONDS FOR CONTAINMENT AIR COOLER AND ASSOCIATED PIPING TO FILL.
D. OPEN INLET VALVE COMPLETELY FOR SW FLOW, AND ILLUMINATE BLUE INDICATING LIGHT "REFILL SEQUENCE COMPLETE" (ZONE E-1)

FOR A LOOP ONLY, CONTAINMENT AIR COOLER INLET VALVE 1366 CLOSES UPON POWER RESTORATION. IF CONTAINMENT AIR COOLER FAN 1-1 WAS IN SLOW SPEED PRIOR TO THE LOOP, REFILL LOGIC AUTOMATICALLY OPENS SERVICE WATER INLET VALVE 1366 AS DESCRIBED ABOVE. IF CONTAINMENT AIR COOLER FAN 1-1 WAS IN FAST SPEED PRIOR TO LOOP, SERVICE WATER FLOW TO THE CONTAINMENT AIR COOLER MUST BE MANUALLY RESTORED.

IF FAN IS STOPPED NORMALLY, VALVE MUST BE MANUALLY CLOSED VIA ITS HANDSWITCH HIS1366 (ZONE E-2).

IF POWER IS LOST, REFILL LOGIC WILL CLOSE CONTAINMENT AIR COOLER INLET VALVE WHEN POWER IS RESTORED, AND DISABLE OPEN CONTROL SWITCH HIS1360 (ZONE E-2).

REFILL LOGIC MAY BE DISABLED BY DEPRESSING GREEN PUSHBUTTON AT BE1142HS (ZONE E-1).

WHEN POWERED FROM TRAIN 1 (BE1207), THE LOGIC FOR CONTAINMENT AIR COOLER 1-3 INLET VALVE 1368 (ZONE E-5) IS SIMILAR.

LOGIC FOR VALVES 1367 AND 1368 (ZONES E-8 AND E-5) IS SIMILAR.

CL-12 CONTROL ROOM EMERGENCY CONDENSING UNIT 1 OUTLET VALVE 2927 (ZONE F-10) OPENS AUTOMATICALLY WHEN THE CREVS COMPRESSOR UNIT STARTS AND THE SYSTEM IS IN THE WATER COOLED MODE (OS-032B, *CD-1*).

VALVE 2927 CLOSES AUTOMATICALLY WHEN EITHER OF THE FOLLOWING CONDITIONS OCCUR:

- SHIFTED TO THE AIR COOLED MODE
- CREVS COMPRESSOR UNIT SHUTS DOWN.

LOGIC FOR VALVE 2928 (ZONE F-11) IS SIMILAR.

CL-13 DELETED.

CL-14 BACKUP SERVICE WATER PUMP P180 (ZONE J-15) WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:

- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY OS-058, E-24)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, F-24)
- 4.16KV BUS C2 LOCKOUT RELAY 86-1/C2 ACTUATES (SEE OS-058 *CD-2*)
- ACTUATION OF THE REVERSE PHASE SEQUENCE UNDERVOLTAGE RELAY 47/C2 (SEE OS-058, NOTE 10)

CL-15 FLOW CONTROL VALVE 5896 (ZONE F-10) WILL MODULATE TO MAINTAIN THE CONTROL ROOM EMERGENCY VENTILATION SYSTEM COMPRESSOR S33-1 (SEE OS-032B, E-4) REFRIGERANT DISCHARGE PRESSURE AT 126 PSIG.

LOGIC FOR FLOW CONTROL VALVE 5897 (ZONE F-11) IS SIMILAR.

CL-16 SERVICE WATER VALVE 1424, (ZONE C-8) MOVES TO FULL OPEN POSITION WHEN THE INSTRUMENT AIR PRESSURE SENSED BY PSL1424 (ZONE C-9) LOWERS TO 75 PSIG OR BELOW.

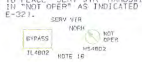
LOGIC FOR SERVICE WATER VALVES 1434 AND 1429 (ZONE C-13 AND C-10) AS SENSED BY PSL1434 AND PSL 1429 (ZONE C-14 AND C-12) IS SIMILAR.

NOTES

1. THE FOLLOWING VALVES HAVE INTERNALS REMOVED:

VALVE	ZONE	VALVE	ZONE
		115	K-3
		117	K-3
		130	B-12
107	J-3	329	B-2
109	J-3	382	F-3

2. TO MAINTAIN SYSTEM REDUNDANCY AND CHANNEL SEPARATION FOR THE SERVICE WATER SYSTEM, VALVES 1399 AND 1395 (ZONES G-13 AND F-13) SHOULD NOT BE OPEN AT THE SAME TIME.
3. WHITE INDICATING LIGHTS (ZONES G-5,G-7,G-8 AND G-11) WILL ILLUMINATE WHEN THEIR RESPECTIVE PUMPS SENSE A PHASE A OR C TIME DELAY OVERCURRENT (*CL-3* AND *CL-5*). WHITE LIGHT ON HIS3609 (ZONE G-15) IS NOT WIRED.
5. FOR OPERATION OF VALVES 5067 AND 5068 (ZONES F-4 AND K-5) SEE CONTAINMENT HYDROGEN DILUTION SYSTEM DWG OS-033C.*CL-3*.
6. FOR GENERAL NOTES, PIPING SYMBOLS, INSTRUMENTATION SYMBOLS AND OPERATIONAL SCHEMATIC INDEX, SEE INDEX SHEET DWG OS-000.
7. 125V DC CONTROL POWER FOR BREAKERS AC107, AC109, AD109, AD107 AND AC201 (ZONES H-5, H-7, H-8, H-11 AND H-15) IS SUPPLIED FROM THEIR RESPECTIVE SWITCHGEAR 125V DC CONTROL BUS. SEE 4.16 KV SYSTEM DWG OS-058, NOTE 6.
8. VALVES 1356, 1358 AND 1357 (ZONES C-1,C-3 AND C-6) HAVE AUXILIARY AIR VOLUME TANKS (NOT SHOWN).
9. SYSTEM IS LINED UP FOR NORMAL OPERATION IN ACCORDANCE WITH APPLICABLE PROCEDURES. THE INDICATED VALVE LINEUP DEPICTS CCW HT EXCH 1-3 ALIGNED AS THE PRIMARY SPARE, TPCW HX 1-1 AND 1-2 IN SERVICE, TPCW 1-3 NOT IN SERVICE AND THE BSW PUMP LINED UP AS A DILUTION PUMP.
10. DELETED
11. HAND INDICATING SWITCH HIS3609A (G-14) IS LOCATED INSIDE MOTOR STARTER CABINET AP1800.
12. VALVE 48 (ZONE E-16) IS AN ISOLATION TELL-TALE.
13. 4.16KV SUPPLY TO SERVICE WATER PUMP 1-3 (ZONE J-7) CAN BE SELECTED FROM BUS C1 BREAKER AC109 (ZONE H-7) OR BUS D1 BREAKER AD109 (ZONE H-8) VIA TRANSFER SWITCHGEAR BREAKERS ACD4 OR ACD5 (OS-058,J-9). BREAKER ACD4 LINES UP POWER FROM BUS C1 AND BREAKER ACD5 LINES UP POWER FROM BUS D1. ACD4 AND ACD5 ARE MECHANICALLY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED AT THE SAME TIME.
14. 480V SUPPLY TO CONTAINMENT AIR COOLER 1-3 SERVICE WATER INLET VALVE 1368 (ZONE E-5) CAN BE SELECTED FROM BREAKER BE1207 (ZONE E-4) OR BREAKER BF1224 (ZONE E-5) VIA ISOLATION BREAKERS BEF128 AND BEF129 (NOT SHOWN). BREAKER BEF128 LINES UP POWER FROM BREAKER BE1207 AND BREAKER BEF129 LINES UP POWER FROM BREAKER BF1224. BEF128 AND BEF129 ARE KIRK KEY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED AT THE SAME TIME.
15. SETPOINTS FOR RSH8432 AND FSL8432 (ZONE A-6) ARE SPECIFIED BY RADIOLOGICAL CONTROLS IN THE DAVIS-BESSE RADIATION MONITOR SETPOINT MANUAL.
16. WHENEVER THE SERVICE WATER SYSTEM IS INOPERABLE, THE OPERATOR IS TO PLACE "SERV WTR" HANDSWITCH HS4802 (ZONE E-33) IN "NOT OPER" AS INDICATED BY THE "BYPASS" LIGHT (ZONE E-32).



17. VALVES SW64 THROUGH SW75 HAVE BEEN DELETED (REMOVED) BY EWR 02-0343-00.
18. COMPUTER POINT P995 WILL ALARM AT ≥ 2.7 PSID AS SENSED BY PDIS4691 (ZONE J-14)
19. ORIFICE PLATE IN FE9808 AND FE9809 ARE INTERCHANGEABLE.
20. ALL VALVES ARE PREFIXED WITH "SW" UNLESS OTHERWISE NOTED.
21. TO ADDRESS SINGLE ACTIVE FAILURE CONCERNS, THE AIR SUPPLY HAS BEEN DISCONNECTED FROM SW2945 AND THE VALVE SHALL REMAIN IN ITS FAILED OPEN POSITION. (REF. ECR 03-0097-00)
22. VALVE SW15 (ZONE E-12) MAY BE THROTTLED TO BALANCE FLOW IN ACCORDANCE WITH APPLICABLE PROCEDURES.
23. BLUE LIGHT EXTINGUISHES WHEN THE FOLLOWING CONDITIONS EXIST:
    - ANY FUSE HAS BLOWN
    - THE DISCONNECT SWITCH IS OPEN
    - THE MCC HAS BEEN DEENERGIZED
    - THREE PHASE ELECTRICAL LOAD IMBALANCE
24. VALVES SW36, SW37, AND SW38 (ZONES C-8, C-10 AND C-13) ARE REQUIRED TO BE THROTTLED TO PROVIDE RUNOUT PROTECTION FOR THE SERVICE WATER PUMPS.
25. AS AN ACCEPTABLE CONDITION, OUTBOARD VACUUM BREAKER VALVES ARE NOT NEEDED TO SUPPORT SERVICE WATER SYSTEM OPERATION. WHEN OUTBOARD VALVE IS REMOVED, A FLANGED PIPE ELBOW SHALL BE INSTALLED TO DIRECT ANY POTENTIAL INBOARD VALVE LEAKAGE TOWARD THE FLOOR. (REF. ECR 05-0086-00 & ECR 05-0086-01)
26. AS AN ACCEPTABLE CONDITION, OUTBOARD VACUUM BREAKER VALVES ARE NOT NEEDED TO SUPPORT SERVICE WATER SYSTEM OPERATION. (REF. ECR 05-0086-02)
27. OPENING OF ALL FOUR BREAKERS BEF151, BEF152, BEF153, AND BEF154 SIMULTANEOUSLY REMOVES CONTROL POWER TO SW1358 (ZONE B-4) AND IT WILL FAIL IN THE OPEN POSITION.
28. ECCS ROOM COOLER #3 IS MECHANICALLY ABANDONED PER ECP 11-0777.

REFERENCES

DRAWINGS

M-041A	E-48B SH 13	E-60B SH 3
M-041B	E-48B SH 14A	E-60B SH 4A
M-041C	E-48B SH 14B	
M-320-53	E-48B SH 14C	
M-320-55	E-48B SH 15	
M-320-56	E-48B SH 26	
M-320-59	E-48B SH 27	
E-34B SH 14	E-48B SH 28	
E-44B SH 6A	E-48B SH 28A	
E-44B SH 6B	E-48B SH 28B	
E-48B SH 6A	E-48B SH 29	
E-48B SH 6B	E-48B SH 30	
E-48B SH 6C	E-48B SH 31A	
E-48B SH 6D	E-48B SH 31B	
E-48B SH 7	E-48B SH 32	
E-48B SH 7A	E-48B SH 33A	
E-48B SH 8	E-48B SH 33B	
E-48B SH 8A	E-48B SH 33C	
E-48B SH 9A	E-48B SH 37A	
E-48B SH 9B	E-48B SH 37B	
E-48B SH 11A	E-48B SH 37C	
E-48B SH 11B	E-48B SH 37D	
E-48B SH 11C	E-48B SH 44	
E-48B SH 11D	E-48B SH 46A	
E-48B SH 11E	E-48B SH 46B	
E-48B SH 11F	E-48B SH 50	
E-48B SH 12	E-48B SH 51	
E-48B SH 12A	E-59B SH 4	

NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DSS MGR
45	7/24/12	INC. DCN 11-0777-002-017 REV.00 DSN. UPDATE ADD NEW NOTE 28 FROM DCN 11-0777-002-016 (WRITTEN AGAINST SH.1) SEE. NOTIF. 600766483	SBW	SAC	-	KPT	-	-	-
44	10/25/11	INC. DCN's 11-0412-001-007 & 11-0412-002-007 BOTH REV.00							
43	10/22/11	INC. DCN 11-0593-001-020 REV.00	SBW	SAC	-	CJC	-	-	-
42	11/2/10	INC. DCN 10-0530-001-001 REV.00	SBW	SAS	-	JHR	-	-	-
41	12/20/07	INC. DCN 07-0088-00-005 REV.00	SBW	SAS	-	SJO	-	-	-
0	11/4/88	INFORMATION ONLY	HB	EKT	HRB	CML	FF	RPM	JAN VMW

SCALE NONE | DESIGNED FXG | DRAWN HRB | DATE 11-4-88

DAVIS-BESSE NUCLEAR POWER STATION UNIT NO 1

OPERATIONAL SCHEMATIC© SERVICE WATER SYSTEM

DRAWING NO OS-020 SH 2 | REV 45

08 07-24-12
DFN=/OPSCH/OS2OS2.DGN

53. The plant is in Mode 3 normal operating temperature and pressure with both steam line isolation valves OPEN.

Instrument air is lost to MS101, Main Steam Line 1 Isolation Valve

(1) How will MS101, Main Steam Line 1 Isolation Valve respond to this loss of instrument air?

(2) How will this loss of instrument air affect MS101, Main Steam Line 1 Isolation Valve Tech Spec required stroke time?

A. (1) fail closed
(2) WILL still meet its Tech Spec required stroke time

B. (1) fail closed
(2) WILL NOT meet its Tech Spec required stroke time

C. (1) remain open
(2) WILL still meet its Tech Spec required minimum stroke time

D. (1) remain open
(2) WILL NOT meet its Tech Spec required stroke time

nswer: C

Explanation/Justification:

- **A.** Incorrect - Plausible if candidate knows an accumulator exists but determines it is only for assisting closure to meet minimum stroke requirements
- **B.** Incorrect - Plausible if candidate knows an accumulator exists but determines it is only for ensuring closure without meeting stroke requirements
- **C.** Correct – Accumulator will both hold open MSIV and pneumatic via N2 assist closing springs to meet design minimum required closing requirement
- **D.** Incorrect - Plausible if Candidate knows an accumulator exists but determines it is only for temporarily maintaining valve open and not also close assist

Sys #	System	Category	KA Statement
078	Instrument Air System (IAS)	K1. Knowledge of the physical connections and/or cause-effect relationships between the IAS and the following systems:	MSIV air

K/A# K1.05 **K/A Importance** 3.4* **Exam Level** RO

References provided to Candidate None **Technical References:** SD-012A R05 page 2-5 and 2-6

Question Source: New **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective:

- Mode 6 - Refueling

  The MS System is not in operation during refueling.

- Load Swings

  During load swings, the HPT may be partially bypassed and steam directed to the Condensers through the TBVs. This occurs when turbine header pressure exceeds the normal operating pressure plus bias set in the Integrated Control System (ICS).

- Turbine Bypass

  Normally, turbine bypass is accomplished by directing steam through the TBVs to the Condensers. Desuperheating water is sprayed into the Condensers to maintain the vacuum. When the Condenser is not available as a heat sink due to a loss of condenser vacuum, cooldown of the SGs can be accomplished by a controlled discharge of steam to the atmosphere through the MSAVVs.

- Loss of Main Feedwater

  In the event of a loss of main feedwater, the MS System drives the AFPTs.

- Post-Accident

  The main steam valves listed on Table 2.1-1 are closed by a signal from SFRCS. See SD-010 for a discussion of SFRCS.

Safety Analysis

MS is associated with USAR Chapter 15 safety analyses for several accidents or abnormal conditions. (Reference USAR Chapters 15.2.7, 15.2.8, 15.2.9, 15.2.10, 15.4.2 and 15.4.4)

2.2 PROCESS/PERFORMANCE CHARACTERISTICS

Each MSIV is provided with a 224-cubic-foot nitrogen accumulator that provides backup nitrogen at 80 psig. This volume is sufficient to maintain the MSIV in an open position for 5 days (References 4.5.15, 4.5.16, 4.6.7 and 4.6.8).

The MSS is designed to provide main steam to the AFWS. Following are the ranges of steam properties and flow rates required by the AFWS. Details are given in the Auxiliary Feedwater System Description (SD-015).

• Pressure	50 to 900 psia
• Temperature	281°F to 590°F
• Flow Rate	at 50 psia, 143 pounds steam per brake horsepower and at 900 psia, 41 pounds steam per brake horsepower

The combined relieving capacity of the MSSVs is 14,174,922 pounds per hour, which is conservative with respect to the required capacity of 13,171,200 lbs/hr (References 4.5.19 and 4.4.4).

Under normal plant operating conditions with turbine valves wide open, the MSS is designed to transport steam from the SGs at outlet conditions of 590°F and 925 psia to the following points at the steam conditions listed:

- Main Turbine Stop Valves (SD-004) — Refer to references 4.5.37 and 4.5.38 for steam conditions
- Moisture Separator/Reheaters (SD-012B) — Refer to references 4.5.37 and 4.5.38 for steam conditions
- Auxiliary Steam and Hot Water System (SD-027) — 250,000 lbm/hr (normal flow is 70,000 to 100,000 lbm/hr)

(Reference 4.2.35)

During startup, the MSS supplies 4,550,000 lbm/hr of steam (total) to both MFPTs (Reference 4.3.33). Evaluations were performed to determine the impact of the Measurement Uncertainty Recapture (MUR)power uprate. These evaluations are documented in references 4.5.39 and 4.5.40.

2.3 ARRANGEMENT

All piping, MSIVs, MSAVVs, and MSSVs are readily accessible for inservice inspection (ISI) (Reference 4.4.1). The routing of the main lines of the MSS is shown on References 4.1.70 through 4.1.81.

2.4 COMPONENT DESIGN

The design data of the major components of the MSS are given in Table 2.4-1. The purpose and features of the major components are described in this section.

<u>Main Steam Isolation Valves</u>

MS101 and MS100

The valves are designed for low leakage upon closure due to a break downstream of the valve. Complete closure for reverse flow occurs when line pressure is less than 80 psig. Under this condition, the leakage rate is not greater than 0.2 pound per hour. The MSIVs are safety-related, air-operated, balanced-disc stop valves set in line with the normal flow direction (Reference 4.4.12). The closure speed of the MSIV can be varied by adjusting the hydraulic control knobs of the hydraulic cylinder, mechanically coupled to the air cylinder (Reference 4.3.11). They are designed to be operated with a differential pressure of 910 psi across the valve. With steam flow in the normal direction and a differential pressure of 910 psi across the MSIVs, the MSIVs are designed to fully close within 5 seconds after the receipt of the closing signal. To assist the springs which shut the valve, each MSIV has a safety grade air accumulator which will provide additional closing force in the event of a loss of instrument air. This ensures the time requirements above can be met. The MSIV Bypass Valves are normally closed. However, if open, they are designed to fully close upon receipt of the closing signal (References 4.2.2 and 4.4.21, and USAR Table 6.2-23). The accumulators are designed to keep the valves open for 5 days after a loss of air (Reference 4.5.15, 4.5.16, 4.6.7 and 4.6.8). Improvements were made to the stem and disc assembly for MS100 and MS101. This

54. Which of the following systems, interlocks, or controls ensure the Containment Vessel remains above the **MINIMUM** internal design pressure?

A. BWST maximum Temperature limits.

B. Containment Spray nozzle size and location

C. Containment Spray Discharge Valve Throttle position

D. Containment Vacuum Relief Valves.

Answer: D

Explanation/Justification:

A. Incorrect – Plausible since a temperature decrease in the BWST would result in a lower Containment Pressure during an inadvertent spray event. BWST maximum temperatures ensure post LOCA injection removes the heat assumed in the accident analysis.

B. Incorrect – Plausible since the spray patterns and location would affect the low pressure created during an inadvertent spray event.

C. Incorrect – Plausible since throttling spray flow would affect pressure reduction but this interlock actuates post LOCA to prevent runout of the CTMT Spray Pumps.

D. Correct – The CTMT Vacuum Relief capacity is designed to protect containment against an inadvertent actuation of CTMT Spray causing significant reduction of Containment Pressure (absolute scale).

Sys #	System	Category	KA Statement
103	Containment System	Generic	Knowledge of the purpose and function of major system components and controls.

K/A# 2.1.28 **K/A Importance** 4.1 **Exam Level** RO

References provided to Candidate None **Technical References:** SD-022F R01 Step 1.1.2.1

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.7)

Objective:

CONTAINMENT VACUUM RELIEF SYSTEM DESCRIPTION

1.0 SYSTEM REQUIREMENTS

1.1 SYSTEM BOUNDARIES AND FUNCTIONS

1.1.1 System Boundaries

The Containment Vacuum Relief System begins at the open-ended pipes located inside the Annulus upstream of Nonreturn Valves CV5080 (NRV5080) through CV5089 (NRV5089) and terminates at the open-ended pipes located inside the Containment Vessel downstream of valves CV5070 (HV5070) through CV5079 (HV5079) as illustrated in Figure 1.1-1. Electrical circuit breakers or fuses which control or feed the equipment or circuits of this process system are included within the boundary of this system.

There are no physical interfaces between this system and other mechanical process systems. The functional interfaces with other systems are provided in Section 2.8.

The major components included in this system are:

- Containment Vessel Vacuum Relief Nonreturn Valves CV5080 (NRV5080) through CV5089 (NRV5089) inclusive.
- Motor-operated Butterfly Isolation Valves CV5070 (HV5070) through CV5079 (HV5079) inclusive.

1.1.2 Functions

1.1.2.1 Functions Important to Safe Plant Operation

The Containment Vacuum Relief System performs the following functions important to safe plant operations. (Reference 4.4.1, 4.4.5, and 4.4.19)

- The system prevents the differential pressure between the inside and outside of the containment from exceeding the Containment's external design pressure by permitting an influx of air to the Containment under positive external differential pressure conditions which may occur in the event of an inadvertent actuation of the Containment Spray System. The basis for this is to maintain the Containment external pressure within its design limits and thereby maintain the integrity of the Containment Vessel. This is based on ASME Section III, paragraph N-1710 requirements.
- The system isolates the Containment in the event of a loss-of-coolant accident (LOCA) to maintain the release of radioactive material to the outside environment within 10 CFR 100 limits.

Sources: References 4.4.1 and 4.4.5

55. The Plant is in Mode 1 at 100% power with all systems in a normal alignment.

Containment Operability is being evaluated.

Which one of the following containment conditions and/or malfunctions will require Technical Specification action within one hour or less.

A. Emergency Air Lock Inner and Outer Doors have failed seal leakage tests.

B. DR2012A, CTMT Sump Pumps Discharge Inside CTMT Isolation has failed its SFAS stroke time.

C. Containment Pressure is + 20 inches water gauge.

D. Containment average air temperature is 115 °F.

Answer: A

Explanation/Justification:

A. Correct – This would render the CTMT Airlock Inoperable under CTMT Systems for TS 3.6.2, Containment Air Locks. CTMT Integrity/Operability under TS 3.6.1 will be affected if total air lock leakage makes overall CTMT leakage exceed allowable amount. TS 3.6.2 Condition C Action C.1 requires action to evaluate overall leakage to be initiated immediately.

B. Incorrect – Plausible because this would render a CTMT Isolation valve Inoperable under CTMT Systems for TS 3.6.3, Containment Isolation Valves, this is a 4 hour action

C. Incorrect – Plausible because this would be an inoperable condition under CTMT Systems for TS 3.6.4, Containment Pressure. If >25 inches this is a one hour action statement.

D. Incorrect – Plausible because this would be an inoperable condition under CTMT Systems for TS 3.6.5 Containment Air Temperature if greater than 120F.

Sys #	System	Category	KA Statement
103	Containment System	K3. Knowledge of the effect that a loss or malfunction of the containment system will have on the following:	Loss of containment integrity under normal operations

K/A# K3.02 **K/A Importance** 3.8 **Exam Level** RO

References provided to Candidate None **Technical References:** TS 3.6.2 Condition C Required Action C.1

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.7 / 45.6)

Objective:

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. (continued)	B.2	Lock an OPERABLE door closed in the affected air lock.	24 hours
	AND		
	B.3	---------------NOTE-------------- Air lock doors in high radiation areas may be verified locked closed by administrative means. ------------------------------------- Verify an OPERABLE door is locked closed in the affected air lock.	Once per 31 days
C. One or more containment air locks inoperable for reasons other than Condition A or B.	C.1	Initiate action to evaluate overall containment leakage rate per LCO 3.6.1.	Immediately
	AND		
	C.2	Verify a door is closed in the affected air lock.	1 hour
	AND		
	C.3	Restore air lock to OPERABLE status.	24 hours
D. Required Action and associated Completion Time not met.	D.1	Be in MODE 3.	6 hours
	AND		
	D.2	Be in MODE 5.	36 hours

56. RCS Temperature is 180 °F.

RCS Pressure is 180 psig.

Which of the following pumps can be started **IMMEDIATELY** from the Control Room to add boric acid from the Borated Water Storage Tank (BWST) to the Reactor Coolant System, if necessary?

1. Boric Acid Addition Pumps
2. High Pressure Injection Pumps
3. Low Pressure Injection Pumps
4. Makeup Pumps

A. 1 & 2 only

B. 1 & 4 only

C. 2 & 3 only

D. 3 & 4 only

Answer: D

Explanation/Justification:

A. Incorrect – RCS Pressure is to high for BAAT Pumps, and HPI is disabled when RCS temperature is less than 280ºF by racking out the breakers.
B. Incorrect – RCS Pressure is to high for BAAT Pumps but the MU Pumps would be a viable source
C. Incorrect - HPI is disabled when RCS temperature is less than 280ºF by racking out the breakers, but the LPI pumps would be a viable source
D. Correct – Both the Makeup Pumps and the LPI pumps can be started immediately in these plant conditions.

Sys #	System	Category	KA Statement
002	Reactor Coolant System (RCS)	K1. Knowledge of the physical connections and/or cause-effect relationships between the RCS and the following systems:	Borated water storage tank

K/A# K1.03 **K/A Importance** 3.8 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06903, R42 Step 4.47 for MU disabled, Step 4.21 for HPI disabled and note 4.46 for BAAT Transfer Pump Discharge Pressure.

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** (CFR: 41.2 to 41.9 / 45.7 to 45.8)

Objective:

NOTE 4.46

RCS pressure will prevent boric acid additions from the BAATs to the Decay Heat system. The maximum RCS pressure for BAAT Pump 1 is 52 psig. The maximum RCS pressure for BAAT Pump 2 is 38 psig.

_______ 4.46 Verify a BA flowpath exists from the BWST to the RCS, refer to TRM 8.1.2.b.

NOTE 4.47

- If hydrogen peroxide was added for source term reduction with RCPs running, the pressurizer will fill with water when a CWRT is used for auxiliary spray (i.e. contraction volume not a major concern). Prior to that point, pressurizer level should not be reduced below 50 inches.
- If hydrogen peroxide was not added for source term reduction with RCPs running (normal cooldown), then an adequate pressurizer level will be needed prior to removing the Makeup Pumps from service in order to have available contraction volume for cooldown to 120°F.

_______ 4.47 WHEN the RCS pressure is less than 80 psig,
THEN remove the Makeup System from service.
REFER TO DB-OP-06006, Makeup and Purification System.

NOTE 4.48

- The RCS cooldown may proceed in parallel with this step for Attachment 3.
- For Attachment 14, RCS cooldown should not continue until after the auxiliary spray source has been swapped from the CWRT over to the Decay Heat Pump (pressurizer temperature less than 250 °F.

4.48 Perform one of the following to reduce RCS pressure to 25 to 30 psig: (N/A step not performed)

_______ • IF hydrogen peroxide was injected for source term reduction with RCPs running,
THEN REFER TO Attachment 14, Pressurizer Cooldown and Depressurization of the RCS after Injection of Hydrogen Peroxide with RCPs running.

OR

_______ • REFER TO Attachment 3, Pressurizer Cooldown and Depressurization of the RCS.

________ b. Place PIC 320, HEATER 2-3 PEGGING STEAM PRESSURE CONTROL in manual and close.

________ c. Verify FW 104, DEAERATOR STORAGE TANKS TO CONDENSER PENT #51 is open.

________ d. Throttle FW 33, DEAERATOR STORAGE TANKS TO CONDENSER GLOBE VALVE, as needed to reduce Deaerator Temp.

________ e. Throttle FW 170, FW MINI BYPASS TO CONDENSER ISOLATION VALVE, to reduce FW Temperature.

NOTE 4.21

A separate clearance should be used to disable each HPI train to provide low temperature overpressure protection (LTOP) and to facilitate testing.

4.21 WHEN RCS temperature is less than 280°F,
THEN disable HPI by performing the following:

4.21.1 Rack out
AND CAUTION tag the following HPI Pump Breakers:

________ • AC111, HPI Pump 1.

________ • AD111, HPI Pump 2.

4.21.2 Place Caution Tags on the following CTRM switches:

________ • HIS1524, HPI PUMP 1

________ • HIS1523, HPI PUMP 2

4.22 Determined required status of MSIV spring packs and stroke requirements as follows:

________ 4.22.1 Request Plant Engineering to determine if planned maintenance activities require the MSIV spring packs to be pinned.

________ 4.22.2 Request IST Engineering to determine if MS100 and MS101 require stroke testing.

________ 4.22.3 IF MSIVs are to be stroked or pinned,
THEN stroke test MS100 and MS101.
REFER TO DB-PF-03812, Miscellaneous Valves Cold Shutdown and Refueling Test.

________ 4.22.4 IF the MSIV actuator springs are required to be pinned,
THEN verify MS100 and MS101 open
AND direct Maintenance to pin the MSIV actuator springs.
REFER TO DB-MM-09065, Main Steam Isolation Valve Maintenance.

57. The Plant is at 100% Power when control rod 7-3 drops to the bottom of the core. The following alarms are in:

- 5-1-E CRD LCO
- 5-2-E CRD ASYMETRIC ROD

The Reactor Operator places the Rod Control Panel in **MANUAL**, and moves the CRD T Handle to insert Control Rods.

How will Group 7 respond to this **IN** command?

Group 7 will ____(1)____ because ____(2)____.

A. (1) insert
(2) an Asymetric Fault exists

B. (1) insert
(2) the dropped rod is unattached from its leadscrew

C. (1) Not move
(2) an In Limit exists

D. (1) Not move
(2) a Sequence Fault exists.

Answer: C

Explanation/Justification:

A. Incorrect – Plausible because asymmetry fault bypasses the in limit when rods in auto

B. Incorrect – Plausible because the dropped rod will not move if unattached however, the alarms provided come from lead screw position, not physical rod position. As a result, they would not be affected by a detached rod.

C. Correct – the in limit interlock prevents rod insertion when any rod in a group has a rod bottom light lit unless the in limit bypass button is depressed

D. Incorrect – Plausible because based on initial Group 7 position, a sequence fault could occur, but group 7 rod at its in limit will prevent insertion

---

Sys #	System	Category	KA Statement
014	Rod Position Indication System	K4. Knowledge of RPIS design feature(s) and/or interlock(s) which provide for the following:	Rod bottom lights

K/A# K4.03 **K/A Importance** 3.2 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-06402 R23 page 152 Att 2 (#16)

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.5 / 45.7)

Objective:

ATTACHMENT 2: ROD CONTROL PANEL INDICATING LIGHTS
Page 7 of 7

16. IN LIMIT

Normal Light Status:	OFF
Conditions for Activation:	The first control rod in the associated group has reached its IN LIMIT
Automatic Actions:	Inhibits inward motion for that control rod group (Unless INLIM BYPASS is pressed or Asymmetry Fault present with Rod Control Panel in AUTO)
Recommended Actions:	Verify IN LIMIT indication is consistent with group control rod position.

17. SUPPLY PHASES

Normal Light Status:	OFF
Conditions for Activation:	
• Selected Supply	1. Rod Control Panel in JOG AND selected group Sealed In AND associated control rod drive mechanism supply phase energized
• Auxiliary Supply	1. Rod Control Panel in JOG AND in AUX AND selected group Sealed In AND associated auxiliary supply phase energized
Automatic Actions	None
Recommended Actions:	Verify supply phases indications are consistent with control rod transfer operations.

18. SYNC CONFIRM

Normal Light Status:	OFF
Conditions for Activation:	1. SUPPLY PHASE lights activated AND Rod Control Panel in JOG AND Rod Control Panel in AUX AND both energized normal supply phases match with their associated auxiliary supply phases [Synchronizer logic permits transfer if one of the normal supply phases is deenergized (e.g., fault)]
Automatic Actions:	CLAMP pushbutton operation is inhibited if SYNC CONFIRM is NOT present
Recommended Actions:	None

58. MI-05254, Nuclear Instrumentation NI05 (RPS CH 2) Power Range Adjustment is in Progress.

- The Load Control Panel is in Manual
- The Rod Control Panel and Reactor Demand are in Auto
- NI6 Indicates 99.8%
- NI7 Indicates 99.6%
- NI8 Indicates 99.4%

I&C has informed the Shift Manager they have completed calibration and are returning the Power Range Test Module rotary switch to the OPERATE position.

- Due to an error, NI5 gain is set incorrectly and NI5 currently reads 105%

When I&C returns the Power Range Test Module to OPERATE position, how will the regulating control rods respond?

A. No effect

B. Insert

C. Withdraw

D. Trip

Answer: B

Explanation/Justification:

A. Incorrect – Plausible if candidate does not know the controlling NI is high auctioneered

B. Correct – Correct answer – Highest NI will control rods and greater than or equal to 1% neutron error will insert rods

C. Incorrect – Plausible if candidate assumes power must be raised to match indication (also opposite of correct answer)

D. Incorrect – Plausible since 105% is greater than the high power trip setpoint of 104.7% however only a single channel is affected and the reactor will not trip.

Sys #	System	Category	KA Statement
015	Nuclear Instrumentation System	A4. Ability to manually operate and/or monitor in the control room:	Selection of controlling NIS channel

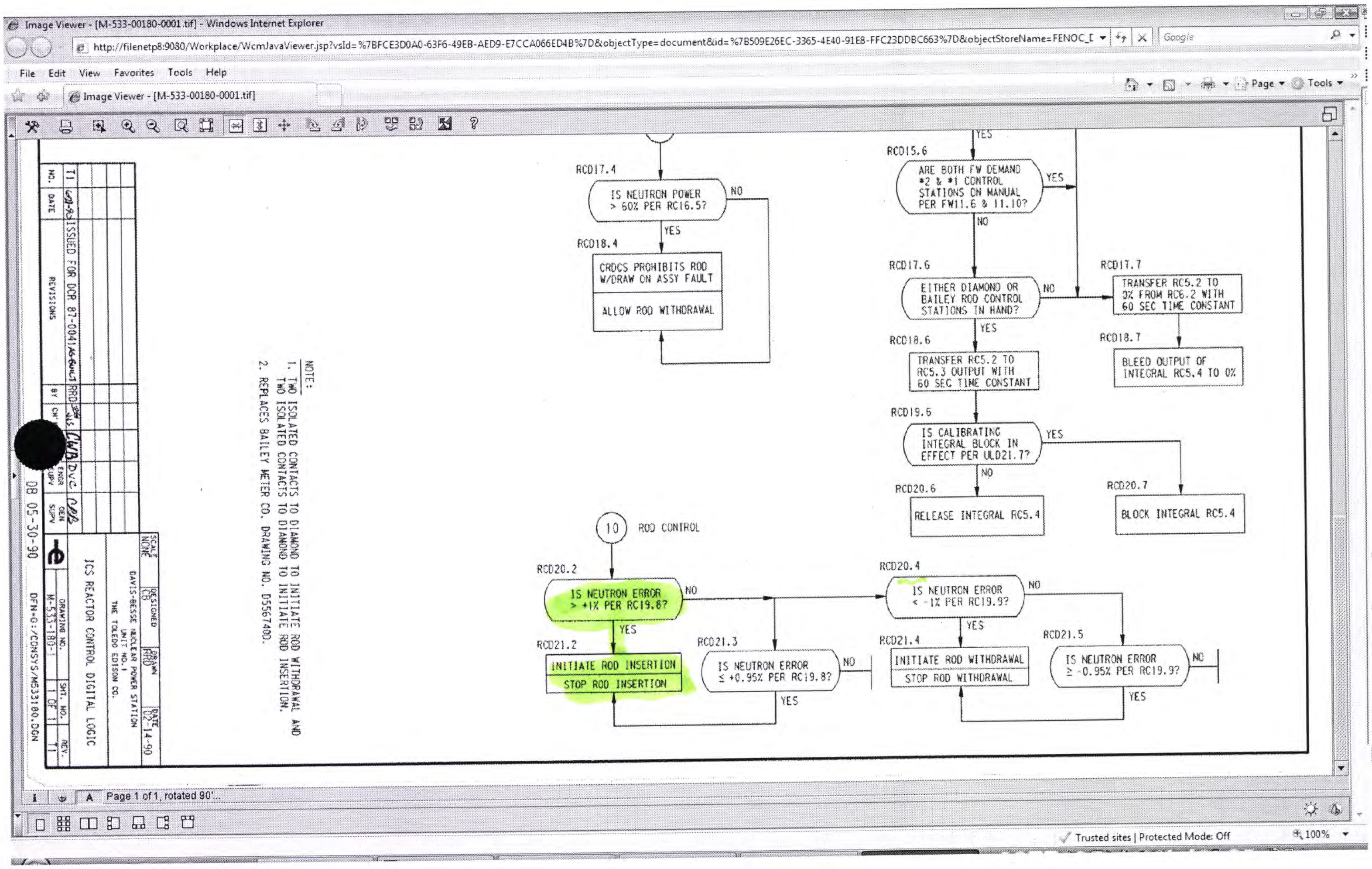
K/A# A4.01 **K/A Importance** 3.6* **Exam Level** RO

References provided to Candidate None **Technical References:** M-533-180-1 ICS Reactor Control Digital Logic

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7 / 45.5 to 45.8)

Objective:



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59. The plant is operating at 100% power. The reactor is manually tripped due to high vibration on the Main Generator.

The following events occur:

- All Turbine Bypass Valves open to control Steam Generator Pressure.
- SP13B1, Steam Line 1 Turbine Bypass Valve sticks full open.

All other equipment functions as designed.

(1) How will the plant respond to this failure, assuming no operator actions?
(2) What, if any, operator actions will be **required** to stabilize the plant without relying on the Main Steam Safety Valve operation?

A. (1) The unaffected Turbine Bypass Valves will modulate closed to control both SG pressures at the normal post trip setpoint of approximately 995 psig. This condition will not result in an SFRCS actuation.
(2) No Operator Action will be required to stabilize the plant.

B. (1) SFRCS will actuate on low SG1 Level, closing the Main Steam Isolation Valves, and starting Auxiliary Feedwater to restoring SG1 Level to 49 inches.
(2) No Operator Action will be required to stabilize the plant.

C. (1) SFRCS will actuate on low SG Pressure on SG1, closing both Main Steam Isolation Valves.
(2) The Operators will use the Atmospheric Vent Valves in manual to control RCS Tave constant or slightly lowering.

D. (1)SFRCS will actuate on Steam to Feed Differential Pressure on SG1, isolating all Main and Auxiliary Feedwater to SG1.
(2) The Operators will open the Atmospheric Vent Valves on #1 SG to blowdown the affected SG.

Answer: C

Explanation/Justification:

A. Incorrect – Plausible if the candidate concludes the steam flow rate due to one open TBV is less than the core decay heat rate post trip. This event will exceed the core decay heat rate even if all other TBVs are closed. If the steam flow was less than core decay heat, then this response would be accurate.

B. Incorrect – Plausible because the Steam Generator Level would be lowering with an open TBV, however the Main Feedwater System and AFW, if actuated, can maintain SG level at setpoint even with an open TBV. The MSIVs would not close on low SG Level.

C. Correct – Without Operator Action, SG pressure in #1 SG would lower and cause an SFRCS Low SG Pressure on #1 SG at 630 psig. Once the MSIVs close, SG Pressure will rise causing the low pressure trip to reset allowing AFW flow to #1 SG. Operator action to control SG Pressure would be necessary to prevent Main Steam Safety Valves from opening.

D. Incorrect – Plausible because SFRCS will eventually actuate on Steam to Feed Differential Pressure once the MSIVs are closed in response to the low SG Pressure. The actions to blowdown the affected SG are actions taken in response to a Steam Line Break in accordance with DB-OP-02525, Steam Leaks, section 4.2, not an action taken in response to a TBV malfunction.

Sys #	System	Category	KA Statement
041	Steam Dump System (SDS) and Turbine Bypass Control	Ability to (a) predict the impacts of the following malfunctions or operations on the SDS; and (b) based on those predictions or mitigate the consequences of those malfunctions or operations:	Steam valve stuck open

KA#	A2.02	K/A Importance 3.6	Exam Level: RO
References provided to Candidate	None	Technical References:	OPS-SYS-1202 Rev. 8 page 9 DB-OP-02000 Table 1 Rev. 26
Question Source:	New	Level Of Difficulty: (1-5)	4
Question Cognitive Level:	High - Comprehension	10 CFR Part 55 Content:	(CFR: 41.5 / 43.5 / 45.3 / 45.13)

b. Valves are interlocked such that they cannot be opened at less than 10% of full load on the turbine. This is sensed by a pressure switch (PS9806) which is located on the inlet to the Low Pressure turbine from Moisture Separator Reheater 1-2. This pressure switch will auto close MS 314 and MS 199 on Turbine Trip, as well.

13. Turbine Stop Valves — SLIDE 42

a. Shuts off steam flow to the Main Turbine under Turbine trip conditions

b. Hydraulically operated reverse seating valves. — SLIDE 43

c. Positioned by a signal from the Electro-Hydraulic Control (EHC) System

d. #2 Main Stop valve supplies the signal needed for ACB 34560 and 34561 to open and cause a transfer to the startup transformer.

14. Turbine Bypass Valves (SP13 A1-A3, B1-B3) — SLIDE 44

a. Location - 603' Level Turbine Building near Condensate Polishers

b. The purpose of the Turbine Bypass valves is to control Main Steam Line pressure by passing excess steam to the condenser during load swings, startups, and shutdowns. The Turbine Bypass Valves are used to control heat up and cooldown rates for the Reactor Coolant system.

c. The six air operated Turbine Bypass Valves have an individual capacity of 5% rated NSS output, with a total combined capacity of 25%.

Q: Why?
A: Line losses and pipe size limitations.

d. The Turbine Bypass Valves will fail closed at 75 psig on a loss of Instrument Air. The Turbine Bypass Valves will be assisted closed by the reserve air bottle and held closed by spring pressure.

(1) ECR 04-0322-00 added double acting actuators to all of the Turbine Bypass Valves, plus added another air tank for the top cylinder, and replaced pistons, etc.

(2) In the past, the Turbine Bypass Valves have been experiencing mechanical binding and sometimes stick open. If this should happen, the Turbine Bypass Valve will have to be manually isolated and then the valve will become an Operator work around and an Operation's concern.

17.0 TABLES

TABLE 1

SFRCS
Actuated
Equipment
Sheet 1 of 2

SFRCS Actuated Equipment	SFRCS AUTOMATIC ACTUATION				SFRCS MANUAL ACTUATION[3]	
	SG Low Pressure		SG High Level OR Reverse Delta P	SG Low Level OR Loss of All RCPs	Manual Initiate	Manual Initiate & Isol
	SG 1	SG 2			6401 & 6402	6403 & 6404
FW612 (Z674)	CL	CL	CL	-	-	CL
SP6B (Z673)	CL	CL	CL	-	-	-
FW780	CL	CL	CL	-	-	CL
FW779	CL	CL	CL	-	-	CL
SP6A (Z678)	CL	CL	CL	-	-	-
FW601 (Z679)	CL	CL	CL	-	-	CL
ICS11B (Z961)	CL	CL	CL	-	-	CL
SP7B (Z675)	CL	CL	CL	-	-	CL
SP7A (Z680)	CL	CL	CL	-	-	CL
ICS11A (Z969)	CL	CL	CL	-	-	CL
MS101 (Z683)	CL	CL	CL	-	-	CL
MS100 (Z686)	CL	CL	CL	-	-	CL
MS101-1 (Z685)	CL	CL	CL	-	-	CL
MS100-1 (Z688)	CL	CL	CL	-	-	CL
MS611	CL	CL	CL	-	-	CL
MS394 (Z684)	CL	CL	CL	-	-	CL
MS375 (Z687)	CL	CL	CL	-	-	CL
MS603	CL	CL	CL	-	-	CL

[3]Manual Actuation Response assumes both trains actuation pushbuttons were depressed.

TABLE 1 (Continued)
SFRCS
Actuated
Equipment
Sheet 2 of 2

SFRCS Actuated Components	SFRCS AUTOMATIC ACTUATION				SFRCS MANUAL ACTUATION[3]	
	SG Low Pressure		SG High Level OR Reverse Delta P	SG Low Level OR Loss of All RCPs	Manual Initiate	Manual Initiate & Isol
	SG 1	SG 2			6401 & 6402	6403 & 6404
AF3870 (Z008)	CL[1]	OP	OP	OP	OP	OP
MS106 (Z003)	CL	OP	OP	OP	OP	OP
MS107 (Z006)	OP	CL	OP	OP	OP	OP
AF3872 (Z010)	OP	CL[2]	OP	OP	OP	OP
MS5889A (Z014)	OP	OP	OP	OP	OP	OP
MS5889B (Z015)	OP	OP	OP	OP	OP	OP
MS106A (Z004)	OP	CL	OP	OP	-	-
MS107A (Z007)	CL	OP	OP	OP	-	-
AF3869 (Z009)	OP	CL	CL	CL	CL	CL
AF3871 (Z011)	CL	OP	CL	CL	CL	CL
RX Trip (ARTS)	TR	TR	TR	TR	TR	TR
Turbine Trip	TR	TR	TR	TR	TR	TR

[1]If AF3870 fails to close, then close AF608. Manual control of OTSG 2 level will be required.
[2]If AF3872 fails to close, then close AF599. Manual control of OTSG 1 level will be required.
[3]Manual Actuation Response assumes both trains actuation pushbuttons were depressed.

60. The Plant is in Mode 3. All systems are in a normal alignment.

Main Condenser pressure is 0.6 IN HgA

If the only operating steam jet air ejector suction valve is closed, isolating the SJAE from the Main Condenser, how will this affect Condenser pressure?

Main Condenser Pressure will:

A. remain constant.

B. control at approximately 3.0 IN HgA.

C. control at approximately 10 IN HgA.

D. eventually rise to Atmospheric Pressure.

Answer: B

Explanation/Justification:

A. Incorrect – Plausible if Candidate determines loss of suction alignment will have no effect due to vacuum being maintained by condensate depression as the Turbine Bypass valves dump steam to the Main Condenser.

B. Correct – The Mechanical Hogger starts at 4.5 IN HgA and reduces pressure to 3.0 IN HgA where its pressure control valve will open to atmosphere to maintain pressure at approximately 3 IN HgA.

C. Incorrect – Plausible the Steam Hogger used during startup will lower condenser pressure to approximately 10 inches HgA, but would not be in service if condenser vacuum has already been established..

D. Incorrect – Plausible because none condensable gases would eventually cause condenser pressure to reach atmospheric pressure.

Sys #	System	Category	KA Statement
055	Condenser Air Removal System	K3. Knowledge of the effect that a loss or malfunction of the CARS will have on the following:	Main condenser

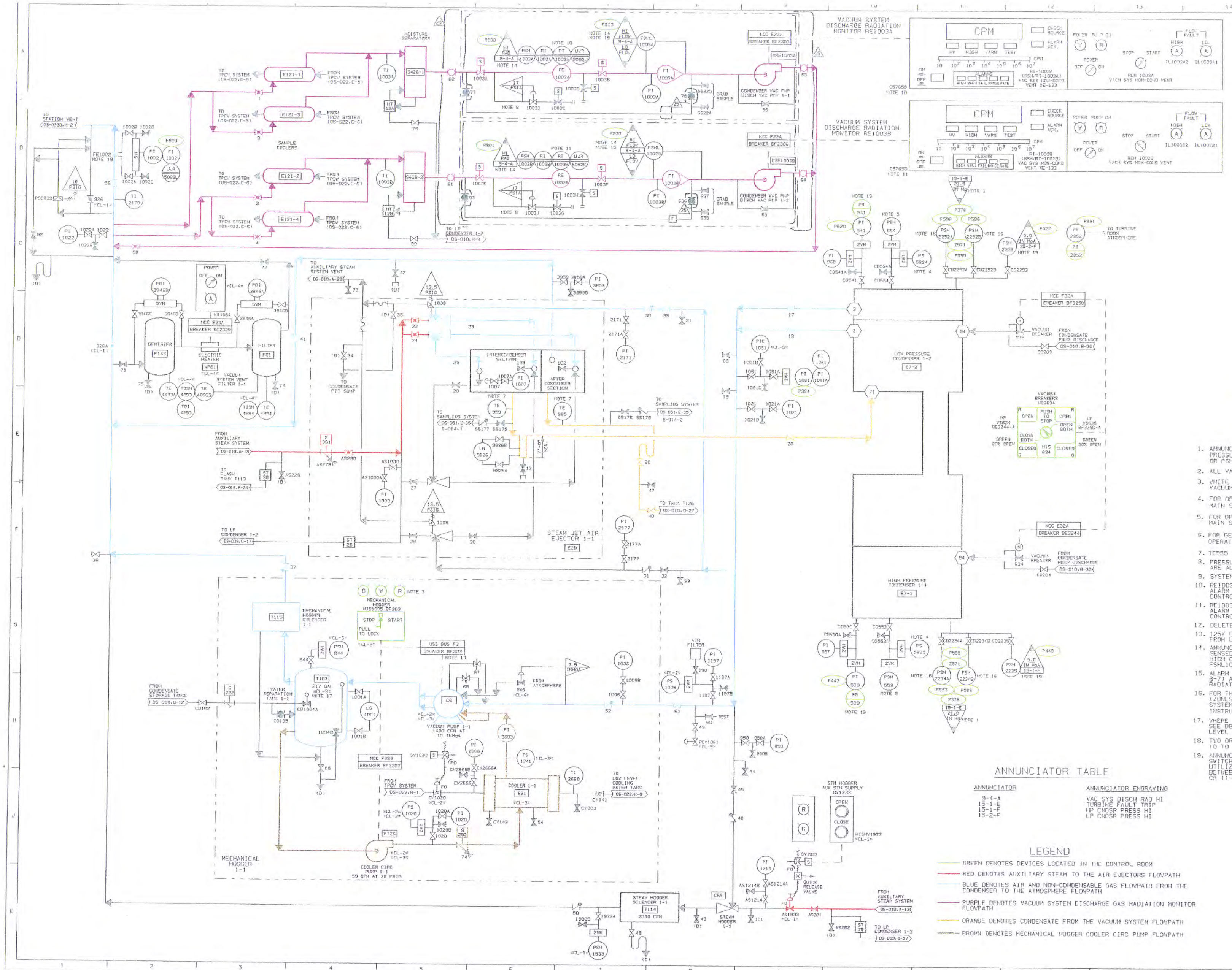
K/A# K3.01 **K/A Importance** 2.5 **Exam Level** RO

References provided to Candidate None **Technical References:** OS-015 CL-6

Question Source: New **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.7 / 45.6)

Objective:



CONTROL LOGICS

CL-1 STEAM HOGGER INLET CONTROL VALVE AS1933 (ZONE K-3) WILL OPEN WITH ITS HANDSWITCH HISNV1933 (ZONE J-10) IN "START" WHEN THE FOLLOWING CONDITIONS EXIST:

- STATION VENT VALVES 926 AND 926A (ZONES C-1 AND D-1) ARE OPEN
- EXHAUST VENT LINE PRESSURE IS <4 PSIG AS SENSED BY PSH1933 (ZONE K-7)

IF ANY OF THE ABOVE PERMISSIVES NO LONGER EXIST, CONTROL VALVE AS1933 WILL CLOSE.

CL-2 WITH MECHANICAL HOGGER HANDSWITCH HIS1005 (ZONE G-5) IN "NORMAL" AFTER "STOP", THE FOLLOWING SEQUENCE WILL OCCUR WHEN VACUUM PRESSURE IS >4.5 IN HgA AS SENSED BY PS1005 (ZONE H-8).

- COOLER CIRCULATING PUMP 1-1 (ZONE J-5) WILL START
- COOLING WATER INLET VALVE CW1020 (ZONE J-5) OPENS
- VACUUM PUMP 1-1 (ZONE H-5) WILL START AFTER COOLER CIRCULATING PUMP DISCHARGE IS >10 PSIG AS SENSED BY PS1020 (ZONE J-5)

ONCE VACUUM PUMP AND CIRCULATING PUMP AUTOMATICALLY START, THEY MUST BE MANUALLY STOPPED.

CL-3 VACUUM PUMP 1-1 (ZONE H-5) WILL TRIP WHEN ONE OF THE FOLLOWING CONDITIONS EXIST:

- WATER SEPARATION TANK 1-1 (ZONE H-4) PRESSURE IS >4 PSIG AS SENSED BY PSH344 (ZONE G-4)
- COOLER 1-1 CIRCULATING WATER EXIT TEMPERATURE IS 120°F AS SENSED BY TS1241 (ZONE H-6)
- LOW COOLING WATER PRESSURE OF <10 PSIG AS SENSED BY PS1020 (ZONE J-5)

NOTE: COOLER CIRCULATING WATER PUMP 1-1 (ZONE J-5) WILL CONTINUE TO RUN AFTER THE VACUUM PUMP IS TRIPPED. SEE NOTE 3.

CL-4 ELECTRIC HEATER WF61 (ZONE D-3) WILL ENERGIZE WHEN CONDITIONS I, II AND III OR I, II AND IV EXIST:

I. HANDSWITCH HS4894 (ZONE D-3) IS IN "ON".
II. DIFFERENTIAL TEMPERATURE BETWEEN DEMISTER OUTLET AND FILTER INLET IS ≤15°F AS SENSED BY TDSH4893 (ZONE E-2).
III. FILTER INLET TEMPERATURE IS ≤190°F AS SENSED BY TISH4894 (ZONE E-3).
IV. FILTER INLET TEMPERATURE IS APPROXIMATELY ≤170°F AS SENSED BY TISH4894 IF A HIGH INLET TEMPERATURE OF ≥190°F HAS PREVIOUSLY DE-ENERGIZED THE HEATER.

HEATER WILL DE-ENERGIZE WHEN CONDITIONS I OR III ARE NOT MET OR DIFFERENTIAL TEMPERATURE BETWEEN DEMISTER OUTLET AND FILTER INLET IS >20°F AS SENSED BY TDSH4893.

THE ALARM LIGHT (NOT SHOWN) WILL ILLUMINATE ON TDSH4893 WHEN DIFFERENTIAL TEMPERATURE IS ≤10°F AS SENSED BY TDSH4893.

CL-5 PRESSURE CONTROL VALVE PCV1061 (ZONE H-8) MODULATES TO MAINTAIN 0.6 IN HgA IN RESPONSE TO ITS CONTROLLER PIC1061 (ZONE D-9).

CL-6 PRESSURE CONTROL VALVE 845 (ZONE H-6) CLOSES AT 3.5 IN HgA INCREASING AND OPENS AT 3 IN HgA DECREASING.

NOTE: AT 3 IN HgA THE MECHANICAL HOGGER IS PLACED IN STANDBY AND THE STEAM JET AIR EJECTOR DRAWS VACUUM DOWN TO ITS OPERATING VALUE (BASED ON CIRCULATING WATER INLET TEMPERATURE.)

NOTES

1. ANNUNCIATOR 15-1-E WILL ALARM WHEN LOW VACUUM IN THE LOW PRESSURE TURBINE EXHAUST IS ≥7.5 IN HgA AS SENSED BY PSH2234A OR PSH2252A AND PSH2234B OR PSHH2252B (ZONES G-11 AND C-11).
2. ALL VALVES ARE PREFIXED WITH "VS" UNLESS OTHERWISE NOTED.
3. WHITE INDICATING LIGHT ON HIS1005 (ZONE G-5) ILLUMINATES ON VACUUM PUMP 1-1 (ZONE H-5) OVERLOAD.
4. FOR OPERATION OF PS5824 AND PS5825 (ZONES C-11 AND G-11) SEE MAIN STEAM AND REHEAT SYSTEM DWG OS-008, *CL-5*.
5. FOR OPERATION OF PSH553 AND PSH554 (ZONES G-10 AND C-10) SEE MAIN STEAM AND REHEAT SYSTEM DWG OS-008, *CL-8*.
6. FOR GENERAL NOTES, PIPING SYMBOLS, INSTRUMENTATION SYMBOLS AND OPERATIONAL SCHEMATIC INDEX, SEE INDEX SHEET DWG OS-000.
7. TE959 AND TE965 (ZONES E-6) ARE INSTALLED STRAP ON TEMPERATURE SENSORS.
8. PRESSURE CONTROL VALVES 1003I AND 1003J (ZONES A-6 AND B-6) ARE ALSO TAGGED AS PCV1003A AND PCV1003B RESPECTIVELY.
9. SYSTEM IS LINED UP FOR NORMAL OPERATION IN ACCORDANCE WITH APPLICABLE PROCEDURES.
10. RE1003A (ZONE A-6) IS A GAMMA SCINTILLATION DETECTOR. WARN ALARM AND HIGH ALARM SETPOINTS ARE SPECIFIED BY RADIOLOGICAL CONTROLS IN THE DAVIS-BESSE RADIATION MONITOR SETPOINT MANUAL.
11. RE1003B (ZONE B-6) IS A BETA SCINTILLATION DETECTOR. WARN ALARM AND HIGH ALARM SETPOINTS ARE SPECIFIED BY RADIOLOGICAL CONTROLS IN THE DAVIS-BESSE RADIATION MONITOR SETPOINT MANUAL.
12. DELETED
13. 125V DC CONTROL POWER FOR BREAKER BF303 (ZONE G-5) IS SUPPLIED FROM USS BUS F3 125V DC CONTROL BUS. SEE OS-059, NOTE 10.
14. ANNUNCIATOR 9-4-A WILL ALARM WHEN HIGH RADIATION EXISTS, AS SENSED BY RSH1003A (ZONE A-6) OR RSH1003B (ZONE B-6), OR WHEN HIGH OR LOW FLOW EXISTS IN THE OPERATING TRAIN, AS SENSED BY FSHL1003A (ZONE A-7) OR FSHL1003B (ZONE B-7) RESPECTIVELY.
15. ALARM SETPOINTS FOR FSHL1003A (ZONE A-7) AND FSHL1003B (ZONE B-7) ARE SPECIFIED BY RADIOLOGICAL CONTROLS IN THE DAVIS-BESSE RADIATION MONITOR SETPOINT MANUAL.
16. FOR THE OPERATION OF PSH2234A, PSH2234B, PSH2252A AND PSH2252B (ZONES G-11 AND C-11) SEE TURBINE ELECTROHYDRAULIC CONTROL SYSTEM DWG OS-023, *CL-4* AND TURBINE SUPERVISORY INSTRUMENTATION DWG OS-024B, NOTE 12.
17. WHERE NOTED THE TANK CAPACITY IS NOMINAL. WHERE APPLICABLE, SEE DB-PF-06705 (TANK LEVEL CALIBRATION CURVES) FOR INDICATED LEVEL VS. VOLUME RELATIONSHIP. (REF: PCAQR 96-0976).
18. TWO ORIFICE PLATES FE-1002 (ZONE B-1) (0 TO 100 SCFM) AND FE-1002A (0 TO 10 SCFM) ARE SUPPLIED. ON INITIAL INSTALLATION USE 0 TO 100 SCFM PLATE.
19. ANNUNCIATOR ALARM 15-1-F (15-2-F) (ZONES G-12 AND C-12) UTILIZES A PRESSURE SWITCH THAT REFERENCES ATMOSPHERIC PRESSURE. PR530 (PR541) (ZONES H-10 AND C-10) UTILIZES A PRESSURE TRANSMITTER THAT REFERNCES ABSOLUTE VACUUM. A VARIATION BETWEEN THESE INDICATIONS WILL OCCUR DUE TO CHANGES IN ATMOSPHERIC PRESSURE. CR 11-93402.

ANNUNCIATOR TABLE

ANNUNCIATOR	ANNUNCIATOR ENGRAVING
9-4-A	VAC SYS DISCH RAD HI
15-1-E	TURBINE FAULT TRIP
15-1-F	HP CNDSR PRESS HI
15-2-F	LP CNDSR PRESS HI

LEGEND

- GREEN DENOTES DEVICES LOCATED IN THE CONTROL ROOM
- RED DENOTES AUXILIARY STEAM TO THE AIR EJECTORS FLOWPATH
- BLUE DENOTES AIR AND NON-CONDENSABLE GAS FLOWPATH FROM THE CONDENSER TO THE ATMOSPHERE FLOWPATH
- PURPLE DENOTES VACUUM SYSTEM DISCHARGE GAS RADIATION MONITOR FLOWPATH
- ORANGE DENOTES CONDENSATE FROM THE VACUUM SYSTEM FLOWPATH
- BROWN DENOTES MECHANICAL HOGGER COOLER CIRC PUMP FLOWPATH

REFERENCES

DRAWINGS

M-006F
M-0059
M-014
M-024C SH 6
M-320-60
M-402-3
E-429 SH 28
E-428 SH 29
E-428 SH 35A
E-468 SH 6A
E-468 SH 6B
E-468 SH 6C
E-468 SH 27
E-468 SH 28
E-468 SH 29
E-468 SH 53
E-508 SH 17

NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DEC HOR
24	5/19/11	INC. DCN 11-0315-001-001 REV.00 & GEN. UPDATE ADD ZONE REF.'S TO KEY NOTE 19 & NEXT TO PR530 & PR541 PER DWG. PRACTICE & ADD ZONE REF. TO NOTE 18. FE1002 FOR DWG. CONSISTENCY	SBW	SAC	-	CJS	-	-	-
25	8/12/11	INC. DCN 11-0391-001-003 REV.00	SBW	SAC	-	KPT	-	-	-
0	6-88	INFORMATION ONLY	HHB	EWT	GAR	CML	JPH	PJS	JAC

SCALE NONE | DESIGNED FXG | DRAWN MIW | DATE 6-88

DAVIS-BESSE NUCLEAR POWER STATION
UNIT NO 1

OPERATIONAL SCHEMATIC©
VACUUM SYSTEMS

DRAWING NO OS-015 | REV 25

DB 08-12-11
DFN= G:\OPSCH\OS15.DGN

61. Chemistry has sampled and analyzed the Miscellaneous Waste Monitor Tank and recommended it for release.

The following conditions exist:

- The MINIMUM Dilution Flow has been established
- The calculated desired recirculation time is 180 minutes
- Miscellaneous Waste System Outlet Radiation Elements RE1878A and RE1878B have been lined up and confirmed operable.
- Chemistry drew the tank sample after 120 minutes of recirculation
- The tank has NOW been recirculating for 200 minutes
- The release valve lineup was been completed satisfactorily.

Based on these conditions, what is the status of the prepared release?

The release ____.

A. Can proceed, RE1878A and RE1878B will automatically stop the release, if necessary

B. Can proceed, the valve lineup has been verified correct

C. Can NOT proceed, until dilution flow has been increased

D. Can NOT proceed, since the sample may not be representative of the tanks content

---

Answer: D

Explanation/Justification:

A. Incorrect. Plausible since it is true that the RMs will auto isolate the release if high activity is detected. However, IAW DB-OP-03011 the permit should be voided.

B. Incorrect. Plausible since the required flowpath is available. However, IAW DB-OP-03011 the permit should be voided.

C. Incorrect. Plausible since this is a required action for certain release flowrates.

D. Correct. IAW DB-OP-03011 Revision 21 pages 11 & 12 minimum required recirculation time has NOT been met to obtain two volume turnover. Therefore, the sample taken by chemistry may not be representative of the tanks content. The permit cannot be approved and should be voided. Candidate must recognize that the recirc time must be met before the sample is drawn NOT before the tank can be discharged and know the reason for the required recirculation time.

Sys #	System	Category	KA Statement
068	Liquid Radwaste System	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the Liquid Radwaste System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Lack of tank recirculation prior to release

K/A# A2.02 **K/A Importance** 2.7* **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-03011 Revision 21 pages 11 & 12

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.5 / 43.5 / 45.3 / 45.13)

Objective:

4.0 PROCEDURE

NOTE 4.1

All references to item numbers are for locations on Attachment 1, Radioactive Liquid Batch Release Permit.

4.1 Preparing a Miscellaneous Waste Monitor Tank (MWMT) for Release

_______ 4.1.1 Verify liquids are NOT being processed through the liquid radioactive waste processing system to the MWMT.

_______ 4.1.2 Determine if DB-SC-03222, Quarterly Functional Test of RE 1878A and/or RE 1878B Miscellaneous Waste System Outlet Radiation Elements is due to be performed.

NOTE 4.1.3

WM1855 will close on a high MWMT level. An open permissive signal will exist when the high level clears. The close button should be depressed, even when the valve position indicator shows a closed position, to prevent it from opening when the MWMT level decreases below the high setpoint.

_______ 4.1.3 Verify WM1855 is closed using HIS1855, MISC WST MONITOR TANK IN.

4.1.4 Lineup and recirculate the MWMT by performing the following:

_______ a. Perform Attachment 18, MWMT Recirculation Lineup.

_______ b. Verify HC1877, MISCELLANEOUS WASTE SYSTEM OUTLET FLOW CONTROLLER, dial set to "0".

_______ c. Open WM1854, MISC WST MONITOR TANK OUT, using HIS1854.

_______ d. Notify the control room that the MWMT pump will be started and to expect alarm 7-2-D, MISC WST MONIT TK OR FLT TRBL.

_______ e. Start the Miscellaneous Waste Monitor Tank Pump using HIS1873, MISC WST MNTR TK PMP.

_______ f. Throttle WM136, MWMT 3 INCH RETURN, to obtain approximately 140 gpm as indicated on FI2165, MWMT DISCHARGE FLOW INDICATOR.

_______ g. Record the date/time recirculation was started in Item 1.b.

______ 4.1.5 Determine and record the volume of liquid (gal.) in the MWMT by using curve CC 15.45 for T29 in DB-PF-06705, Tank Level Calibration Curves:

______ IV MWMT volume (gal) ______

______ 4.1.6 Record the volume of liquid in the MWMT in Item 3.a.

______ 4.1.7 WHEN flow has stabilized as indicated on MWMT Transfer Pump Flow Indicator FI2165,
THEN calculate the desired recirculation time for two turnovers using the following formula.

______ IV

$$\text{Recirc Time} = \frac{(2)\ \text{X}\ (\text{Gallons of Liquid in Tank})}{\text{FI 2165 readings (gpm)}}$$

$$= \frac{(2)\ \text{X}\ (\qquad\qquad \text{gallons})}{(\qquad\qquad \text{gpm})}$$

Recirc Time = ______________ Minutes

______ 4.1.8 Determine and record date/time the MWMT recirculation will be completed:

______ IV

______ Date ______ Time

______ 4.1.9 Record the date/time the minimum tank recirculation will be completed and ready for sampling in Item 1.c.

Independent Verification of calculations by ______________________ Date ________

______ 4.1.10 IF the contents of the MWMT were processed through the Liquid Radwaste System,
THEN circle "YES" on Item 3.d,
OTHERWISE circle "NO" on Item 3.d.

NOTE 4.1.11

The pre-sample RE functionality check conducted by the Shift Manager may be performed by verifying RE status from the Inoperable Equipment Tracking Log, Turnover Checklist or Unit Log. If desired, verification that the associated surveillance tests are current may also be utilized to determine functionality. It is not necessary to verify surveillance tests at this time. If the surveillance tests are verified at this time, then the tests should be re-verified prior to approving the release to ensure RE functionality.

______ 4.1.11 Perform a pre-sample RE functionality check on RE1878A and RE1878B.

______ 4.1.12 IF RE1878A is non functional,
THEN record RE1878A non functionality in Item 5.a.

62. The following plant conditions exist:

A small break Loss of Coolant Accident has just occurred.

All systems function as designed.

Reactor Coolant System pressure is 1550 psig.

Containment pressure is 16.5 psia.

Without operator action, which one of the following radiation detectors will provide indication of actual Containment radiation levels?

1. RE 4596A, CONTAINMENT HIGH RANGE RADIATION ELEMENT
2. RE 4597 AA, CONTAINMENT NORMAL RANGE RADIATION MONITOR
3. RE 4597 AB, CONTAINMENT ACCIDENT RANGE RADIATION MONITOR

A. Only 1

B. Only 2

C. 2 and 3

D. 1 and 3

Answer: A

Explanation/Justification:

A. Correct – At 1550 psig in the RCS, an SFAS Level 1&2 will have actuated. This causes the isolation valves to RE4597 AA and AB to close leaving only RE4596 available.

B. Incorrect – Plausible because although at 1550 psig in the RCS, an SFAS Level 2 will have actuated, these RCS condition are indicative of a small break LOCA event. As a result, candidate may assume only the normal range is available and accident range monitors are not yet in service.

C. Incorrect – Plausible because at 1550 psig in the RCS, an SFAS Level 2 will have actuated. Since RE4596 cabling can be affected by high temperatures condition in Containment it is plausible this detector is not used in this scenario..

D. Incorrect – Plausible because at 1550 psig in the RCS, an SFAS Level 2 will have actuated. It is logical the normal range monitor will have isolated leaving the accident range RE4597 and high range RE4596 available.

Sys #	**System**	**Category**	**KA Statement**
072	Area Radiation Monitoring System	A1. Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ARM system controls including:	Radiation levels

K/A# A1.01 **K/A Importance** 3.4 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02000 R26 Table 2 SFAS Valves expected response level 2

Question Source: New **Level Of Difficulty: (1-5)** 2.5

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.5 / 45.5)

Objective:

TABLE 2
SFAS Actuated Equipment
Sheet 1 of 5

SFAS INCIDENT LEVEL 1

ACTUATION CHANNEL 1			ACTUATION CHANNEL 2		
Equipment Number	Equipment Description	Position	Equipment Number	Equipment Description	Position
EVS-1	CTMT EMER VENT SYS 1	Start	**EVS-2**	CTMT EMER VENT SYS 2	Start
CV5011A	CTMT AIR SAMPLE	Closed	**CV5010A**	CTMT AIR SAMPLE	Closed
CV5011B	CTMT AIR SAMPLE	Closed	**CV5010B**	CTMT AIR SAMPLE	Closed
CV5011C	CTMT AIR SAMPLE	Closed	**CV5010C**	CTMT AIR SAMPLE	Closed
CV5011D	CTMT AIR SAMPLE	Closed	**CV5010D**	CTMT AIR SAMPLE	Closed
CV5008	CTMT PURGE OUT	Closed	**CV5005**	CTMT PURGE IN	Closed
CV5009	PEN RM 4 PURGE OUT	Closed	**CV5004**	PEN RM 3 PURGE IN	Closed
CV5006	CTMT PURGE IN	Closed	**CV5007**	CTMT PURGE OUT	Closed
CV5016	PEN RM 3 PURGE IN	Closed	**CV5021**	PEN RM 4 PURGE OUT	Closed
HA5439	AUX BLDG WEST HDR OUT	Closed	**HA5441**	AUX BLDG NE HDR OUT	Closed
HA5440	AUX BLDG COM HDR OUT	Closed	**HA5442**	AUX BLDG SE HDR OUT	Closed
CV5011E	CTMT AIR SAMPLE RET	Closed	**CV5010E**	CTMT AIR SAMPLE RET	Closed
CV5024	FUEL HDLG AREA TO EVS	Closed	**CV5025**	FUEL HDLG AREA TO EVS	Closed
HA5301A-H **HA5361A&B**	CONTROL ROOM HVAC	Closed	**HA5311A-H** **HA5362A&B**	CONTROL ROOM HVAC	Closed
HA5716 A&B	AUX BLDG NE & SE HDR OUT	Closed	**HA5715A&B**	AUX BLDG WEST & COM HEADER OUT	Closed

63. The following plant conditions exist:

- Plant is operating at 100% power.
- Service Water Loop 1 is supplying Secondary Loads
- Service Water Loop 2 is supplying Primary Loads

The following event occurs:

- Bus C1 Locks Out

Without operator action, how will Turbine Plant Cooling Water loads be cooled?

A. Fire Protection System

B. Service Water Train 1

C. Service Water Train 2

D. Circulating Water

Answer: D

Explanation/Justification:

A. Incorrect – Plausible because Service Water Pump 1 will de-energize on a C1 bus lockout and fittings are available to supply cooling water to heat exchangers from fire protection system.
B. Incorrect – Plausible if Candidate does not know Service Water Pump 1 is powered from C1 or assumes C1 will be restored by an EDG Start.
C. Incorrect – Plausible if the Candidate assumes secondary loads will auto transfer to Service Water train 2, however SW1395 does not have an auto open feature.
D. Correct – Service Water Pump 1 will de-energize and SW1399, SW 1 Isolation to Secondary Loads will close when SW Pressure drops below 50 psig. CT2955 will open when SW pressure drops below 30 psig allowing Circulating Water to cool secondary loads

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Sys #	System	Category	KA Statement
075	Circulating Water System	K2. Knowledge of bus power supplies to the following:	Emergency/essential SWS pumps

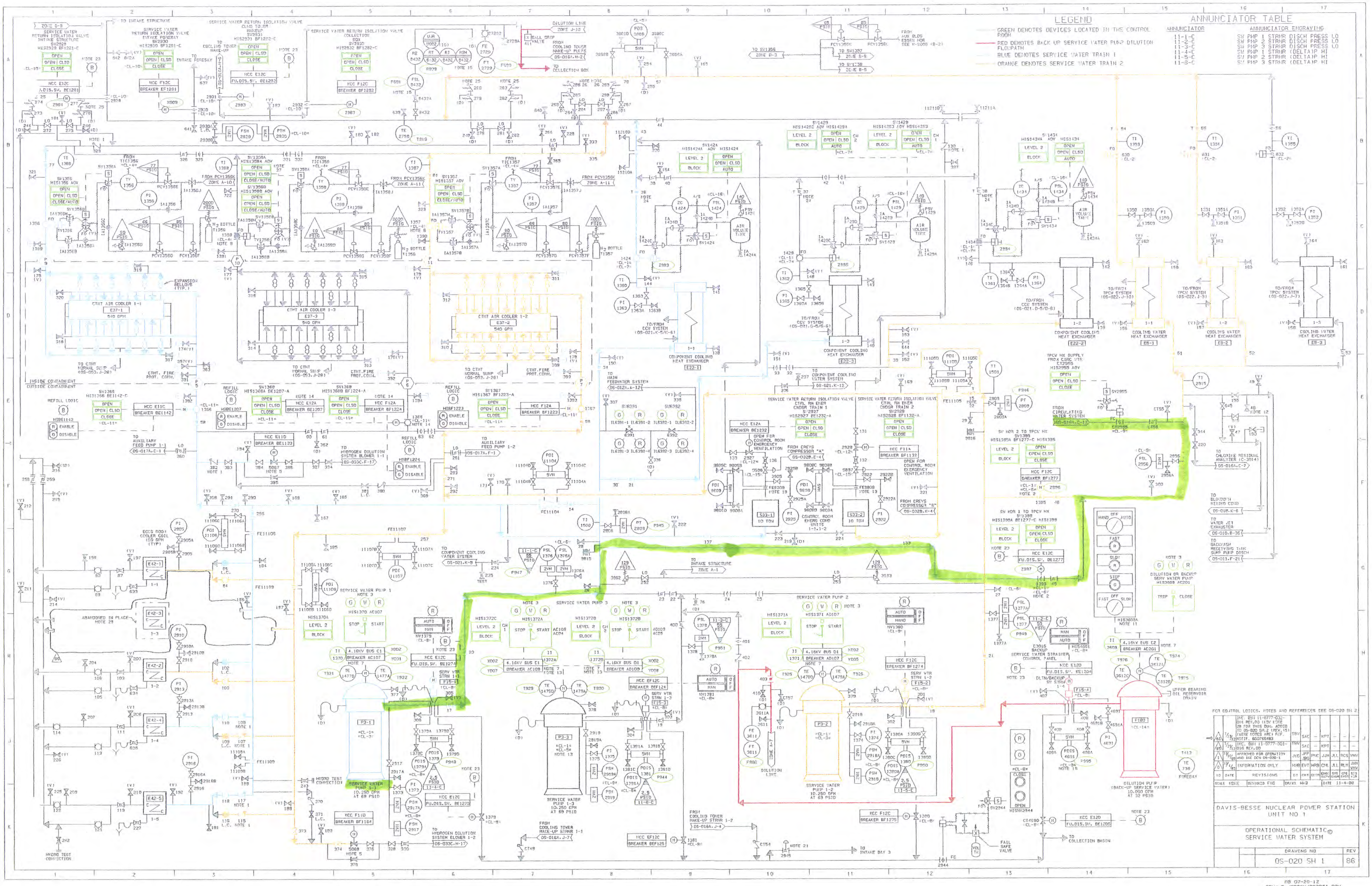
K/A# K2.03 **K/A Importance** 2.6* **Exam Level** RO

References provided to Candidate None **Technical References:** OS-020 SH1 and SH2

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.7)

Objective:



DB 07-20-12
DFN= G:/OPSCH/OS20S1.DGN

CONTROL LOGICS

CL-1 WITH REGARD TO THE SERVICE WATER SYSTEM, THE FOLLOWING ACTIONS WILL OCCUR IN THE EVENT OF A SAFETY FEATURES ACTUATION SYSTEM (SFAS) LEVEL 2 SIGNAL:

COMPONENT	SIGNAL	ZONE	ACTION	REMARKS
SW PUMP 1-1	SA241A	J-5	START	BLOCK PUSHBUTTON
SW PUMP 1-2	SA242A	J-11	START	BLOCK PUSHBUTTON
SW PUMP 1-3	SA241B, SA242B	J-7	START	BLOCK PUSHBUTTON
VALVE 1395	SA272F	F-13	CLOSE	BLOCK PUSHBUTTON
VALVE 1399	SA271F	G-13	CLOSE	BLOCK PUSHBUTTON
VALVE 1424	SA241C	C-8	OPEN	BLOCK PUSHBUTTON
VALVE 1429	SA241D, SA242D	C-10	OPEN	BLOCK PUSHBUTTON
VALVE 1434	SA242C	C-13	OPEN	BLOCK PUSHBUTTON

TO STOP A SERVICE WATER PUMP OR CLOSE A SERVICE WATER LINE VALVE DURING A SFAS, EACH COMPONENTS' "BLOCK" PUSHBUTTON MUST BE DEPRESSED FIRST.

CL-2 COOLING WATER HEAT EXCHANGER OUTLET TEMPERATURE CONTROL VALVE 630 (ZONE B-14) MODULATES TO MAINTAIN 85°F IN RESPONSE TO TIC630 (OS-022, H-10).

LOGIC FOR VALVES 631 AND 632 (ZONES B-15 AND B-16) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC631 AND TIC632 (OS-022, H-8 AND H-7) RESPECTIVELY.

CL-3 SERVICE WATER PUMP 1-1 (ZONE J-5) STARTS AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS PROVIDED SERVICE WATER PUMP 1-3 (ZONE J-7) SUPPLY BREAKER IS NOT CLOSED:
- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

SERVICE WATER PUMP 1-1 WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:
- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY OS-058, J-7)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, J-7)
- BUS UNDERVOLTAGE SENSED BY 27/C1 RELAY (OS-058,G-5)
- 4.16KV BUS C1 LOCKOUT RELAY 86-1/C1 ACTUATES (SEE DWG OS-058 *CD-1*)

SERVICE WATER PUMP 1-2 (ZONE J-11) STARTS AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS PROVIDED SERVICE WATER PUMP 1-3 (ZONE J-7) SUPPLY BREAKER IS NOT CLOSED:
- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

SERVICE WATER PUMP 1-2 WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:
- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY (OS-058, J-24)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, J-24)
- BUS UNDERVOLTAGE SENSED BY 27/D1 RELAY (OS-058,G-5)
- 4.16KV BUS D1 LOCKOUT RELAY 86-1/D1 ACTUATES (SEE DWG OS-058 *CD-1*)

CL-4 CONTAINMENT AIR COOLER 1-1 SERVICE WATER OUTLET VALVE 1356 (ZONE C-1) MODULATES TO MAINTAIN 75°F IN RESPONSE TO TIC1356 (OS-033A,E-4) ONLY WHEN CONTAINMENT AIR COOLER FAN 1-1 (OS-033A,F-5) IS IN HIGH SPEED.

CONTAINMENT AIR COOLER 1-1 OUTLET VALVE SW1356 OPENS FULLY UPON A SLOW SPEED START SIGNAL TO CONTAINMENT AIR COOLER FAN 1-1. SW1356 WILL REMAIN FULLY OPEN IF CONTAINMENT AIR COOLER 1-1 IS STOPPED FROM SLOW SPEED. SW1356 WILL FULLY CLOSE IF CONTAINMENT AIR COOLER 1-1 IS STOPPED FROM FAST SPEED.

HANDSWITCH HIS1356 (ZONE C-1) WILL CLOSE SW1356 ONLY WHEN CONTAINMENT AIR COOLER 1-1 IS OFF. TEMPERATURE MODULATION MAY ALSO CLOSE SW1356 WHEN CONTAINMENT AIR COOLER 1-1 IS OPERATING IN FAST SPEED AND SW1356 IS CONTROLLING IN AUTO.

LOGIC FOR VALVES 1357 AND 1358 (ZONES C-6 AND C-3) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC1357 AND TIC1358 (OS-033A, E-9 AND E-6) RESPECTIVELY.

CL-5 SERVICE WATER PUMP 1-3 (ZONE J-7) WHEN ALIGNED AS PUMP 1-1 STARTS AUTOMATICALLY PROVIDED ONE OF ITS SUPPLY BREAKERS IS RACKED IN AND THE FOLLOWING CONDITIONS EXIST:
- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

PUMP WILL TRIP THE SAME AS PUMP 1-1 (SEE *CL-3*).

SERVICE WATER PUMP 1-3 (ZONE J-7) WHEN ALIGNED AS PUMP 1-2 STARTS AUTOMATICALLY PROVIDED ONE OF ITS SUPPLY BREAKERS IS RACKED IN AND THE FOLLOWING CONDITIONS EXIST:
- SFAS SIGNAL (SEE *CL-1*)
- EMERGENCY DIESEL GENERATOR (EDG) OUTPUT BREAKER CLOSURE AFTER 21 SECONDS WITHOUT THE "SA" SIGNAL. WITH THE "SA" SIGNAL AND EDG OUTPUT BREAKER CLOSURE, THE SFAS SEQUENCER WILL START THE PUMP.

PUMP WILL TRIP THE SAME AS PUMP 1-2 (SEE *CL-3*).

CL-6 SERVICE WATER TO COOLING WATER HEAT EXCHANGER ISOLATION VALVE 1399 (ZONE G-15) WILL CLOSE AUTOMATICALLY UNDER THE FOLLOWING CONDITIONS:
- SFAS SIGNAL (SEE *CL-1*)
- SERVICE WATER PUMP 1-1 (ZONE J-5) OR SERVICE WATER PUMP 1-3 (ZONE J-7) ACTING AS SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE <50 PSIG AS SENSED BY PSL1376A (ZONE D-7).

LOGIC FOR VALVE 1395 (ZONE F-13) IS SIMILAR.

CL-7 COMPONENT COOLING HEAT EXCHANGER OUTLET ISOLATION VALVE 1424 (ZONE C-8) WILL MODULATE TO MAINTAIN 95°F IN RESPONSE TO TIC1424 (OS-021,K-7).

LOGIC FOR VALVE 1434 (ZONE C-13) IS SIMILAR EXCEPT THE TEMPERATURE IS CONTROLLED BY TIC1434 (OS-021,D-7).

VALVE 1429 (ZONE C-10) WILL MODULATE TO MAINTAIN 95°F IN RESPONSE TO TIC1429 (OS-021,G-7) PROVIDED THAT BREAKER AD108 (OS-058,H-25) FOR COMPONENT COOLING PUMP 1-3 (OS-021,G-3) IS RACKED IN AND HIS1429A (ZONE B-11) IS IN "AUTO". WHEN BREAKER AD108 IS RACKED OUT AND BREAKER AC108 (OS-058,H-8) IS RACKED IN, HIS1429B (ZONE B-12) "AUTO" PUSHBUTTON MUST BE DEPRESSED.

CL-8 SERVICE WATER STRAINER 1-1 MOTOR (ZONE H-6) WILL START AND SERVICE WATER STRAINER 1-1 DRAIN VALVE 1379 (ZONE K-6) WILL OPEN WHEN ANY OF THE FOLLOWING CONDITIONS EXIST:

I. SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≥116 PSIG AS SENSED BY PSH2917A (ZONE K-5).

II. DIFFERENTIAL PRESSURE ACROSS STRAINER 1-1 IS ≥1.9 PSID AS SENSED BY PDIS1379A (ZONE J-6) AND STRAINER 1-1 HANDSWITCH HS1379 (ZONE H-6) IS IN "AUTO".

III. STRAINER 1-1 HANDSWITCH IS IN "HAND".

SERVICE WATER STRAINER 1-1 WILL STOP WHEN THE APPROPRIATE CONDITION EXISTS:

A. WHEN STRAINER 1-1 IS STARTED BY CONDITION I, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≤98 PSIG AS SENSED BY PSH2917 (ZONE K-5).

B. WHEN STRAINER 1-1 IS STARTED BY CONDITION II, THE STRAINER MOTOR WILL STOP AFTER 2 MINUTES.

C. WHEN STRAINER 1-1 IS STARTED BY CONDITION III, THE STRAINER MOTOR WILL STOP 2 MINUTES AFTER ITS HANDSWITCH IS PLACED IN "AUTO" OR "OFF".

D. WHEN STRAINER 1-1 IS STARTED BY CONDITION II AND WHILE RUNNING, CONDITION I IS SENSED, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≤98 PSIG AS SENSED BY PSH2917 AND THE STRAINER HAS BEEN RUNNING FOR ≥2 MINUTES.

E. WHEN STRAINER 1-1 IS STARTED BY CONDITION III AND WHILE RUNNING, CONDITION I IS SENSED, THE STRAINER MOTOR WILL STOP WHEN SERVICE WATER PUMP 1-1 DISCHARGE PRESSURE IS ≤98 PSIG AS SENSED BY PSH2917 AND ≥2 MINUTES AFTER ITS HANDSWITCH IS PLACED IN "AUTO" OR "OFF".

CONDITION "E" IS SIMILAR WHEN THE STRAINER IS STARTED BY CONDITION I AND WHILE RUNNING, CONDITION III EXISTS.

SERVICE WATER STRAINER 1-1 DRAIN VALVE 1379 WILL CLOSE WHEN IT IS FULL OPEN AND SERVICE WATER STRAINER 1-1 IS STOPPED.

LOGIC FOR STRAINERS 1-2, 1-3 AND 1-4 (ZONES J-12, J-8 AND J-14) IS SIMILAR EXCEPT DISCHARGE PRESSURE SETPOINTS, FOR STRAINERS 1-2 AND 1-3, ARE 105 PSIG, 93 PSIG AND 114 PSIG, 98 PSIG (INCREASING, DECREASING) RESPECTIVELY AND STRAINER 1-4 DOES NOT HAVE DISCHARGE PRESSURE INTERLOCKS AND DIFFERENTIAL PRESSURE ACROSS STRAINER IS ≥ 2.4 PSID AS SENSED BY PDIS4691 (ZONE J-14) AND DILUTION PUMP STRAINER 1-4 DRAIN VALVE CT4690 (ZONE K-13) WILL CLOSE WHEN IT IS ≥ 20% OPEN AND DLTN/BACKUP SERVICE WATER STRAINER 1-4 IS STOPPED.

STRAINERS 1-1 (F15-1), 1-2 (F15-2), 1-3 (F15-3) AND 1-4 (F15-4) WILL NOT OPERATE IF A THERMAL OVERLOAD EXISTS FOR THEIR RESPECTIVE MOTOR STARTERS.

CL-9 COOLING WATER HEAT EXCHANGER CIRCULATING WATER VALVE CT2955 (ZONE E-14) OPENS AUTOMATICALLY WHEN PSL2956 (ZONE F-15) SENSES < 30 PSIG, PROVIDED PDS3886 (ZONE A-8) SENSES > 0.3 PSID.

THE VALVE WILL CLOSE AUTOMATICALLY WHEN PDS3886 SENSES <0.3 PSID FOR 2 MINUTES.

CL-10 SERVICE WATER TO INTAKE FOREBAY VALVE 2930 (ZONE B-3) OPENS AUTOMATICALLY WHEN PSH2930 (ZONE B-4) SENSES PRESSURE > 50 PSIG. SERVICE WATER TO INTAKE STRUCTURE VALVE 2929 (ZONE B-2) OPENS AUTOMATICALLY WHEN PSH2929 (ZONE B-3) SENSES > 50 PSIG FOR 20 SECONDS. VALVES 2930 AND 2929 MUST BE MANUALLY CLOSED VIA THEIR RESPECTIVE HANDSWITCHES HIS2930 AND HIS2929 (ZONES A-2 AND A-1).

NOTE: ONE OF ADMINISTRATIVELY CONTROLLED VALVES 2929, 2930, 2931, OR 2932 (ZONE B-4) MUST BE OPEN WITH ITS BREAKER OPEN.

CL-11 FOR A LOOP/LOCA, CONTAINMENT AIR COOLER INLET VALVE 1366 CLOSES UPON POWER RESTORATION. REFILL LOGIC AUTOMATICALLY OPENS SERVICE WATER INLET VALVE 1366 (ZONE E-3) WHEN CONTAINMENT AIR COOLER FAN 1-1 (OS-33A, F-5) STARTS. REFILL LOGIC SEQUENCE IS AS FOLLOWS:

A. WAIT 30 SECONDS AFTER FAN START FOR OUTLET VALVE OPENING OR SW PUMP RESTART FOLLOWING A LOSS OF POWER.
B. PARTIALLY OPEN CONTAINMENT AIR COOLER INLET VALVE TO FILL PIPING AT A REDUCED FLOW RATE.
C. WAIT 180 SECONDS FOR CONTAINMENT AIR COOLER AND ASSOCIATED PIPING TO FILL.
D. OPEN INLET VALVE COMPLETELY FOR SW FLOW, AND ILLUMINATE BLUE INDICATING LIGHT "REFILL SEQUENCE COMPLETE" (ZONE E-1)

FOR A LOOP ONLY, CONTAINMENT AIR COOLER INLET VALVE 1366 CLOSES UPON POWER RESTORATION. IF CONTAINMENT AIR COOLER FAN 1-1 WAS IN SLOW SPEED PRIOR TO THE LOOP, REFILL LOGIC AUTOMATICALLY OPENS SERVICE WATER INLET VALVE 1366 AS DESCRIBED ABOVE. IF CONTAINMENT AIR COOLER FAN 1-1 WAS IN FAST SPEED PRIOR TO LOOP, SERVICE WATER FLOW TO THE CONTAINMENT AIR COOLER MUST BE MANUALLY RESTORED.

IF FAN IS STOPPED NORMALLY, VALVE MUST BE MANUALLY CLOSED VIA ITS HANDSWITCH HIS1366 (ZONE E-2).

IF POWER IS LOST, REFILL LOGIC WILL CLOSE CONTAINMENT AIR COOLER INLET VALVE WHEN POWER IS RESTORED, AND DISABLE OPEN CONTROL SWITCH HIS1360 (ZONE E-2).

REFILL LOGIC MAY BE DISABLED BY DEPRESSING GREEN PUSHBUTTON AT BE1142HS (ZONE E-1).

WHEN POWERED FROM TRAIN 1 (BE1207), THE LOGIC FOR CONTAINMENT AIR COOLER 1-3 INLET VALVE 1368 (ZONE E-5) IS SIMILAR.

LOGIC FOR VALVES 1367 AND 1368 (ZONES E-8 AND E-5) IS SIMILAR.

CL-12 CONTROL ROOM EMERGENCY CONDENSING UNIT 1 OUTLET VALVE 2927 (ZONE F-10) OPENS AUTOMATICALLY WHEN THE CREVS COMPRESSOR UNIT STARTS AND THE SYSTEM IS IN THE WATER COOLED MODE (OS-032B, *CD-1*).

VALVE 2927 CLOSES AUTOMATICALLY WHEN EITHER OF THE FOLLOWING CONDITIONS OCCUR:
- SHIFTED TO THE AIR COOLED MODE
- CREVS COMPRESSOR UNIT SHUTS DOWN.

LOGIC FOR VALVE 2928 (ZONE F-11) IS SIMILAR.

CL-13 DELETED.

CL-14 BACKUP SERVICE WATER PUMP P180 (ZONE J-15) WILL TRIP IF ANY OF THE FOLLOWING CONDITIONS EXIST:
- PHASE A OR C TIME DELAY OVERCURRENT SENSED BY RELAY CO (SEE NOTE 3) AND A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY ITH (PART OF 50/51 RELAY OS-058, E-24)
- PHASE A OR C INSTANTANEOUS OVERCURRENT SENSED BY RELAY IIT (PART OF 50/51 RELAY)
- INSTANTANEOUS GROUND OVERCURRENT SENSED BY 50GS RELAY (OS-058, F-24)
- 4.16KV BUS C2 LOCKOUT RELAY 86-1/C2 ACTUATES (SEE OS-058 *CD-2*)
- ACTUATION OF THE REVERSE PHASE SEQUENCE UNDERVOLTAGE RELAY 47/C2 (SEE OS-058, NOTE 10)

CL-15 FLOW CONTROL VALVE 5896 (ZONE F-10) WILL MODULATE TO MAINTAIN THE CONTROL ROOM EMERGENCY VENTILATION SYSTEM COMPRESSOR S33-1 (SEE OS-032B, E-4) REFRIGERANT DISCHARGE PRESSURE AT 126 PSIG.

LOGIC FOR FLOW CONTROL VALVE 5897 (ZONE F-11) IS SIMILAR.

CL-16 SERVICE WATER VALVE 1424, (ZONE C-8) MOVES TO FULL OPEN POSITION WHEN THE INSTRUMENT AIR PRESSURE SENSED BY PSL1424 (ZONE C-9) LOWERS TO 75 PSIG OR BELOW.

LOGIC FOR SERVICE WATER VALVES 1434 AND 1429 (ZONE C-13 AND C-10) AS SENSED BY PSL1434 AND PSL 1429 (ZONE C-14 AND C-12) IS SIMILAR.

NOTES

1. THE FOLLOWING VALVES HAVE INTERNALS REMOVED:

VALVE	ZONE	VALVE	ZONE
		115	K-3
		117	K-3
		130	B-12
107	J-3	329	B-2
109	J-3	382	F-3

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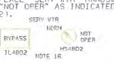
2. TO MAINTAIN SYSTEM REDUNDANCY AND CHANNEL SEPARATION FOR THE SERVICE WATER SYSTEM, VALVES 1399 AND 1395 (ZONES G-13 AND F-13) SHOULD NOT BE OPEN AT THE SAME TIME.
3. WHITE INDICATING LIGHTS (ZONES G-5,G-7,G-8 AND G-11) WILL ILLUMINATE WHEN THEIR RESPECTIVE PUMPS SENSE A PHASE A OR C TIME DELAY OVERCURRENT (*CL-3* AND *CL-5*). WHITE LIGHT ON HIS3609 (ZONE G-15) IS NOT WIRED.
5. FOR OPERATION OF VALVES 5067 AND 5068 (ZONES F-4 AND K-5) SEE CONTAINMENT HYDROGEN DILUTION SYSTEM DWG OS-033C, *CL-3*.
6. FOR GENERAL NOTES, PIPING SYMBOLS, INSTRUMENTATION SYMBOLS AND OPERATIONAL SCHEMATIC INDEX, SEE INDEX SHEET DWG OS-000.
7. 125V DC CONTROL POWER FOR BREAKERS AC107, AC109, AD109, AD107 AND AC201 (ZONES H-5, H-7, H-8, H-11 AND H-15) IS SUPPLIED FROM THEIR RESPECTIVE SWITCHGEAR 125V DC CONTROL BUS. SEE 4.16 KV SYSTEM DWG OS-058, NOTE 6.
8. VALVES 1356, 1358 AND 1357 (ZONES C-1,C-3 AND C-6) HAVE AUXILIARY AIR VOLUME TANKS (NOT SHOWN).
9. SYSTEM IS LINED UP FOR NORMAL OPERATION IN ACCORDANCE WITH APPLICABLE PROCEDURES. THE INDICATED VALVE LINEUP DEPICTS CCW HT EXCH 1-3 ALIGNED AS THE PRIMARY SPARE, TPCW HX 1-1 AND 1-2 IN SERVICE, TPCW 1-3 NOT IN SERVICE AND THE BSW PUMP LINED UP AS A DILUTION PUMP.
10. DELETED
11. HAND INDICATING SWITCH HIS3609A (G-14) IS LOCATED INSIDE MOTOR STARTER CABINET AP1800.
12. VALVE 48 (ZONE E-16) IS AN ISOLATION TELL-TALE.
13. 4.16KV SUPPLY TO SERVICE WATER PUMP 1-3 (ZONE J-7) CAN BE SELECTED FROM BUS C1 BREAKER AC109 (ZONE H-7) OR BUS D1 BREAKER AD109 (ZONE H-8) VIA TRANSFER SWITCHGEAR BREAKERS ACD4 OR ACD5 (OS-058,J-9). BREAKER ACD4 LINES UP POWER FROM BUS C1 AND BREAKER ACD5 LINES UP POWER FROM BUS D1. ACD4 AND ACD5 ARE MECHANICALLY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED AT THE SAME TIME.
14. 480V SUPPLY TO CONTAINMENT AIR COOLER 1-3 SERVICE WATER INLET VALVE 1368 (ZONE E-5) CAN BE SELECTED FROM BREAKER BE1207 (ZONE E-4) OR BREAKER BF1224 (ZONE E-5) VIA ISOLATION BREAKERS BEF128 AND BEF129 (NOT SHOWN). BREAKER BEF128 LINES UP POWER FROM BREAKER BE1207 AND BREAKER BEF129 LINES UP POWER FROM BREAKER BF1224. BEF128 AND BEF129 ARE KIRK KEY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED AT THE SAME TIME.
15. SETPOINTS FOR RSH8432 AND FSL8432 (ZONE A-6) ARE SPECIFIED BY RADIOLOGICAL CONTROLS IN THE DAVIS-BESSE RADIATION MONITOR SETPOINT MANUAL.
16. WHENEVER THE SERVICE WATER SYSTEM IS INOPERABLE, THE OPERATOR IS TO PLACE "SERV WTR" HANDSWITCH HS4802 (ZONE E-33) IN "NOT OPER" AS INDICATED BY THE "BYPASS" LIGHT (ZONE E-32).



17. VALVES SW64 THROUGH SW75 HAVE BEEN DELETED (REMOVED) BY EWR 02-0343-00.
18. COMPUTER POINT P995 WILL ALARM AT ≥ 2.7 PSID AS SENSED BY PDIS4691 (ZONE J-14)
19. ORIFICE PLATE IN FE9808 AND FE9809 ARE INTERCHANGEABLE.
20. ALL VALVES ARE PREFIXED WITH "SW" UNLESS OTHERWISE NOTED.
21. TO ADDRESS SINGLE ACTIVE FAILURE CONCERNS, THE AIR SUPPLY HAS BEEN DISCONNECTED FROM SW2945 AND THE VALVE SHALL REMAIN IN ITS FAILED OPEN POSITION. (REF. ECR 03-0087-00)
22. VALVE SW15 (ZONE E-12) MAY BE THROTTLED TO BALANCE FLOW IN ACCORDANCE WITH APPLICABLE PROCEDURES.
23. BLUE LIGHT EXTINGUISHES WHEN THE FOLLOWING CONDITIONS EXIST:
    - ANY FUSE HAS BLOWN
    - THE DISCONNECT SWITCH IS OPEN
    - THE MCC HAS BEEN DEENERGIZED
    - THREE PHASE ELECTRICAL LOAD IMBALANCE
24. VALVES SW36, SW37, AND SW38 (ZONES C-8, C-10 AND C-13) ARE REQUIRED TO BE THROTTLED TO PROVIDE RUNOUT PROTECTION FOR THE SERVICE WATER PUMPS.
25. AS AN ACCEPTABLE CONDITION, OUTBOARD VACUUM BREAKER VALVES ARE NOT NEEDED TO SUPPORT SERVICE WATER SYSTEM OPERATION. WHEN OUTBOARD VALVE IS REMOVED, A FLANGED PIPE ELBOW SHALL BE INSTALLED TO DIRECT ANY POTENTIAL INBOARD VALVE LEAKAGE TOWARD THE FLOOR. (REF. ECR 05-0086-00 & ECR 05-0086-01)
26. AS AN ACCEPTABLE CONDITION, OUTBOARD VACUUM BREAKER VALVES ARE NOT NEEDED TO SUPPORT SERVICE WATER SYSTEM OPERATION. (REF. ECR 05-0086-02)
27. OPENING OF ALL FOUR BREAKERS BEF151, BEF152, BEF153, AND BEF154 SIMULTANEOUSLY REMOVES CONTROL POWER TO SW1358 (ZONE B-4) AND IT WILL FAIL IN THE OPEN POSITION.

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28. ECCS ROOM COOLER #3 IS MECHANICALLY ABANDONED PER ECP 11-0777.

REFERENCES

DRAWINGS

M-041A	E-48B SH 13	E-60B SH 3
M-041B	E-48B SH 14A	E-60B SH 4A
M-041C	E-48B SH 14B	
M-320-53	E-48B SH 14C	
M-320-55	E-48B SH 15	
M-320-56	E-48B SH 26	
M-320-59	E-48B SH 27	
E-34B SH 14	E-48B SH 28	
E-44B SH 6A	E-48B SH 28A	
E-44B SH 6B	E-48B SH 28B	
E-48B SH 6A	E-48B SH 29	
E-48B SH 6B	E-48B SH 30	
E-48B SH 6C	E-48B SH 31A	
E-48B SH 6D	E-48B SH 31B	
E-48B SH 7	E-48B SH 32	
E-48B SH 7A	E-48B SH 33A	
E-48B SH 8	E-48B SH 33B	
E-48B SH 8A	E-48B SH 33C	
E-48B SH 9A	E-48B SH 37A	
E-48B SH 9B	E-48B SH 37B	
E-48B SH 11A	E-48B SH 37C	
E-48B SH 11B	E-48B SH 37D	
E-48B SH 11C	E-48B SH 44	
E-48B SH 11D	E-48B SH 46A	
E-48B SH 11E	E-48B SH 46B	
E-48B SH 11F	E-48B SH 50	
E-48B SH 12	E-48B SH 51	
E-48B SH 12A	E-58B SH 4	

NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR SUPV	SYS ENGR	OPS ENGR	DES MGR
45	7/24/12	INC. DWN 11-0777-002-017 REV.00 GEN. UPDATE ADD NEW NOTE 28 FROM DWN 11-0777-002-016 (WRITTEN AGAINST SH.1) SEE. NOTIF. 600766483	SBW	SAC	-	KPT	-	-	
44	10/25/11	INC. DWN'S 11-0412-001-007 & 11-0412-002-007 BOTH REV.00							
43	10/22/11	INC. DWN 11-0593-001-020 REV.00	SBW	SAC	-	CJB	-	-	-
42	11/2/10	INC. DWN 10-0630-001-001 REV.00	SBW	SAS	-	JHR	-	-	-
41	12/20/07	INC. DWN 07-0098-00-005 REV.00	SBW	SAS	-	SJO	-	-	-
0	11/4/88	INFORMATION ONLY	HB	EWT	HRB	CML	PF	RPH	JAN VHW

SCALE NONE | DESIGNED FXG | DRAWN HWB | DATE 11-4-88

DAVIS-BESSE NUCLEAR POWER STATION
UNIT NO 1

OPERATIONAL SCHEMATIC ©
SERVICE WATER SYSTEM

DRAWING NO	REV
OS-020 SH 2	45

08 07-24-12
DFN=/OPSCH/OS20S2.DGN

64. The following plant conditions exist:

Plant is operating at 100% power.

Annunciator 9-1-F, INSTR AIR HDR PRESS LO alarms.

The Reactor Operator reports that Instrument Air pressure (using PI810) reads 72 psig and the secondary plant appears stable.

Which one of the following sets of actions is **required** to be performed?

A. Manually trip the reactor and initiate AFW flow and isolation of both SG's.

B. Start the standby Station Air Compressor and the Emergency Instrument Air Compressor, and perform a rapid shutdown per DB-OP-02504, Rapid Shutdown.

C. Dispatch operators to locate the cause of excessive air demand and maintain reactor power at the present level.

D. Rapidly lower power per DB-OP-02504, Rapid Shutdown, until Instrument Air pressure rises to approximately 90 psig.

Answer: A

Explanation/Justification:

A. Correct – This Instrument Air Header Pressure (even with stable plant) requires tripping the reactor and initiating and isolating SFRCS which is an entry condition to the Emergency Operating Procedure DB-OP-02000.

B. Incorrect – Plausible because starting the Standby and EIAC ould improve condition in the instrument air system and the plant is stable, however this pressure is below minimum for continued power operation.

C. Incorrect – This is Plausible because these actions are consistent with operator response to stable low air pressure of a dryer switching failure.

D. Incorrect – Plausible because continued operation is permitted with a stable low air pressure of 90 psig.

Sys #	System	Category	KA Statement
079	Station Air System	Generic	Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions.

K/A# 2.4.2 **K/A Importance** 4.5

Exam Level RO

References provided to Candidate None

Technical References: DB-OP-02528 R16, Step 4.1

Question Source: BANK 37548

Level Of Difficulty: (1-5) 2

Question Cognitive Level: Low - Fundamental

10 CFR Part 55 Content: (CFR: 41.7 / 45.7 / 45.8)

Objective:

4.0 SUPPLEMENTAL ACTIONS – INSTRUMENT AIR SYSTEM MALFUNCTIONS

4.1 Severe Loss of Instrument Air

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1.1 **IF AT ANY TIME** a severe secondary plant upset occurs, OR the Instrument Air header pressure drops to 75 PSIG (PI810, INSTRUMENT AIR HEADER PRESS), THEN perform the following: ___ a. Trip the Reactor. ___ b. Initiate and Isolate SFRCS using Manual Actuation Switches. ___ c. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture AND return to this procedure, Subsection 4.1, Severe Loss of Instrument Air as conditions permit.	
4.1.2 Verify all available Air Compressors are running. ___ • EIAC (HIS813) ___ • SAC 1 (HIS812) ___ • SAC 2 (HIS1494) ___ • Temporary Diesel Air Compressor. REFER TO DB-OP-06251, Station and Instrument Air Operating Procedure.	
___ 4.1.3 Announce over the GAI-Tronics "Anyone using or working on Instrument or Station Air system stop and call the Control Room."	

65. I&C is performing testing on fire detection for EDG Room 2 and inadvertently sends a fire alarm signal from one detector to the Fire Detection system.

The following conditions are noted:

- Annunciator 9-1-G FIRE OR RADIATION TRBL Alarms
- The Control Room Fire and Radiation CRT indicates FP114A, DIESEL GENERATOR ROOM 2 SPRINKLER PREACTION valve has actuated

What will be the status of the sprinkler system in EDG Room 2 and why?

The sprinkler system in EDG Room 2 will __________(1)__________ because ______________(2)______________.

A. (1) be flowing water
(2) the preaction valve has opened to pressurize the sprinkler header

B. (1) be flowing water
(2) the supervisory air has been vented

C. (1) not be flowing water
(2) it takes a second alarm signal to pressurize the sprinkler header

D. (1) not be flowing water
(2) the sprinklers are held closed by a fusible link

Answer: D

Explanation/Justification:

A. Incorrect – Plausible because the sprinkler header does charge but is not actuated

B. Incorrect – Plausible because there is supervisory air which would vent if a fusible link melts

C. Incorrect – Plausible because most safety systems require a redundant signal to actuate

D. Correct – The EDG Room sprinkler header is dry with supervisory air pressure (for alarm purpose) held by the preaction valve on one side and the fusible links on each sprinkler on the other. The header will charge when a fire alarm causes the preaction valve to open but water will only flow through a sprinkler that has its fusible link melted

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Sys #	System	Category	KA Statement
086	Fire Protection System (FPS)	K6. Knowledge of the effect of a loss or malfunction on the Fire Protection System following will have on the :	Fire, smoke, and heat detectors

K/A#	K6.04	**K/A Importance** 2.6	**Exam Level** RO
References provided to Candidate	None	**Technical References:**	System Description 036A, Page 2-2 step 2.1.2.1.2
Question Source:	New	**Level Of Difficulty: (1-5)**	3
Question Cognitive Level:	High - Comprehension	**10 CFR Part 55 Content:**	(CFR: 41.7 / 45.7)
Objective:			

System pipe sizes are determined by one of two methods, pipe schedule or hydraulic design.

Pipe schedule systems are designed using predetermined minimum pipe sizes established in NFPA 13, "Standard for the Installation of Sprinkler Systems" (Reference 4.4.6). The sizes are dependent upon the hazard of the occupancy being protected by the system and are based upon using sprinklers having a ½ inch diameter orifice.

For hydraulically designed sprinkler systems, pipe sizes are selected on a pressure loss basis to provide a prescribed density (gallons per minute per sq. ft.) distributed with a reasonable degree of uniformity over a specified area. This permits the selection of pipe sizes in accordance with the characteristics of the water supply available. The design density and area of operation vary with the occupancy hazard and are provided in NFPA 13 (Reference 4.4.6).

Water flow from a wet pipe sprinkler system is initiated by the operation of individual automatic sprinklers. Only sprinklers whose operating elements reach their design operating temperature will fuse and discharge water. The operation of alarm check valves and flow switches are described in Section 2.1.2.1.8.1.

2.1.2.1.2 Preaction Sprinkler Systems

Preaction sprinkler systems consist of automatic sprinklers, distribution piping (which contains supervisory air pressure), an air check valve, a deluge valve with alarm trim (which controls water flow into the system and provides for a water flow alarm), pipe hangers/supports, and an isolation valve. The preaction sprinkler systems rely on a detection system to actuate the deluge valve and the Station and Instrument Air System for supervisory air. Deluge valves used in preaction sprinkler systems are manufactured by Automatic Sprinkler Corporation. Two preaction sprinkler systems are installed, one in each Diesel Generator Room.

System pipe sizes are determined by pipe schedule. This method described in Section 2.1.2.1.1. NFPA 13 (Reference 4.4.6) provides design requirements for preaction sprinkler systems.

An air check valve is installed on the system side of the deluge valve. This check valve is provided with a water seal which aids in maintaining the supervisory air pressure in the distribution piping. The air check valve is provided with an auxiliary drain, above the clapper, for draining water from the system after it has operated.

Supervisory air is supplied by the Station and Instrument Air System (Reference 4.1.3). The air pressure is reduced by a pressure regulator, and is maintained on all system piping downstream of the air check valve. The supervisory air pressure is provided only to monitor the integrity of the system distribution piping and automatic sprinklers. A low air pressure alarm is provided in the control room. The alarm sounds when the supervisory air pressure reaches a predetermined minimum pressure. Loss of the supervisory air pressure will not release the system deluge valve.

The system deluge valve is actuated either by a signal from a detection system installed in the area the preaction system protects or by manually actuating the deluge valve. Details of the deluge valve operation and alarm transmission are provided in Section 2.1.2.1.8.2.

Water entering the preaction system distribution piping will remain in the piping until the individual automatic sprinklers operate. Only sprinklers whose operating elements reach their design operating temperature will fuse, resulting in the discharge of supervisory air and water.

66. The plant is in MODE 6 with core reload in progress.

From 0600 to 0700, the operating DH Train was secured to facilitate fuel handling near the Loop 2 RCS Hot Leg.

At 0900, which of the following conditions would require immediately suspending irradiated fuel movement in accordance with DB-OP-00030, Fuel Handling Operations?

A. Loss of Communications with the Refueling Outage Containment Coordinator.

B. One Fan of Control Room Emergency Ventilation System is determined to be inoperable. The remaining Fan is operable.

C. One Train of the Spent Fuel Pool Emergency Ventilation System (EVS) is determined to be inoperable. The remaining Train is operable.

D. The operating Decay Heat Removal Train is determined to be Inoperable. The standby Train is operable.

Answer: D

Explanation/Justification:

A. Incorrect – While loss of communications does require suspending fuel handling operation, this individual is not one of the required locations.
B. Incorrect – TS 3.7.10 only requires immediately suspending fuel handling operations if the CRE Boundary is inoperable.
C. Incorrect – TS 3.7.13 only requires immediately suspending fuel handling operations if both trains are lost.
D. Correct – TS 3.9.4 required one DHR Loop to be operable AND in operation. Condition A.2 requires suspending loading fuel assemblies in the core.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of refueling administrative requirements.

K/A# 2.1.40 **K/A Importance** 2.8 **Exam Level** RO

References provided to Candidate None **Technical References:** TS 3.9.4, DHR and Coolant Circulation

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.10 / 43.5 / 45.13)

Objective:

3.9 REFUELING OPERATIONS

3.9.4 Decay Heat Removal (DHR) and Coolant Circulation - High Water Level

LCO 3.9.4 One DHR loop shall be OPERABLE and in operation.

---NOTE---
The required DHR loop may be removed from operation for ≤ 1 hour per 8 hour period, provided no operations are permitted that would cause introduction of coolant into the Reactor Coolant System (RCS) with boron concentration less than that required to meet the minimum required boron concentration of LCO 3.9.1, "Boron Concentration."

APPLICABILITY: MODE 6 with the water level ≥ 23 ft above the top of reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DHR loop requirements not met.	A.1 Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet the boron concentration of LCO 3.9.1.	Immediately
	<u>AND</u>	
	A.2 Suspend loading irradiated fuel assemblies in the core.	Immediately
	<u>AND</u>	
	A.3 Initiate action to satisfy DHR loop requirements.	Immediately
	<u>AND</u>	

67. The plant is operating at 100% power with all systems in normal alignment.

Over the last 2 minutes, Makeup Tank Level has lower from 75 inches to 70 inches.

Which of the following conditions will confirm the lowering of Makeup Tank Level is due to a Makeup Tank level indicator malfunction as opposed to some other event?

A. Makeup Tank Pressure is stable at 30 psig.

B. Pressurizer Level rises from 219 to 226 inches.

C. RCS Tave Lowers from 582 °F to 580.5 °F.

D. Makeup Flow is stable at 60 gpm

Answer: A

Explanation/Justification:

- **A.** Correct – The makeup Tank uses Hydrogen Gas overpressure to control RCS Oxygen. If real Makeup Tank level is lowering, you would see a corresponding change in Makeup Tank Pressure.
- **B.** Incorrect – Plausible because without leakage, an increase of 7 inches in the Pressurizer would cause Makeup Tank level to lower approximately 5 inches.
- **C.** Incorrect – Plausible because without leakage, a decrease in RCS Tave of approximately 1.5 °F would cause Makeup Tank level to lower approximately 5 inches.
- **D.** Incorrect – Makeup Flow rate is independent of Makeup Tank Level. The fact that Letdown flow is stable does not provide information to determine the status of the Makeup Tank Level indicator.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Ability to identify and interpret diverse indications to validate the response of another indication.

K/A# 2.1.45 **K/A Importance** 4.3

Exam Level RO

References provided to Candidate None

Technical References: General Physics Equation Sheet 1-14

Question Source: New

Level Of Difficulty: (1-5) 3

Question Cognitive Level: Low - Fundamental

10 CFR Part 55 Content: (CFR: 41.7 / 43.5 / 45.4)

Objective:

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Where:

P	=	pressure in absolute pressure scale (psia, Pa)
V	=	volume (ft^3, m^3)
T	=	temperature in absolute temperature scale (°R, K)

Equation 1-14 Combined Gas Law

First Law of thermodynamics

Energy cannot be created or destroyed. One kind of energy can be transformed into another kind of energy, but the sum of energies entering a process must equal the sum of energies stored in or leaving a process.

Energy In	=	Energy Out	+	Energy Accumulated

Equation 1-15

$$PE_1 + KE_1 + P_1V_1 + U_1 + Q = PE_2 + KE_2 + P_2V_2 + U_2 + W$$

Where:

PE	=	potential energy (ft lb_f, J)
KE	=	kinetic energy (ft lb_f, J)
P	=	pressure (lb_f/ft^2, Pa)
V	=	volume (ft^3, m^3)
U	=	internal energy (Btu, J)
Q	=	heat transferred to or from the system (Btu, J)
W	=	work done by or to the system (ft lb_f, J)

Equation 1-16

$$H = U + \frac{PV}{J}$$

Where:

H	=	enthalpy (Btu, J)
U	=	total internal energy (Btu, J)
P	=	pressure (lb_f/ft^2, Pa)
V	=	total volume (ft^3, m^3)
J	=	Joule's constant (778 ft lb_f/Btu)

Equation 1-17

$$h = \frac{H}{m}$$

$$h = \frac{U}{m} + \frac{PV}{Jm}$$

$$h = u + \frac{P\upsilon}{J}$$

Where:

h	=	specific enthalpy (Btu/lb_m, J/kg)
H	=	enthalpy (Btu, J)
m	=	mass (lb_m, kg)
U	=	total internal energy (Btu, J)
P	=	pressure (lb_f/ft^2, Pa)
V	=	total volume (ft^3, m^3)
J	=	Joule's constant (778 ft lb_f/Btu)
u	=	specific internal energy (Btu/lb_m, J/kg)
υ	=	specific volume (ft^3/lb_m, m^3/kg)

Equation 1-18

68. Initial conditions:

- The plant is at 2135 psig and 525 °F.
- No Tech Spec required equipment is INOPERABLE.

AC101, EDG1 Output Breaker, is racked into the test position to support maintenance.

In accordance with Technical Specification 3.8.1, AC Sources - Operating, which one of the following lists the **MINIMUM required** action(s) that must be performed within one hour?

A. Test start EDG 2 ONLY

B. Verify correct breaker alignment and indicated power availability for the offsite circuit supplying A Bus ONLY.

C. Verify correct breaker alignment and indicated power availability for each offsite circuits.

D. Test start EDG 2 and verify correct breaker alignment and indicated power availability for each offsite circuits.

Answer: C

Explanation/Justification:

A. Incorrect –Plausible because the #2 EDG will be started, but starting the opposite train EDG is only required within 24 hours
B. Incorrect – Verification of breaker status within one hour is required on each operable off-site circuits, not just those supplying A Bus. Plausible because A bus is the normal feed to C1 which is fed by EDG 1.
C. Correct in accordance with T.S. 3.8.1 Condition B with a completion time of 1 hour.
D. Incorrect – Verification of breaker status within one hour is required, but starting the opposite train EDG is only required within 24 hours.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Ability to analyze the effect of maintenance activities, such as degraded power sources, on the status of limiting conditions for operations.

K/A# 2.2.36 **K/A Importance** 3.1

Exam Level RO

References provided to Candidate None

Technical References: T.S. 3.8.1 Condition B & SR 3.8.1.1

Question Source: BANK 92552

Level Of Difficulty: (1-5) 3

Question Cognitive Level: Low - Memory

10 CFR Part 55 Content: (CFR: 41.10 / 43.2 / 45.13)

Objective:

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.3	Restore offsite circuit to OPERABLE status.	72 hours
B. One EDG inoperable.	B.1	Perform SR 3.8.1.1 for OPERABLE offsite circuit(s).	1 hour <u>AND</u> Once per 8 hours thereafter
	<u>AND</u>		
	B.2	Declare required feature(s) supported by the inoperable EDG inoperable when its redundant required feature(s) is inoperable.	4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)
	<u>AND</u>		
	B.3.1	Determine OPERABLE EDG is not inoperable due to common cause failure.	24 hours
	<u>OR</u>		
	B.3.2	Perform SR 3.8.1.2 for OPERABLE EDG.	24 hours
	<u>AND</u>		
	B.4	Restore EDG to OPERABLE status.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	Verify correct breaker alignment and indicated power availability for each offsite circuit.	7 days
SR 3.8.1.2	-----------------------------NOTES----------------------------- 1. All EDG starts may be preceded by an engine prelube period and followed by a warmup period prior to loading. 2. A modified EDG start involving idling and/or gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances of SR 3.8.1.8 must be met. -- Verify each EDG starts from standby conditions and achieves steady state voltage $\geq$ 3744 V and $\leq$ 4400 V, and frequency $\geq$ 59.5 Hz and $\leq$ 60.5 Hz.	31 days
SR 3.8.1.3	-----------------------------NOTES----------------------------- 1. EDG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one EDG at a time. 4. This SR shall be preceded by and immediately follow, without shutdown, a successful performance of SR 3.8.1.2 or SR 3.8.1.8. -- Verify each EDG is synchronized and loaded and operates for $\geq$ 60 minutes at a load $\geq$ 2340 kW and $\leq$ 2600 kW.	31 days
SR 3.8.1.4	Verify each day tank contains $\geq$ 4000 gal of fuel oil.	31 days

69. Per NOBP-OP-0007, Infrequently Performed Tests and Evolutions, which of the following individuals make the final determination as to the whether an evolution will be conducted as an IPTE or not?

A. Shift Engineer

B. Shift Manager

C. Director Site Operations

D. Site Vice President

Answer: C

Explanation/Justification:

A. Incorrect per NOBP-OP-0007 R05 Page 7 Step 5.1.4.
B. Incorrect per NOBP-OP-0007 R05 Page 7 Step 5.1.4.
C. Correct per NOBP-OP-0007 R05 Page 7 Step 5.1.4.
D. Incorrect per NOBP-OP-0007 R05 Page 7 Step 5.1.4.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of the process for conducting special or infrequent tests.

K/A# 2.2.7 **K/A Importance** 2.9 **Exam Level** RO

References provided to Candidate None **Technical References:** NOBP-OP-0007 R05 Page 7 Step 5.1.4

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR: 41.10 / 43.3 / 45.13)

Objective:

5.1.4 The Director Site Operations shall make the final determination as to the need to conduct an IPTE and shall designate an IPTE Manager. The Director Site Operations shall conduct a roles and responsibilities discussion with the designated IPTE Managers. When the test or evolution will extend over two or more shifts, additional IPTE Managers may be required; however, only one IPTE Manager assumes responsibility for oversight of the IPTE at any given time.

5.1.5 The Director, Site Operations shall notify the Site Vice President of activities which will be conducted as an IPTE. This notification will allow the Site Vice President the opportunity to question those involved and review preparations, including contingencies, if desired.

5.2 <u>Preparation of NOBP-OP-0007-01, IPTE Worksheet,</u>

5.2.1 The individual preparing the worksheet:

1. Completes Sections A through C of NOBP-OP-0007-01, IPTE Worksheet.

2. Reviews any applicable corrective actions from previous IPTE's completed for this evolution. Copies of previous IPTE's are kept in the control room IPTE folder.

3. Signs cover page of NOBP-OP-0007-01, IPTE Worksheet as Preparer.

5.2.2 The IPTE Manager shall ensure the timely and accurate completion of the preparation of the worksheet and sign the cover page of NOBP-OP-0007-01, IPTE Worksheet.

5.2.3 Following completion of the preparation of the IPTE Worksheet the IPTE Manager shall obtain the Operations Manager Review and Director Site Operations approval and signatures on the cover page of NOBP-OP-0007-01, IPTE Worksheet.

70. Which OPERATIONAL MODE does the following set of conditions describe?

- Keff > 0.99
- RTP < 5%
- Tave > 280 °F

A. Hot Shutdown

B. Hot Standby

C. Startup

D. Power Operation

Answer: C

Explanation/Justification:

A. Incorrect per TS Definition Table 1.1-1.
B. Incorrect per TS Definition Table 1.1-1.
C. Correct per TS Definition Table 1.1-1.
D. Incorrect per TS Definition Table 1.1-1.

Sys #	**System**	**Category**	**KA Statement**
N/A	N/A	Generic	Ability to determine Technical Specification Mode of Operation.

K/A# 2.2.35 **K/A Importance** 3.6 **Exam Level** RO

References provided to Candidate None **Technical References:** TS Table 1.1-1

Question Source: BANK 29962 **Level Of Difficulty: (1-5)** 2

Question Cognitive Level: Low - Memory **10 CFR Part 55 Content:** (CFR: 41.7 / 41.10 / 43.2 / 45.13)

Objective:

Table 1.1-1 (page 1 of 1)
MODES

MODE	TITLE	REACTIVITY CONDITION (k_{eff})	% RATED THERMAL POWER[a]	AVERAGE REACTOR COOLANT TEMPERATURE (°F)
1	Power Operation	≥ 0.99	> 5	NA
2	Startup	≥ 0.99	≤ 5	NA
3	Hot Standby	< 0.99	NA	≥ 280
4	Hot Shutdown[b]	< 0.99	NA	$280 > T_{avg} > 200$
5	Cold Shutdown[b]	< 0.99	NA	≤ 200
6	Refueling[c]	NA	NA	NA

(a) Excluding decay heat.

(b) All reactor vessel head closure bolts fully tensioned.

(c) One or more reactor vessel head closure bolts less than fully tensioned.

71. The following plant conditions exist:

- A large break LOCA with fuel damage has occurred
- All systems function as designed

It becomes necessary to take action to prevent damage to one of the operating LPI pumps

The LPI pump is in a 60 Rem/hr radiation field

Which of the following is the **MAXIMUM** amount of time that a worker is authorized to remain in the above radiation field without exceeding the TEDE emergency dose limits?

A. 1 minute

B. 10 minutes

C. 30 minutes

D. 60 minutes

Answer: B

Explanation/Justification:

A. Incorrect – 1 minute exposure would result in a 1 REM exposure. While this is less than the TEDE Emergency Dose Limit it is not the maximum time permitted in that radiation field.

B. Correct – 10 minute exposure would result in a 10 REM exposure which is less than the TEDE Emergency Dose Limit.

C. Incorrect – One hour exposure would result in 30 REM dose which exceeds the TEDE Emergency Dose Limit.

D. Incorrect – One hour exposure would result in 60 REM dose which exceeds the TEDE Emergency Dose Limit.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of radiation exposure limits under normal or emergency conditions.

K/A# 2.3.4 **K/A Importance** 3.2 **Exam Level** RO

References provided to Candidate None **Technical References:** RA-EP-02620 R06 page 6 and 7

Question Source: BANK 38751 **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.12 / 43.4 / 45.10)

Objective:

6.0 PROCEDURE

> **NOTE 6.1**
>
> It is preferable to document authorization by the Emergency Director, or when designated, the Emergency Plant Manager, before the exposure. However, verbal authorization may be granted and then documented as soon as possible.

6.1 Authorization of Emergency Dose

6.1.1 The Emergency Director, or when designated, the Emergency Plant Manager, shall:

a. Evaluate the risk of not performing the task against the anticipated dose associated with performing the task before authorizing emergency dose.

b. Authorize individual dose in excess of the 10 CFR 20 occupational dose limits as listed in Step 3.2, by completing Form DBEP-204, Emergency Dose Authorization.

6.1.2 The following guidelines are provided for emergency dose:

a. Personnel performing emergency tasks should be volunteers familiar with the consequences of radiation dose.

b. Declared pregnant individuals shall not be used.

c. Emergency dose should be limited to once in a lifetime for any individual.

d. When possible, the individual should be over the age of 45.

e. Personnel shall not enter any area where dose rates are unknown, unmonitored, or cannot be determined.

f. All attempts should be made to keep emergency dose ALARA.

g. The individual's dose history should be available for review.

6.1.3 Authorize increased dose for workers performing emergency services using the following guidance:

a. Limit doses to the following when protecting valuable property and lower doses are not practical:

1. 10,000 mrem TEDE
2. 30,000 mrem to the lens of the eye
3. 100,000 mrem:
   - Total Organ Dose Equivalent (TODE)
   - Shallow Dose Equivalent (SDE) to the skin of the whole body or to any extremity

> <u>WARNING 6.1.3.b</u>
>
> The following guidelines may be exceeded only in extreme situations. The personnel involved in exceeding these guides, shall be volunteers and made fully aware of the risks involved with this dose prior to receiving this dose.

b. Limit doses to the following when <u>protecting large populations or performing life-saving activities</u> and lower doses are not practical:

1. 25,000 mrem TEDE

2. 75,000 mrem to the lens of the eye

3. 250,000 mrem SDE

6.1.4 The briefer and individual who will receive the emergency dose shall fill in the information required on DBEP-204, Emergency Dose Authorization, and obtain the Emergency RP Manager's signature before receiving the emergency dose.

a. Individual should review Attachment 1.

6.1.5 For any dose in excess of the 10 CFR 20 occupational dose limits specified in Step 3.2, the Emergency RP Manager shall:

a. Notify the Medical Director when emergency doses have been authorized. (The phone number is listed in the Emergency Plan Telephone Directory under *Other Resources/Medical Director*.)

b. Call the Emergency Medical Consultant for follow-up care and further evaluation, as required. (The phone number is listed in the Emergency Plan Telephone Directory under *Other Resources/ Medical Consultants*.)

6.1.6 <u>IF</u> radiological surveys or dosimetry data indicate conditions approaching the dose limits for nonessential personnel as stated in RA-EP-02610, Emergency Radiation Protection Organization Activation and Response,

<u>THEN</u> the Emergency Director, with the recommendations from the Emergency RP Manager, should consider evacuation of the affected personnel according to RA-EP-02530, Evacuation.

72. The plant is operating at 100% power with all systems in normal alignment. The Containment Purge System is in service and aligned to the Mechanical Penetrations Rooms.

A planned maintenance evolution will involve venting filters at the Miscellaneous Waste Duratek skid.

Which of the following installed Radiation Monitors would give the **FIRST** indication that the venting is creating a radiological airborne hazard?

A. RE5405, Radwaste Area Exhaust System

B. RE5403, Fuel Handling Exhaust System

C. RE5052, Containment Purge Exhaust System

D. RE4597, Station Vent

Answer: B

Explanation/Justification:

A. Incorrect – Although it is logical that radioactive systems would be served by the Radwaste Ventilation System, the Duratek System is located in the Spent Fuel Pool Area that is not served by the Radwaste Ventilation System.

B. Correct – The Duratek System is located in the Spent Fuel Pool Area. As a result, the radiation monitor on this ventilation system would have the first opportunity to detect elevated radiation levels.

C. Incorrect - Although it is logical that radioactive systems would be served by Containment Purge System in the Penetration Rooms, but the Duratek System is located in the Spent Fuel Pool Area that is not served by the Containment Purge Ventilation System.

D. Incorrect – A number of ventilation fans directly discharge to the Station Vent without an intermediate Radiation Element which for some locations, the Station Vent Radiation Monitor may be the first indication of a rising radiation trend. In this case, the Station Vent is in the flowpath for release, the Station Vent Radiation Monitors are downstream from the other Radiation Monitors and therefore would not give first indication.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Ability to use radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc.

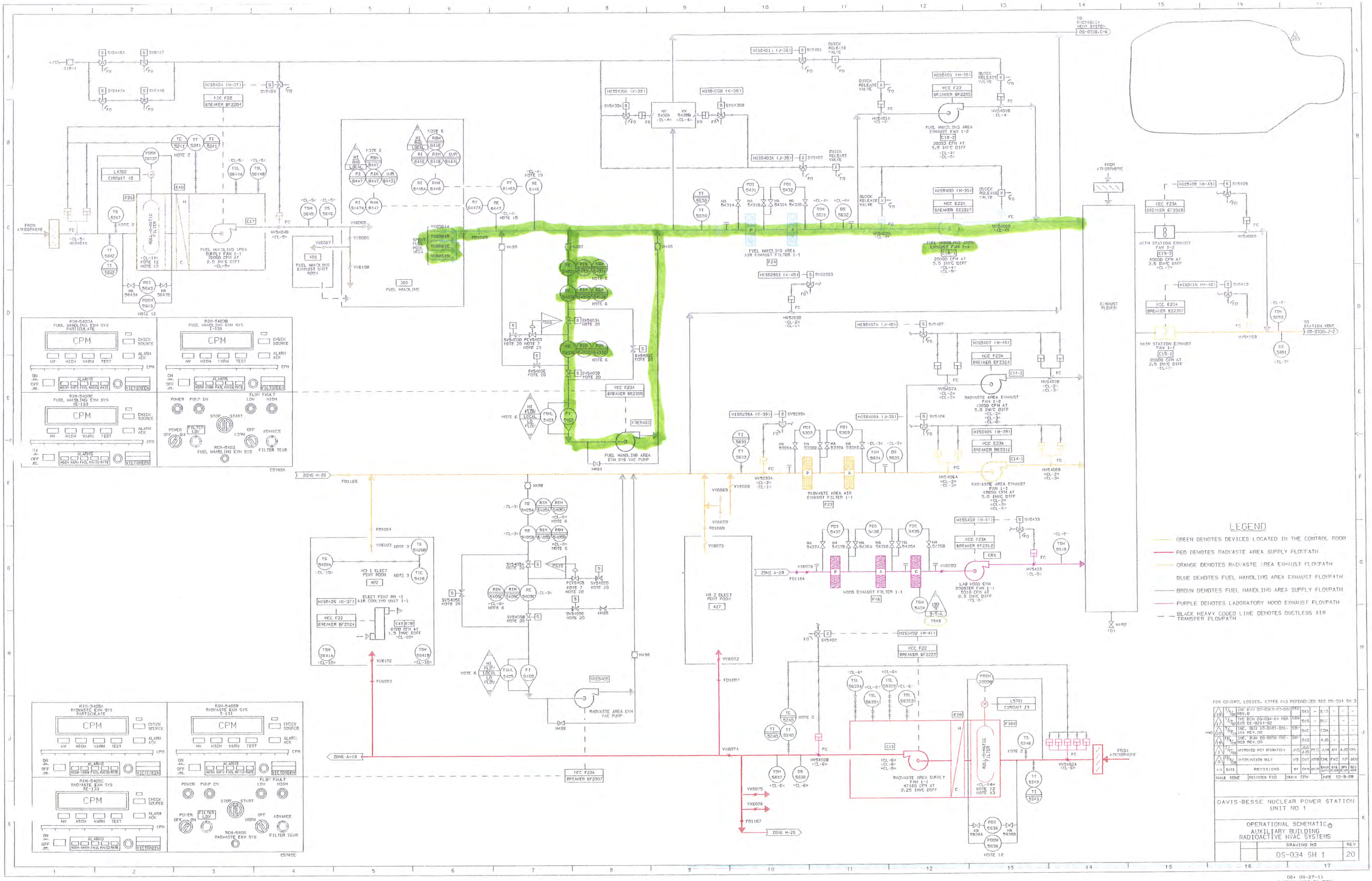
K/A# 2.3.5 **K/A Importance** 2.9 **Exam Level** RO

References provided to Candidate None **Technical References:** Ops Schematic OS33 A-E, OS34 Sheets 1-3

Question Source: New **Level Of Difficulty: (1-5)** 3

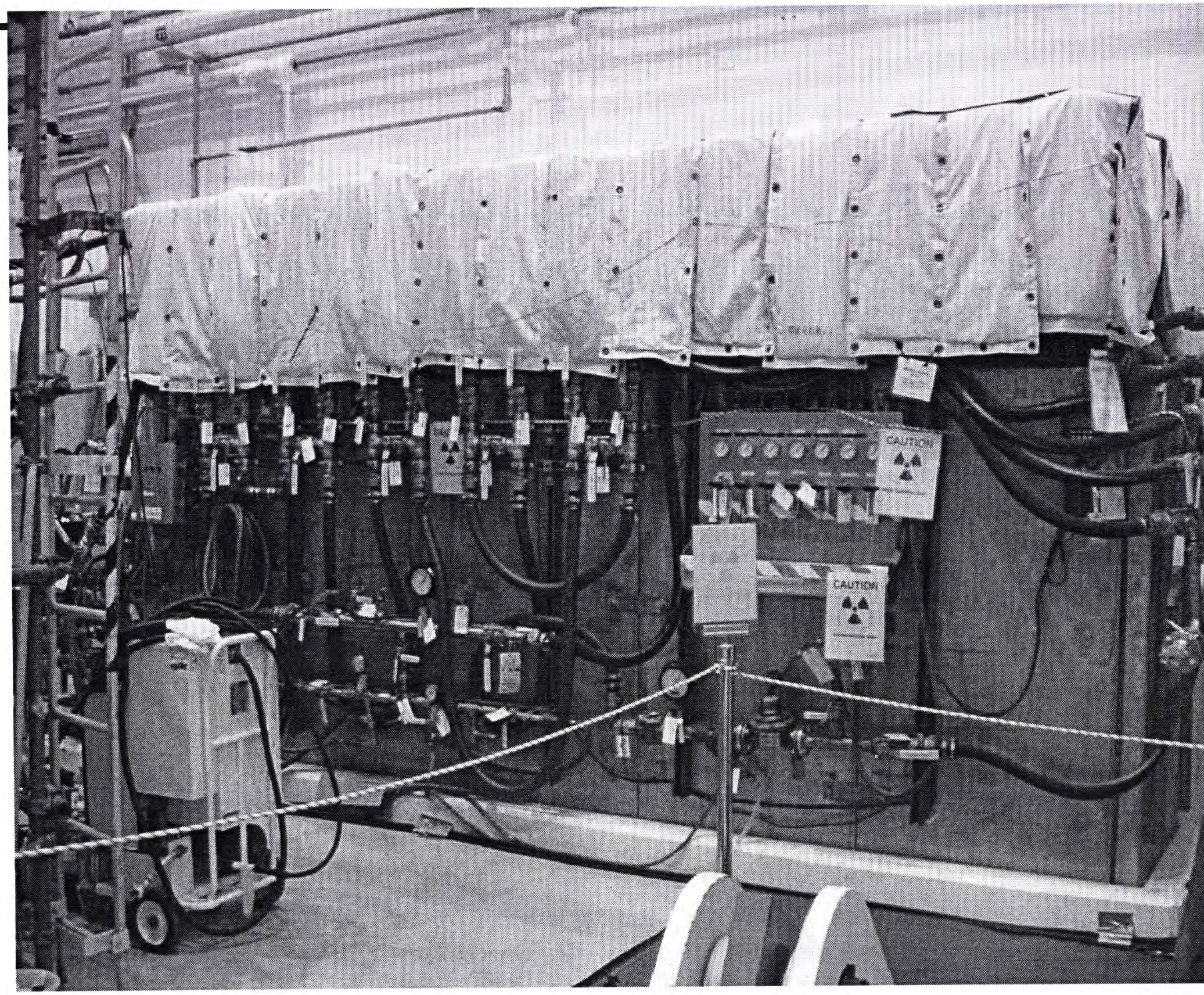
Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.11 / 41.12 / 43.4 / 45.9)

Objective:



DB: 09-27-11
G/OPSCH/OS34S1.DGN

Duratek Skid



73. A Large Break LOCA has occurred. Borated Water Storage Tank level is 30 feet and lowering.

Step 10.2 of DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture directs performing Attachment 7, Section 1, Actions to Close Breakers for DH7A, DH7B, DH9A, DH9B, and HP31.

A review of local area Radiation Monitors in the vicinity of the Motor Control Centers indicates a peak dose rate of 34 REM/hr along the expected travel route to perform the required actions.

A Radiation Protection Technician in not IMMEDIATELY available to provide RP Coverage for this task.

Based on these conditions, what direction will you give the equipment operator and what is the basis for this direction?

As the Reactor Operator, you will ___(1)___ this task to an Equipment Operator because ___(2)___.

A. (1) NOT assign
(2) the dose rate exceeds the Locked High Radiation Area dose rate and Equipment Operators do not carry Locked High Radiation Area Keys.

B. (1) NOT assign
(2) the dose rate exceeds the Very High Radiation Area criteria and entry is not allowed without Radiation Protection coverage.

C. (1) assign
(2) the task is required to complete the mitigation strategy for a LOCA and the total dose received will be within allowed limitations for post accident response.

D. (1)assign
(2) the task is required to complete the mitigation strategy for a LOCA. Since the dose limitations for post accident response will be exceeded, prior approval of the Emergency Director is required is required.

Answer: C

Explanation/Justification:

A. Incorrect – Assignment of the task is required to enable establishing Containment Emergency Sump as a suction source for the ECCS Pumps and therefore must be assigned.

B. Incorrect - Assignment of the task is required to enable establishing Containment Emergency Sump as a suction source for the ECCS Pumps and therefore must be assigned.

C. Correct – Restoring power as directed by Attachment 7 Section 1 is a required mitigation strategy to enable establishing Containment Emergency Sump as a suction source for the ECCS Pumps. As noted in the procedure warning, the total dose received is expected to be less than 2 Rem and based on time motion studies and worst case dose rates, RP coverage is not required.

D. Incorrect – While the action is part of the required mitigation strategy, the excepted dose will be within the allowed dose and not require pre-approval to exceed exposure limits

Sys #	System	Category	KA Statement
N/A	N/A	Generic	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.

K/A# 2.3.13 **K/A Importance** 3.4 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02000 Attachment 7 section 1 Warning

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.12 / 43.4 / 45.9 / 45.10)

ATTACHMENT 7: TRANSFERRING LPI SUCTION TO THE EMERGENCY SUMP

This attachment restores power to allow transfer of ECCS Pump Suctions from the BWST to the Emergency Sump. The valves are normally depowered to satisfy fire related Appendix R concerns. (Time Critical Operator Action = a total of 23 minutes to direct performance of the attachment and the time to complete the attachment in the field.)

WARNING: ATTACHMENT 7
Some areas of the Auxiliary Building may experience extremely high radiation levels. Minimizing the time spent in these areas will reduce the dose received. The following route is required for closing the breakers for DH7A, DH7B, DH9A, DH9B and HP31. Failure to follow this route could result in a dose significantly higher than the projected 2.0 rem. An RP Technician is NOT required to accompany the Operator performing this attachment. Worst case conditions (34 REM/hr) for the route provided have been assumed in the development of this attachment.

Section 1. Action to close breakers for DH7A, DH7B, DH9A, DH9B. and HP31

This portion of the Attachment will normally be performed by an Operator with the Procedure in Hand.

1. Obtain dosimetry for entering the Auxiliary Building.
2. Enter old RCA entrance Auxiliary Building 603 elevation. (Door 408)
3. Move through Chem Lab Room 424.
4. Go to F11B located in Fuel Handling Storage Room (Room 405)
5. Close Breaker BF 1148, DH7A.
6. Return down Passageway 404 and 411 to southeast stairs near elevator.
7. Descend stairs to 565 elevation.
8. Go to F11D located in Passageway 227 south of Makeup Pump Room.
9. Close Breaker BF 1142, DH9A.
10. Continue down passageway toward Makeup Pump Room and over stairs ("Pygmy Pass") to BWST Heat Exchanger Area.
11. Travel down Passageway 209 to Aux Building Central Stairs.
12. Descend to bottom of stairs and exit into ECCS Train 1 room.

74. The plant is operating at 50% power with all systems in normal alignment. A power increase to 100% power is in progress.
The following Annunciator Alarms are received:

- 13-4-C, DEAR STRG TK 1 LVL.
- 13-4-D, DEAR STRG TK 2 LVL.

Subsequently, the following Deaerator Storage Tank levels are noted:

- LI202, Deaerator Storage Tank Level 1 is 0.5 feet and LOWERING.
- LI205, Deaerator Storage Tank Level 2 is 0.5 feet and LOWERING.

Which of the following actions are **required** for this plant condition?

A. Stop the power increased until Deaerator Level rises.

B. Dispatch an Operator to reset High Pressure Feedwater Heater 4 Drains to the Deaerator to prevent losing FW Heater inventory to the Condenser.

C. Start BOTH FW Heater Drain Pumps to add inventory to the Deaerator.

D. Trip the Reactor, Trip BOTH MFP's, Initiate and Isolate SFRCS.

Answer: D

Explanation/Justification:

A. Incorrect – The candidate may select this action because reducing power would reduce Deaerator Inventory usage that could restore Deaerator Level. Also, the automatic runback on low Deaerator Level stops at 60% power.

B. Incorrect – The candidate may select this action because if FW Heater 4 drains are going to the Condenser, Deaerator level would lower. This action could restore Deaerator level.

C. Incorrect – The candidate may select this action because starting Heater Drain Pumps would add inventory to the Deaerator. This action could restore Deaerator level.

D. Correct – This is the correct action per annunciator alarm response procedure DB-OP-02013 in anticipation of a loss of all Main Feedwater.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of annunciator alarms, indications, or response procedures.

K/A# 2.4.31 **K/A Importance** 4.2 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02013 R10, Condensate and Feedwater Alarm Panel 13 Annunciators. Page 45

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: Low - Fundamental **10 CFR Part 55 Content:** (CFR: 41.10 / 45.3)

Objective:

3.3 IF the Deaerator Storage Tank 1 level is less than 4 feet,
THEN verify an ICS runback is in progress.

> NOTE 3.4
>
> The MFPs have no automatic trip on low Deaerator Storage Tank level.

3.4 IF the Deaerator Storage Tank is approaching low level off scale as indicated on LI 202,
THEN perform the following:

3.4.1 Trip the Reactor.

3.4.2 Trip BOTH Main Feed Pumps using HS 797 and HS 798, TURBINE TRIP.

3.4.3 Initiate AFW flow AND isolation of BOTH SGs BY depressing SFRCS manual actuation Switches HIS 6403 (AFP 1 to SG 1 and ISO SG 1) AND HIS 6404 (AFP 2 to SG 2 and ISO SG 2).

3.4.4 GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.

3.5 Observe CD 421, DEAERATOR HEATER 1-3 LEVEL CONTROL, to determine if it is functioning properly at LIC 421 as follows:

3.5.1 IF a high Deaerator Storage Tank level exists,
THEN verify CD 421, DEAERATOR HEATER 1-3 LEVEL CONTROL, is closed.

3.5.2 IF a low Deaerator Storage Tank level exists,
THEN verify CD 421, DEAERATOR HEATER 1-3 LEVEL CONTROL, is open.

3.6 IF a high Deaerator Storage Tank level exists
AND CD 421, DEAERATOR HEATER 1-3 LEVEL CONTROL, is functioning properly,
THEN drain the Deaerator Storage Tank to the hotwell to a normal (7.25 to 8.75 feet) level by performing the following:

3.6.1 Close FW 423, DEAERATOR STORAGE TANK 2 TO 1 OUTLET CROSSOVER.

3.6.2 Open FW 104, DEAERATOR STORAGE TANK TO CONDENSER VALVE.

3.6.3 Verify FW 33, DEAERATOR STORAGE TANKS TO CONDENSER GLOBE, is open.

75. The plant was in MODE 1 when the Control Room was evacuated per DB-OP-02519, Serious Control Room Fire.

When the Supplementary Actions are complete, which ONE of the following describes how inventory is being supplied to the RCS?

A. High Pressure Injection Pump #1 is RUNNING with an operator MANUALLY controlling HP2C, HPI Train 1 Injection Valve.

B. High Pressure Injection Pump #2 is RUNNING with an operator MANUALLY controlling HP2A, HPI Train 2 Injection Valve.

C. Makeup Pump #1 is RUNNING with an operator MANUALLY controlling MU 6420, NORMAL MAKEUP FLOW CONTROLLER BYPASS.

D. Makeup Pump #2 is RUNNING with an operator MANUALLY controlling MU 6419, MU INJECTION TRAIN 1.

Answer: C

Explanation/Justification:

A. Incorrect –The plant maintains Hot Standby Conditions following a Serious Control Room Fire. HPI discharge pressure is insufficient to provide RCS inventory at that pressure.

B. Incorrect –The plant maintains Hot Standby Conditions following a Serious Control Room Fire. HPI discharge pressure is insufficient to provide RCS inventory at that pressure.

C. Correct – DB-OP-02519 Attachment 5 directs the Equipment Operator to lineup MUP 1 and isolate, MU32 and MU6419 to allow another Operator to control level with MU6420

D. Incorrect –Although MU is used, the protection of Train 1 for Serious Control Room Fire dictates the used of MU Train 1 and MU Pump 2 is tripped from the control room if time permits.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects.

K/A# 2.4.35 **K/A Importance** 3.8 **Exam Level** RO

References provided to Candidate None **Technical References:** DB-OP-02519 R17 Attachment 5 and Attachment 3 step 6.a.

Source: Bank 29276 **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** (CFR: 41.10 / 43.5 / 45.13)

Objective:

ATTACHMENT 5: EQUIPMENT OPERATOR ACTIONS OUTSIDE THE CONTROL ROOM

NOTE 1.0

During the performance of this procedure in actual emergency conditions the operator is authorized to cross posted radiological boundaries. The Aux Bldg will be closed until post event surveys are complete.

1.0 Perform makeup restoration and electrical isolation, as follows:

______ a. Verify the radio is NOT in the Silence Mode by keying the transmitter.

______ b. Proceed to the Emergency entrance to the RRA.

______ c. Obtain emergency dosimetry.

d. Proceed to passage to Makeup Pump Room using the Emergency Entrance to RRA.

______ 1. Place ALL E11D disconnect switches in LOCAL at CDE11D.

______ 2. Open BE1185, MP 0381 BA PMP 1, at E11D.

e. Proceed to the Makeup Pump Room.

______ 1. Verify MU 6409, MAKE-UP PUMP DISCHARGE CROSS CONNECT, is open using NV 6409.

______ 2. Verify MU 6405, MAKE-UP PUMP 1 THREE WAY SUCTION, is positioned to the BWST using NV 6405.

______ 3. Close MU 209, NORMAL MAKE-UP FLOW CONTROLLER INLET ISOLATION (SE corner of the room).

______ 4. WHEN notified by the Unit Supervisor that Train 2 Electrical sources have been de-energized,
THEN verify MU 6408, MAKEUP PUMP DISCHARGE CROSS CONNECT, is open.

f. Proceed to #2 Mechanical Penetration Room.

______ 1. Verify MU 6422, NORMAL MAKE-UP TO REACTOR COOLANT SYSTEM ISOLATION, is open.

ATTACHMENT 5: EQUIPMENT OPERATOR ACTIONS OUTSIDE THE CONTROL ROOM

1.0 Continued

g. Proceed to the #1 Mechanical Penetration Room.

_______ 1. Attempt to close MU 6421, MAKE-UP TO REACTOR COOLANT SYSTEM TRAIN 1 ISOLATION, is using NVMU6421

_______ 2. IF MU 6421, MAKE-UP TO REACTOR COOLANT SYSTEM TRAIN 1 ISOLATION, closes using NVMU6421,
THEN continue to step 1.0.g.3
OTHERWISE manually close MU 6421, MAKE-UP TO REACTOR COOLANT SYSTEM TRAIN 1 ISOLATION.

_______ 3. Notify the Primary Reactor Operator that #1 Makeup Pump is ready for operation.

h. Proceed to #3 Mechanical Penetration Room.

_______ 1. Verify AF 608, AUXILIARY FEEDWATER TO STEAM GENERATOR 1 LINE STOP, is open.

_______ 2. Obtain Portable Temperature Monitors TI 5503 AND TI 5504 from the storage location near the Gai-Tronics.

_______ 3. Open C3812, RCS TEMP. LOOP 1.

NOTE 1.0.h.4

An Operator Aid is located on Shield Building wall next to C3812.

_______ 4. Uncouple both connectors by turning the engagement (center) nuts counterclockwise until the threads are disengaged.

_______ 5. Disengage the output plug connectors (free lower half, the upper half is stationary).

_______ 6. Remove BOTH Portable Temperature Monitor input connector protective covers (threaded caps).

_______ 7. Insert TI 5503 input cable into the output plug connection (stationary upper portion) on the left AND tighten the engagement nut.

continued

ATTACHMENT 3: PRIMARY SIDE REACTOR OPERATOR ACTIONS OUTSIDE THE CONTROL ROOM

5.0 Proceed to corridor outside #3 Mechanical Penetration Room.

_______ a. Open BE 1180, MCC YE2 FEEDER, at E11B.

b. Place the following disconnect switches in LOCAL at CDE11B-2:

- _______ MU 59C
- _______ MU 59D
- _______ RC 240A
- _______ CC 1407A
- _______ DH 12.

_______ c. Place ALL disconnect switches in LOCAL at CDE11B-1.

_______ d. Place ALL disconnect switches in LOCAL at CDE11C.

_______ e. Place ALL disconnect switches in LOCAL at CDE11A.

_______ f. Place ALL disconnect switches in LOCAL at CDYE2.

6.0 Restore RCS Makeup by performing the following:

a. Proceed to Makeup Pump Room

_______ 1. WHEN notified by the Equipment Operator that #1 Makeup Pump is ready for operation,
THEN start MU PUMP 1-1 MAIN OIL PUMP (AC) using NP0371B.

_______ 2. Verify MU PUMP 1-1 AUX GEAR L.O. PUMP starts as indicated on NP0371D.

_______ 3. Check approximately 12 gpm CCW flow to Makeup Pump 1 Oil Cooler at FI 2190.

_______ 4. Check #1 Makeup Pump Oil System discharge pressure is greater than 15 PSIG as read on PI MU106B.

_______ 5. Establish communication with the Shift Manager.

_______ 6. Start Makeup Pump 1 by depressing the CLOSE pushbutton on NP0371A.

_______ 7. Inspect Makeup Pump 1 for proper operation.

(SRO ONLY)
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6. The plant is operating at 100% power with all systems in normal alignment **EXCEPT** EDG-1 is on clearance for lube oil replacement. A reactor trip coincident with a loss of offsite power occurs. The following conditions exist:
   - RCS pressure is 2245 psig and stable
   - The hottest RCS Thot is 610 °F and stable
   - EDG 2 has started
   - EDG 2 output breaker AD-101 is OPEN
   - Both AFW Pumps are now in service.

   The crew has entered DB-OP-02000, "RPS, SFAS, SFRCS TRIP, OR SG TUBE RUPTURE"

   (1) What procedure section is **required** to be implemented?
   (2) What actions will be **required**?

A. (1) Specific Rule 6, Power For C1 And D1 Buses OR EDG Start
(2) Depress the Field Flash Pushbutton AND close the EDG 2 Output Breaker AD101.

B. (1) Specific Rule 6, Power For C1 And D1 Buses OR EDG Start
(2) Place DG 2 SYNC switch in the EDG BKR TO D1 position AND close EDG 2 output breaker AD101

C. (1) Specific Rule 2, Actions for Loss of Subcooling Margin
(2) Specific Rule 4, Raise SG Level to 124 inches

D. (1) Specific Rule 2, Actions for Loss of Subcooling Margin
(2) GO TO Attachment 4, Initiate MU/HPI Cooling

Answer: B

Explanation/Justification:

A. Incorrect. Correct procedure section. Wrong actions.

B. Correct. IAW DB-OP-02000 Revision 25 step 4 supplemental actions page 16 and step 2 RNO page 246. SRO ONLY since it requires the candidate to assess the given plant conditions and then select the appropriate procedure section and actions contained in that section.

C. Incorrect. Wrong section and action. Plausible if the candidate misuses the steam tables and determines that subcooling is less than adequate. The actions would be correct for loss of subcooling.

D. Incorrect. Wrong section and action. Plausible if the candidate misuses the steam tables and determines that subcooling is less than adequate. These actions would only be taken if no AFW flow was present in addition to no M/U flow. However M/U flow should be available.

Sys #	System	Category	KA Statement
000056	Loss of Offsite Power	Generic	Ability to interpret and execute procedure steps.

K/A# 2.1.20 **K/A Importance** 4.6 **Exam Level** SRO

References provided to Candidate Steam Tables **Technical References:** DB-OP-02000 R26 step 4 supplemental actions page 16 and step 2 RNO page 246

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** (CFR: 55.43(b)(5)

4.0 SUPPLEMENTAL ACTIONS

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.1 Implement any necessary **Specific Rules** Actions. 2. ACTIONS FOR LOSS OF SUBCOOLING MARGIN 4. STEAM GENERATOR CONTROL 6. POWER FOR C1 AND D1 BUSES **OR** EDG START	

Specific Rule 6, Power For C1 And D1 Buses OR EDG Start	
ACTION/EXPECTED RESPONSE	**RESPONSE NOT OBTAINED**
6.1 IF a loss of Power to C1 OR D1 Bus occurred OR an EDG(s) has started THEN perform the following:	
___ 1. Verify the affected train(s) EDG is running.	Attempt to start EDG(s) that failed to start as follows: ___ 1. Press Control Room EDG START pushbutton(s). ___ 2. IF the EDG(s) failed to start, THEN dispatch an Operator to attempt a local Start. REFER TO DB-OP-06316, EDG Operating Procedure.
___ 2. Verify the affected train(s) essential bus (C1 – D1) is energized.	IF the EDG is running, but EDG Output Breaker did NOT close: THEN perform the following: ___ 1. Place DG 1 (2) SYNC switch in the EDG BKR TO C1 (D1) position. 2. Attempt to close the EDG(s) output breaker: ___ • EDG 1 – AC 101 ___ • EDG 2 – AD 101 ___ 3. Turn SYNC switch to OFF (to allow power restoration from other sources).

7. The plant was operating at 100% power with all systems in normal alignment.
   - A 460 gpm Steam Generator Tube Rupture (SGTR) occurs on SG1
   - The reactor automatically trips coincident with a Loss of Off Site Power
   - All systems function as designed

   The crew is cooling down and depressurizing the RCS by performing the actions of DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture.

   During this cooldown and depressurization, which of the following conditions are **required** before the crew will isolate (stop feeding and steaming) SG1?

A. T_{hot} reaches 520 °F AND RCS pressure reaches 1000 psig

B. T_{hot} reaches 500 °F AND RCS pressure reaches 1000 psig

C. SG1 indicated level is rising AND reaches 200 inches

D. LPI system flow is $\geq$ 1350 gpm AND has been for at least 20 minutes.

Answer: A

Explanation/Justification:

A. Correct. IAW DB-OP-02000 Rev. 26 step 8.37. These are the conditions necessary for the SRO to implement Attachment 17 for isolating a SG. This is SRO only since it requires the candidate to assess the conditions, including diagnosing Reactor Coolant Pumps tripped due to the loss of offsite power that will require the implementation of the Attachment for isolating a ruptured SG.

B. Incorrect. These are the conditions necessary to isolate a ruptured SG if the plant is being cooled with forced circulation (RCP running)

C. Incorrect. These are conditions in the SGTR procedure for increasing the C/D rate to 235 °F/hr.

D. Incorrect. These are the conditions necessary to stop HPI/MU flow.

Sys #	**System**	**Category**	**KA Statement**
000038	Steam Generator Tube Rupture (SGTR)	EA2 Ability to determine and interpret the following as they apply to SGTR:	When to isolate one or more S/Gs

K/A# EA2.01	**K/A Importance** 4.7	**Exam Level**	SRO
References provided to Candidate	None	**Technical References:**	DB-OP-02000 Rev. 26 step 8.37
Question Source:	New	**Level Of Difficulty: (1-5)**	3
Question Cognitive Level:	High - Comprehension	**10 CFR Part 55 Content:**	10 CFR: 55.43(b)(5)
Objective:			

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8.37 WHEN either of the following conditions are met: • RCS Natural Circulation 520°F AND 1000 psig OR • RCS Forced Circulation 500°F AND 1000 psig THEN perform the following.	
___ Control TBVs - AVVs on the good SG to maintain RCS temperature constant or slightly decreasing. **OR** the use of trickle feed if established in response to an Overcooling.	___ IF the non-tube ruptured SG is NOT in service, THEN GO TO Step 8.53 to establish trickle feed or MU/HPI Cooling.
___ Stop steaming the tube ruptured SG by performing Attachment 17, Isolation of a Faulted SG.	
___ 8.38 IF accessible, AND additional BWST inventory is required, THEN lineup and transfer the contents of the Clean Waste Receiver Tanks with the highest boron concentration to the BWST. REFER TO DB-OP-06101, Clean Liquid Radwaste System.	
8.39 Proceed with Plant Operations as follows:	
___ IF Subcooling Margin is adequate, THEN GO TO DB-OP-06903, Plant Cooldown AND REFER TO DB-OP-02531, SG Tube Leak, for additional guidance.	___ IF the RCS is saturated, THEN GO TO Section 11, RCS Saturated with SG Removing Heat Cooldown.

8. The plant is operating at 28% power with all systems in normal alignment for this power level EXCEPT condensate pump 2 is Tagged Out for motor replacement.

The following alarms occur:

- (1-5-F) DC PANEL VOLTAGE LO
- (1-6-G) DC BUS2 TRBL
- (1-6-K) YV2 - YV4 TRBL

Zero volts are indicated at EI 6276, +125V DC PNL D2P

Based on these indications, how will the plant respond and what procedure supplemental actions will be **required**?

A. No automatic Reactor or turbine trip will occur;
Manually trip the reactor, Initiate AND Isolate SFRCS and GO TO DB-OP-02000, RPS,SFAS, SFRCS Trip, or SG Tube Rupture

B. No automatic Reactor or turbine trip will occur; Place the SG/RX Demand H/A Station in HAND, Use the toggle switch to insert Control Rods without causing a cross limit or a Reactor Trip, REFER TO DB-OP-02504, Rapid Shutdown.

C. No automatic Reactor trip will occur, the turbine will automatically trip, REFER TO DB-OP-02500, Turbine Trip, reduce reactor power to within the capacity of the available Atmospheric Vent Valves.

D. No automatic Reactor trip will occur, the turbine will automatically trip, Manually trip the reactor, Initiate AND Isolate SFRCS and GO TO DB-OP-02000, RPS,SFAS, SFRCS Trip, or SG Tube Rupture.

Answer: C

Explanation/Justification:

A. Incorrect. The turbine will automatically trip. These are the correct actions for loss of D1P bus since condensate pumps 1 and 3 will trip and the supplemental actions of DB-OP-0257 require these actions.

B. Incorrect. The turbine will automatically trip. These are the correct actions for loss of D1P if at least one condensate pump is running.

C. Correct. IAW DB-OP-02538 LOSS OF D2P and DBP REV. 19 symptoms page 3, step 4.5 on page 6 and DB-OP-02500 TURBINE TRIP REV.11 step 4.3 page 6. SRO ONLY since it requires the candidate to analyze the given conditions and recognize that a loss of D1P and DBP has occurred and what components are affected (RO knowledge). The SRO must then select the appropriate supplemental procedural actions.

D. Incorrect. Plant response is correct. Supplemental actions are wrong. These are the right actions for loss of D1P bus since condensate pumps 1 and 3 will trip and the supplemental actions of DB-OP-0257 require these actions.

Sys #	System	Category	KA Statement
000058	Loss of DC Power	AA2. Ability to determine and interpret the following as they apply to the Loss of DC Power:	DC loads lost; impact on ability to operate and monitor plant systems

K/A# AA2.03 **K/A Importance** 3.9 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02538 LOSS OF D2P and DBP REV. 19 symptoms page 3, step 4.5 on page 6 and DB-OP-02500 TURBINE TRIP REV.11 step 4.3 page 6

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

1.0 PURPOSE

This procedure provides operational direction for a loss of Essential DC distribution panel D2P and non-essential distribution panel DBP.

2.0 SYMPTOMS – LOSS OF D2P AND DBP

2.1 Annunciator Alarms:

- (1-5-F) DC PANEL VOLTAGE LO
- (1-6-G) DC BUS 2 TRBL
- (1-6-K) YV2-YV4 TRBL

2.2 Zero volts indicated at EI 6276, +125V DC PNL D2P.

2.3 Loss of breaker status indication for the following buses and associated loads:

- B Bus - load breakers
- D1 Bus.

2.4 No Immediate Actions Required
GO TO Subsection 4.1, Supplemental Actions – Loss of D2P and DBP

3.0 IMMEDIATE ACTIONS – LOSS OF D2P AND DBP

3.1 Loss of D2P and DBP
None Required
GO TO Step 4.1, Supplemental Actions – Loss of D2P and DBP

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.5 Verify SG Pressure Control is being maintained by the AVVs. (Main Turbine trips and TBVs are failed closed. Position indication for AVVs is also lost).	
___ 4.6 IF Letdown Flow is lost (MU3, LETDOWN STOP fails closed) THEN perform Attachment 4, Hand Jack Open MU3 LETDOWN ISO. REFER TO DB-OP-02512, Makeup System Malfunctions for Loss of Letdown Flowpath.	
___ 4.7 Verify all radioactive effluent releases are terminated.	
4.8 IF SW Loop 2 was supplying secondary loads, AND IF SW Loop 2 Header Pressure lowered to 50 psig THEN verify SW secondary loads have transferred to Circ Water: ___ • Verify CT 2955 is open. ___ • Verify SW 1395 is closed.	
___ 4.9 IF it is necessary to operate the Auxiliary Boiler, THEN control Aux Boiler Deaerator level using CD22, AUX BOILER DEAERATOR HEATER MAKEUP FROM COND POL DEMINS FLOW CONTROL BYPASS (Aux Boiler Deaerator Level Control valves CD1666B/C are failed).	

4.0 SUPPLEMENTAL ACTIONS – TURBINE TRIP

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.1 Verify all Turbine Stop Valves OR all Control Valves are closed.	Trip the Main Turbine using one or more of the following methods: ___ • Press the EMERGENCY TRIP pushbutton (EHC Panel 1). ___ • Stop BOTH EHC Fluid Pumps by placing HIS2413, PUMP 1, AND HIS2414, PUMP 2 in LOCKOUT. ___ • Turn and pull the MANUAL TRIP handle at the Turbine Front Standard. IF all 4 Turbine Stop Valves OR all 4 Turbine Control Valves are not closed, THEN perform the following: ___ 1. Trip the Reactor ___ 2. Initiate and Isolate SFRCS using Manual Actuation Switches. ___ 3. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.
___ 4.2 Check proper MFW control of SG level on Low Level Limit control (40 inches).	___ Take manual control of Main Feedwater to maintain SG Level on Low Level Limit control (40 inches).
___ 4.3 Reduce Reactor Power to within the capacity of the available Turbine Bypass Valves if necessary to allow AVVs to close, by performing Attachment 1, Reduce Reactor Power to Allow AVVs to Close.	___ Take manual control of Turbine Bypass Valves OR Atmospheric Vent Valves OR Both to maintain SG Press.

9. The Plant is in Mode 6 with the Reactor Coolant System level is being drained to 18 inches above hot leg centerline. DH Train 2 is in service providing core cooling; The Steam Generator Nozzle Dams are installed with lower SG Primary Side Manways removed to allow SG inspections.

   How will the DH removal system be aligned to prevent pump cavitation in the event of a loss of instrument air?

A. Throttle DH1A, DH Pump 2 Discharge to RCS to limit total flow through the decay heat removal system.

B. Throttle DH14A, DH Cooler 2 Outlet Flow Control Valve to limit total flow through the decay heat removal system.

C. Remove power from DH1518, DH Pump 2 Suction From RCS

D. Remove power from DH11 and 12 Reactor coolant system to DH system isolation valve.

Answer: A

Explanation/Justification: Pre-emptive mitigation strategy

A. Correct - At low RCS level, the DH System is vulnerable to runout on a loss of instrument air. To prevent this from occurring, a motor operated throttle valve is set in accordance with the system operating procedure to limit flow in the event of a loss of instrument air. SRO ONLY since it requires the candidate to assess the given plant conditions and then select the appropriate procedure actions contained in that section.

B. Incorrect – Plausible because throttling DB14A would limit flow, the valve fails open on a loss of air and would cause excess flow from the RCS.

C. Incorrect – Plausible because this valve is depowered to ensure a flowpath from the RCS remains available, but this does not protect from a loss of instrument air event.

D. Incorrect – Plausible because these valves are depowered to ensure a flowpath from the RCS remains available, but this does not protect from a loss of instrument air event.

Sys #	**System**	**Category**	**KA Statement**
000065	Loss of Instrument Air	Generic	Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies.

K/A# 2.4.9
K/A Importance 4.2
Exam Level SRO
References provided to Candidate None
Technical References: DB-OP-06012 Rev. 57 page 161 Note 4.27.5 and DP-PF-06703 Rev. 20 CC6.4
Question Source: New
Level Of Difficulty: (1-5) 3
Question Cognitive Level: High - Comprehension
10 CFR Part 55 Content: 10 CFR: 55.43(b)(5)
Objective:

4.27 Preparation for DH Loop 2 Operation at Reduced RCS Inventory

Prerequisites

________ 4.27.1 Verify DB-OP-06904, Shutdown Operations has directed performance of this Subsection.

Prerequisites completed by __________________________________ Date ____________

Procedure

> NOTE 4.27.2
>
> DH1B* is closed to protect DH Loop 1 in the event of an inadvertent SFAS trip causing DH Pump 1 to start and DH14B* to fail open.

________ 4.27.2 Verify DH1B*, DH PUMP 1 DISCHARGE TO RCS, is closed.

________ 4.27.3 Position the following valves as necessary to obtain a DH Loop 2 flowrate of 3650 to 3700 gpm as indicated on FYI DH2A, DH2 FLOW.

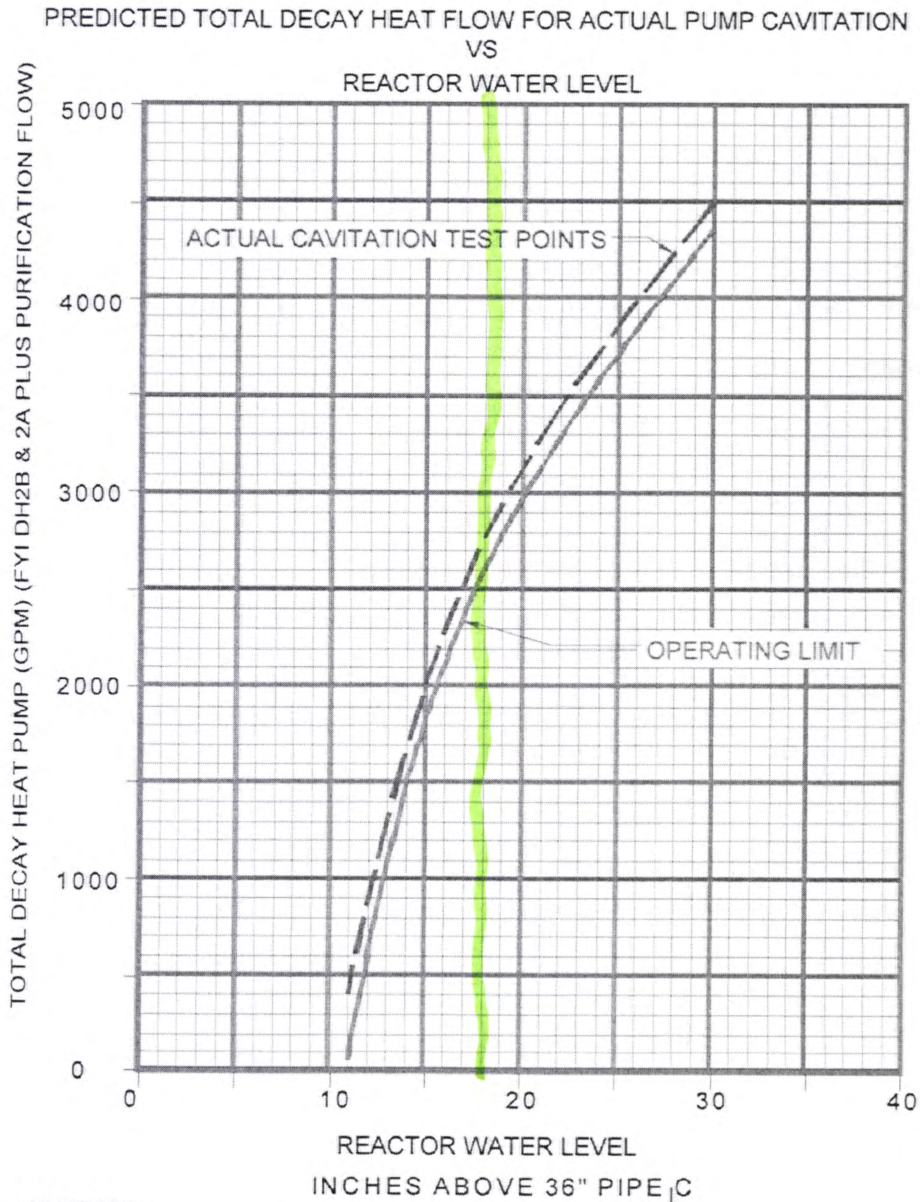
- DH14A*, DH COOLER 2 OUTLET FLOW CONTROL VALVE, using HIC DH14A.
- DH13A, DH COOLER 2 BYPASS FLOW CONTROL VALVE, using HIC DH13A.

________ 4.27.4 Place control power on DH1A* using HIS DH1A-2.

> NOTE 4.27.5
>
> - DH1A is throttled to limit DH Loop 2 flow to less than the maximum limits of curves CC 6.2 and CC 6.4 of DB-PF-06703, Miscellaneous Operation Curves, if DH14A were to fail open. Additional DH flow reduction to achieve proper flow at reduced RCS level is maintained by throttling DH14A and/or DH13A.
> - RCS temperature should be monitored continuously to ensure that reduced DH flow is still adequate to maintain desired RCS temperature.

________ 4.27.5 Throttle closed on DH1A*, DH PUMP 2 DISCHARGE TO RCS, using HIS DH1A to reduce DH Loop 2 flow slightly (approximately 50 gpm) less than the maximum limits of curves CC 6.2 and CC 6.4 of DB-PF-06703, Miscellaneous Operation Curves, as indicated on FYI DH2A, DH2 FLOW.

*Controlled per DB-OP-00008, Operation and Control of Locked Valves



CC6.4
Notification 60057605

CAUTION: This curve is for guidance only. This curve should not be exeeded or loss of pump NPSH may occur. The actual test points are points at which either pump NPSH was lost or pump suction pressure was low causing excessive pump cavitation.

Rx Water Level	Actual Test Point	Adjusted Operating Limit Curve
30"	4500	4360 GPM
18"	2750	2590
11"	400	50

[illegible]0. The plant is operating at 100% power with all systems in normal alignment. A reactor trip coincident with a loss of offsite power occurs. All plant systems respond normally.

Based on these conditions, what procedure actions will be **required** to stabilize the plant?

A. Raise Steam Generator level to 124 inches to **promote natural circulation** in accordance with DB-OP-02000 Specific Rule 4, Steam Generator Control.

B. Lineup HPI piggyback operations to mitigate the **Loss of all RCS Makeup** in accordance with DB-OP-02000, Attachment 1, Primary Inventory Control Actions.

C. Initiate and Isolate SFRCS to mitigate the **Loss of ICS power** in accordance with DB-OP-02000 Supplemental Actions step 4.6, Check for ICS Power available.

D. Verify the Standby CCW Pump is running to mitigate the **Loss of Instrument Air** in accordance with DB-OP-02000 Supplemental Actions step 4.7, Check for Instrument Air Available.

Answer: D

Explanation/Justification:

A. Incorrect – Although the loss of Off-Site power causes all RCPs to be lost, the raised loop design at Davis-Besse does not require raising level to 124 inches to promote Natural Circulation Cooling. This is the correct action to promote boiler condenser SG heat transfer if Subcooling Margin is lost.

B. Incorrect – The previously running MU Pump will restart when the EDG starts. Although cooling to the running Makeup Pump is lost, the pump can operate for at least 1 hour without cooling and the standby Makeup Pump would be available. This is the correct procedure action if all Makeup Pumps are lost.

C. Incorrect – Although this is the correct action for a loss of ICS power, ICS power is provided by YAU and YBU and is not lost of a loss of Off-Site power.

D. Correct – The loss of Off-site power will result in a loss of instrument air. The Standby CCW Pump is started to mitigate CC1460 failing closed preventing the in service CCW Pump from providing cooling to the previously running Makeup Pump. SRO ONLY since it requires the candidate to assess the given plant conditions and then select the appropriate procedure section and actions contained in that section.

Sys #	System	Category	KA Statement
BW/E10	Post-Trip Stabilization	EA2. Ability to determine and interpret the following as they apply to the (Post-Trip Stabilization)	Facility conditions and selection of appropriate procedures during abnormal and emergency operations.

K/A# EA2.1 **K/A Importance** 4.0 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02000 Rev. 26 Supplemental action step 4.7

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.5 (Continued) Check for NNI Power available.	**IF NNI Y AC OR DC is lost, THEN perform the following:** ___ Use PAM or NNI X indicators. IF all Makeup Tank Level indications are lost, THEN Lock both Makeup Pump Suctions on the BWST. ___ • MU6405 ___ • MU3971
___ 4.6 Check for ICS Power available. Annunciator ICS/NNI 118 VAC PWR TRBL (14-2-D), ICS Power Annunciators Off ________ ICS Hand/Auto Stations Lit ________	___ Initiate AND Isolate SFRCS using MANUAL ACTUATION switches.
___ 4.7 Check for Instrument Air available. Air Compressor Running # ________ At least one compressor running. Instrument Air Pressure ________psig Instrument Air greater than 75 psig	___ Initiate AND Isolate SFRCS using MANUAL ACTUATION switches. ___ Start the standby CCW Pump. ___ IF D2 Bus is NOT energized, THEN restore power to D2. REFER TO Attachment 6, Reenergization Of Buses D2, F7, and MCC F71 to allow start of Air Compressor.

1. The plant is operating at 100% power.

The following events occur:

- Reactor Trip
- Main Steam Safety Valves on BOTH Steam Generators stick open and can not be reseated.
- All Feedwater Flow is isolated to #1 Steam Generator.
- Trickle Feed is established to #2 Steam Generator
- RCS Pressure is stabilized at 1700 psig.

In accordance with DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture, what Steam Generator Level if any, is **required** to be maintained for these plant conditions?

A. No specific Level requirement exists for these plant conditions.

B. Maintain 40 inches using Main Feedwater flow.

C. Maintain 49 inches using Auxiliary Feedwater flow.

D. Maintain 124 inches using Auxiliary Feedwater flow.

Answer: A

Explanation/Justification:

A. Correct per **note** for step 7.28 RNO. SRO ONLY since it requires the candidate to assess the given plant conditions and then select the appropriate procedure actions contained in that section, in this case a note preceding a supplemental action step.

B. Incorrect – Plausible because this the normal method of control and sytem used to maintain SG Level following a Reactor Trip

C. Incorrect – Plausible because this the normal method of control and sytem used to maintain SG Level following AFW Actuation that would occur when Feedwater isolated to #1 SG.

D. Incorrect – Plausible because this the normal method of control and sytem used to maintain SG Level following AFW Actuation that would occur when Feedwater isolated to #1 SG. and RCS Pressure reduction caused by overcooling resulted in an SFAS actuation.

Sys #	System	Category	KA Statement
BW/E05	Steam Line Rupture - Excessive Heat Transfer	Generic	Knowledge of the operational implications of EOP warnings, cautions, and notes.

K/A# 2.4.20 **K/A Importance** 4.3 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02000 Step 7.28 RNO
DB-OP-02000 Specific Rule 4

Question Source: New **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 7.28 WHEN the faulted (isolated) SG boils dry, THEN check Reactor Coolant System Cooldown rate is less than 100 °F/hr.	IF overcooling continues at greater than 100 °F/hr THEN perform the following: **Note 7.28 RNO** Compliance with Specific Rule 4 requirements for SG Level and flow is NOT required when utilizing Trickle Feed cooling. IF the steam release location is NOT detrimental to personnel or key equipment, THEN establish trickle feed cooling as follows: ___ 1. Manually reduce AFW flow to the non-isolated SG ___ 2. Adjust SG feed flow rate to maintain RCS temperature constant or slightly lowering. IF trickle feed cooling can NOT be established OR a Lack of Heat Transfer exists OR an inability to control RCS cooldown rate exists when using trickle feed, THEN isolate AFW flow to BOTH SGs by closing: ___ • AF608, AFW TO SG1 STOP AND ___ • AF599, AFW TO SG2 STOP ___ Initiate MU/HPI PORV Cooling. GO TO Attachment 4, Initiate MU/HPI Cooling **(SRO Directed)**.

Specific Rule 4, Steam Generator Control	
ACTION/EXPECTED RESPONSE	**RESPONSE NOT OBTAINED**
4.3 Maintain SG Level as follows:	
___ 1. IF AFW is in service, THEN maintain full continuous AFW flow until the appropriate SG level is reached.	
___ 2. IF SFRCS has NOT actuated, THEN maintain Low Level Limits on the Startup Range using MFW.	___ IF SG Level can NOT be maintained due to a loss of Feedwater, THEN REFER TO Attachment 5, Guidelines for Restoring Feedwater.
___ 3. IF SFRCS has actuated AND SA2 has NOT actuated, THEN maintain operable SGs at 49 inches (55 inches) on the Startup Range using AFW or at 40 inches using MFW if AFW is NOT available.	
___ 4. IF SFRCS has actuated AND SA2 has actuated OR SCM is NOT adequate, THEN maintain operable SGs at 124 inches (130 inches) on the Startup Range using AFW or MFW if AFW is NOT available.	

2. A plant startup-up is in progress in middle of Core life with the following conditions:
   - Reactor power is 10^{-8} amps on the Intermediate Range and stable
   - Rod Control is in MANUAL
   - ICS Reactor Demand is in MANUAL
   - Group 6 Rods are at 50%
   - The Rod Control Group Select Switch is selected to Group 6
   - All Rods are on their normal power supply.

   From these initial conditions, the following occurs:
   - The Group 6 rods continuously withdraw outward. NI3 and NI4 SUR is 4 DPM.

   In accordance with DB-OP-02516, CRD Malfunctions:

   (1) What operator actions are **required**?

   In the event that Rod Motion does not stop:

   (2) IAW accident analysis, what Automatic RPS Trip is credited for terminating the event?

A. (1) Depress the Rod Stop Push Button
(2) High RCS Temperature.

B. (1) Depress the Rod Stop Push Button
(2) High RCS Pressure.

C. (1) Turn the Group Select switch to Group 5 position
(2) High RCS Temperature.

D. (1) Turn the Group Select switch to Group 5 position
(2) High RCS Pressure.

Answer: B

Explanation/Justification:

A. Incorrect – Depressing the Rod Stop Pushbutton is the Operator Action directed to stop continuous Rod withdraw by DB-OP-02516.. High RCS Temperature trip is plausible because the RCS will heatup once the point of adding heat is reached.

B. Correct – Depressing the Rod Stop Pushbutton is the Operator Action directed to stop continuous Rod withdraw by DB-OP-02516. High RCS Pressure is the RPS trip that will automatically terminate the event. SRO ONLY since part 2 of the question requires knowledge of TS bases and accident analysis associated with that bases.

C. Incorrect – While selecting Group 5 with all group 5 rods already withdrawn may stop all rod motion, this action is not directed by DB-OP-02516, CRD Malfunctions. High RCS Temperature trip is plausible because the RCS will heatup once the point of adding heat is reached.

D. Incorrect – While selecting Group 5 with all group 5 rods already withdrawn may stop all rod motion, this action is not directed by DB-OP-02516, CRD Malfunctions. .High RCS Pressure is the automatic trip that will automatically terminate the event.

Sys #	System	Category	KA Statement
000001	Continuous Rod Withdrawal	AA2. Ability to determine and interpret the following as they apply to the Continuous Rod Withdrawal :	Proper actions to be taken if automatic safety functions have not taken place

K/A# AA2.03 **K/A Importance** 4.8 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02516 R13 CRD Malfunctions. USAR 15.2.1 Startup Accident - Uncontrolled Control Rod Assembly Group Withdrawal. TS bases page B 3.3.1-9

Question Source: New **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(2)

3.0 IMMEDIATE ACTIONS – CRD MALFUNCTIONS

3.1 Dropped Control Rods
None Required
GO TO Step 4.1, Supplemental Actions – Dropped Control Rods.

3.2 Misaligned Control Rods
None Required
GO TO Step 4.2, Supplemental Actions – Misaligned Control Rods.

3.3 Undesired Control Rod Motion

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 3.3.1 STOP Control Rod motion by depressing AND holding the ROD STOP Button.	___ 1. Trip the Reactor. ___ 2. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.
___ 3.3.2 GO TO Subsection 4.3. Supplementary Actions – Undesired Control Rod Motion.	

3.4 Control Rod Position Indication Malfunctions
None Required
GO TO Step 4.4, Supplemental Actions – Control Rod Position Indication Malfunctions

3.5 Stuck Control Rods
None Required
GO TO Step 4.5, Supplemental Actions – Stuck Control Rods.

BASES

BACKGROUND (continued)

The actual nominal trip setpoint entered into the bistable is more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST and CHANNEL CALIBRATION. One example of such a change in measurement error is drift during the Surveillance Frequency. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value.

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

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

The Allowable Values listed in Table 3.3.1-1 are established using Method 1 or Method 2 of Reference 6 or 7, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of those uncertainties are factored into the determination of each trip setpoint. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

Each of the analyzed accidents and transients can be detected by one or more RPS Functions. The accident analysis contained in Reference 8 takes credit for most RPS trip Functions. Functions not specifically credited in the accident analysis are Containment High Pressure, RC high temperature, High Flux - Low Setpoint, and Shutdown Bypass High Pressure.

TABLE 15.2-1

Class 1 Events

Event	Analysis Assumption	Effect
Uncontrolled Control Rod Assembly Group Withdrawal from a Subcritical Condition.	Uncontrolled single-group and all-group CRA withdrawal from subcriticality with the reactor at zero power; only high flux and high RC pressure trips were used to terminate the accident.	Power rise terminated by negative Doppler effect, high Reactor Coolant System pressure trip or over power trip.
Uncontrolled Control Rod Assembly Group Withdrawal at Power.	Uncontrolled single-group and all-group CRA withdrawal with the reactor at rated power; only high flux and high RC pressure trips were used to terminate the accident.	Power rise terminated by over-power trip or high Reactor Coolant System pressure trip.
Control Rod Assembly Misalignment (Stuck-out, Stuck-in, or Dropped Control Rod Assembly).	Maximum worth control rod assembly dropped into core with the reactor at rated power, near middle-of-life condition. Stuck-out CRA worth considered in calculating the shutdown margin.	Subcriticality can be achieved if one CRA is stuck out. Dropped CRA does not result in reactor trip towards end of life condition. 22
Makeup and Purification System Malfunction.	Uncontrolled addition of unborated water to the Reactor Coolant System due to failure of equipment designed to limit flow rate and total water addition.	Slow change of power terminated by reactor trip on high coolant temperature or pressure. During shutdown a decrease in shutdown margin occurs, but criticality does not occur.

3. A plant startup-up is in progress with the following conditions:
   - Reactor power is 3% and stable
   - A single Group 2 rod is found at 95%

   (1) What Tech. Spec. action is **required**?
   (2) The Tech. Spec. regulating rod and safety rod insertion limits ensures the safety analysis assumptions for which of the following remain valid?

   I. Ejected rod worth
   II. Dropped rod worth
   III. Reactivity limits
   IV. Shutdown Margin
   V. MTC is within the limits of the COLR

A. (1) Verify SDM is within limit OR Initiate boration to restore SDM to within limit.
(2) II, III, & IV **ONLY**

B. (1) Verify SDM is within limit OR Initiate boration to restore SDM to within limit.
(2) I, III, & IV **ONLY**

C. (1) Verify SDM is within limit AND Reduce THERMAL POWER to less than or equal to THERMAL POWER allowed by regulating rod group insertion limits.
(2) II, IV, & V **ONLY**

D. (1) Verify SDM is within limit AND Reduce THERMAL POWER to less than or equal to THERMAL POWER allowed by regulating rod group insertion limits.
(2) I, IV, & V **ONLY**

Answer: B

Explanation/Justification:

A. Incorrect. Right TS action. Wrong bases dropped rod worth is not a bases and Ejected rod worth is a bases.

B. Correct. IAW TS 3.1.5-1 Amend 279 TS Bases B 3.1.5-1 Rev. 0. Part 1 is RO knowledge since it requires the candidate to recognize the conditions that require TS actions for boration. At DB the term emergency boration was used in the old TS for this action. In the new TS, this is only referred to as initiate boration. For DB this meets the intent of any TS LCO relative to emergency boration. Part 2 is SRO ONLY in that it requires the candidate to have knowledge of TS bases. Discussed with chief examiner to get concurrence that this approach to E-boration at DB still meets the K/A as written.

C. Incorrect. This is the correct TS action if the rod were a group 5, 6, or 7 rod. Wrong bases.

D. Incorrect. This is the correct TS action if the rod were a group 5, 6, or 7 rod. Wrong bases.

Sys # 000024
System Emergency Boration
Category Generic
KA Statement Ability to recognize system parameters that are entry-level conditions for Technical Specifications.

K/A# 2.2.42
K/A Importance 4.6
Exam Level SRO
References provided to Candidate None
Technical References: TS 3.1.5-1 Amend 279 TS Bases B 3.1.5-1 Rev. 0
Question Source: New
Level Of Difficulty: (1-5) 3
Question Cognitive Level: Low - Fundamental
10 CFR Part 55 Content: 10 CFR: 55.43(b)(2)
Objective:

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Safety Rod Insertion Limits

LCO 3.1.5 Each safety rod shall be fully withdrawn.

---NOTE---
Not required for any safety rod inserted to perform SR 3.1.4.2.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One safety rod not fully withdrawn.	A.1.1 Verify SDM is within limit.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.2 Declare the rod misaligned.	1 hour
B. More than one safety rod not fully withdrawn.	B.1.1 Verify SDM is within limit.	1 hour
	<u>OR</u>	
	B.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	B.2 Be in MODE 3.	6 hours

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.5 Safety Rod Insertion Limits

BASES

BACKGROUND

The insertion limits of the safety rods are initial condition assumptions in all safety analyses that assume rod insertion upon reactor trip. The insertion limits directly affect core power distributions and assumptions of available SDM, ejected rod worth, and initial reactivity insertion rate.

The applicable criteria for the reactivity and power distribution design requirements are UFSAR, Appendices 3D.1.6, 3D.1.21, 3D.1.22, 3D.1.23, and 3D.1.24 (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2).

Limits on safety rod insertion have been established, and all rod positions are monitored and controlled during power operation to ensure that the reactivity limits, ejected rod worth, and SDM limits are preserved.

The regulating groups are used for precise reactivity control of the reactor. The positions of the regulating groups are normally automatically controlled by the control system, but they can also be manually controlled. They are capable of adding negative reactivity very quickly (compared to borating). The regulating groups must be maintained above designed insertion limits and are typically near the fully withdrawn position during normal operations. Hence, they are not capable of adding a large amount of positive reactivity. Boration or dilution of the Reactor Coolant System (RCS) compensates for the reactivity changes associated with large changes in RCS temperature and fuel burnup.

The safety groups can be fully withdrawn without the core going critical. This provides available negative reactivity in the event of boration errors. The safety groups are controlled manually by the control room operator. During normal full power operation, the safety groups are fully withdrawn. The safety groups must be completely withdrawn from the core prior to withdrawing any regulating groups during an approach to criticality. The safety groups remain in the fully withdrawn position until the reactor is shut down or if being tested in accordance with SR 3.1.4.2. They add negative reactivity to shut down the reactor upon receipt of a reactor trip signal.

(SRO ONLY)

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4. A plant startup-up is in progress with the following conditions:
   - Reactor power, as indicated on NI 3 and NI 4 (intermediate range detectors), is 1 X 10^{-8} amps
   - All systems are in normal alignment for this condition

   A fuse in the power supply to the NI 3 detector blows (detector supply voltage is zero).

   (1) How will the NI 1 and NI 2 (source range detectors) respond to this blown fuse?
   (2) IAW Technical Specification bases, the intermediate range neutron flux channels ____________________ safety function.

A. (1) re-energize
(2) have NO

B. (1) re-energize
(2) have a

C. (1) remain de-energized
(2) have NO

D. (1) remain de-energized
(2) have a

Answer: A

Explanation/Justification:

A. Correct. IAW DB-OP-02505 Rev. 05 Att. 1 pages 34 & 35; TS Bases page B 3.3.10-1 Rev. 1. Part 1 is RO knowledge. Candidate must know the IR and PR contact alignment for the given power level, then determine the indication/impact of the blown fuse on the source range detectors. Part 2 is SRO ONLY Tech Spec bases knowledge.

B. Incorrect. Right impact and indication. Wrong TS bases.

C. Incorrect. Wrong impact. Plausible if candidate does not know the contact alignment or setpoints for re-energizing the source ranges. Right TS bases.

D. Incorrect. Wrong impact. Plausible if candidate does not know the contact alignment or setpoints for re-energizing the source ranges. Wrong TS bases.

Sys #	System	Category	KA Statement
000033	Loss of Intermediate Range Nuclear Instrumentation	AA2. Ability to determine and interpret the following as they apply to the Loss of Intermediate Range Nuclear Instrumentation:	Indication of blown fuse

K/A# AA2.03 **K/A Importance** 3.1 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02505 Rev. 05 Att. 1 pages 34 & 35; TS Bases page B 3.3.10-1 Rev. 1

Question Source: New **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(2)

Objective:

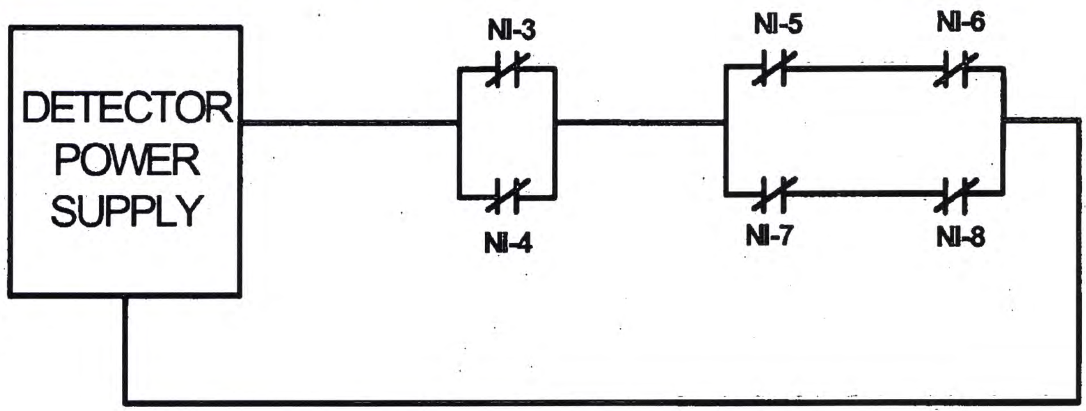
As allowed by Technical Specifications, direction is also provided to place a failed RPS channel in Manual Bypass. This action will remove that affected RPS channel from the trip logic allowing operation in a two out of three logic as opposed to a one out of three remaining channel logic minimizing the potential for a spurious Reactor Trip.

Direction is also provided to place a single failed channel Power Range Test Module in the TEST OPERATE position. In the TEST OPERATE position, that channel's Power Range Nuclear Instrument will not be sent to the auctioneer high circuit for the input to the Integrated Control System. Normal control can be restored once a valid signal is available to the Integrated Control System.

Loss of Intermediate Range Nuclear Instrumentation

The direction in this section is intended to ensure compliance with the requirements of the Technical Specifications. If both Intermediate Ranges Nuclear Instruments are lost when the Reactor is in Mode 2 or in other modes with the CRD System capable of rod withdrawal, prompt action is required to suspend positive reactivity changes. Positive reactivity changes are not permitted without the ability to monitor the impact of the change.

The low failure of an Intermediate Range Nuclear Instrument could cause the Source Range Nuclear Instruments to energize. Operation of the Source Range Proportional Counter in a high gamma field will shorten the life of this detector. To protect the detector, the high voltage from the Detector Power Supply to the Preamplifier is cut off whenever reactor power exceeds the monitoring capability of the source range. This cutoff signal is supplied by both the intermediate and power range channels.



The two source range channels are provided with identical, but independent, high voltage cutoff circuits. When power to an intermediate or power range nuclear instrumentation channel rises above a preset level, its Bistable trips causing the corresponding contact to open. When power to the channel lowers below the preset level, the Bistable automatically resets causing the contact to close.

To remove high voltage on rising power, the contacts for both NI-3 and NI-4 must open at 1E-9 amps or the contacts for NI-5 or NI-6 and NI-7 or NI-8 must open at 10% power. To reapply high voltage on lowering power, the contacts for either NI-3 or NI-4 must close at 5E-10 amps and the contacts for both NI-5 and NI-6 or both NI-7 and NI-8 must close at 5% power.

Direction is provided to either lower power to Source Range levels or to turn the Source Range Detector High Voltage off. Operation of the source range detectors with core flux levels higher than the source range may adversely affect the detector life. Minimizing the time at high flux or de-energizing the detector high voltage will reduce the impact and minimize the potential for failure.

Loss of Source Range Nuclear Instrumentation

The direction in this section is intended to ensure compliance with the requirements of the Technical Specifications. If both Source Ranges Nuclear Instruments are lost when the Reactor is in Mode 2, 3, 4, or 5, prompt action is required to prevent the Control Rod Drive System from with drawing Control Rods. In addition, if power is below 1E-10 amps, both sources ranges are required to be restored prior to raising neutron flux levels.

If either Source Ranges Nuclear Instrument is lost when the Reactor is in Mode 6, prompt action is required to suspend positive reactivity additions. In addition, if both Source Range Nuclear Instruments are lost, action is required to verify RCS boron concentration provide acceptable shutdown margin. This Technical Specification for Mode 6 requires two source range neutron flux monitors to be OPERABLE to ensure that redundant monitoring capability is available to detect changes in core reactivity. To be OPERABLE, each monitor must provide continuous visual indication in the control room, and one monitor must provide audible indication in the containment and the control room. TS 3.9.2 requirement may be met using Reactor Protective System Source Range Nuclear Instruments and/or Post Accident Monitoring (Gamma-Metrics) Nuclear Instruments. Refer to TS 3.9.2 for additional information.

B 3.3 INSTRUMENTATION

B 3.3.10 Intermediate Range Neutron Flux

BASES

BACKGROUND

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

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

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

APPLICABLE SAFETY ANALYSES

Intermediate range neutron flux channels are necessary to monitor core reactivity changes and are the primary indication to trigger operator actions to anticipate Reactor Protection System (RPS) actuation in the event of reactivity transients starting from low power conditions. However, the intermediate range neutron flux channels are not credited in the safety analysis.

The intermediate range neutron flux channels have no safety function and are not assumed to function during any UFSAR design basis accident or transient analysis. However, the intermediate range neutron flux channels provide on scale monitoring of neutron flux levels during startup and shutdown conditions. Therefore, they are being retained in Technical Specifications.

LCO

Two intermediate range neutron flux instrumentation channels shall be OPERABLE to provide the operator with redundant neutron flux indication. These enable operators to control the increase in power and to detect neutron flux transients. This indication is used until the power range instrumentation is on scale. Violation of this requirement could prevent the operator from detecting and controlling neutron flux transients that could result in reactor trip during power escalation.

5. The following plant conditions exist at the times(t) specified:

t = 0	The plant was at 100% power.
t = 30 sec	Toxic fumes have entered the control room.
t = 1 min.	DB-OP-02508, Control Room Evacuation has been implemented.
t = 1.5 min.	The reactor and turbine are tripped.
t = 2 min.	SFRCS has been actuated.
t = 5 min	Letdown is isolated.
t = 6 min	The standby Makeup Pump has been started.
t = 20 min	Local shutdown control from the Aux Shutdown Panel has been established.
t = 25 min	Steam generator pressures are between 980 and 1000 PSIG and stable.
t = 30 min	Steam generator levels are stable at 49 inches.

Based on this sequence of events and these indications, what is the **HIGHEST** Emergency Classification?
(Refer to attached reference)

A. Unusual Event

B. Alert

C. Site Area Emergency

D. General Emergency

<u>Answer: C</u>

Explanation/Justification:

- **A.** Incorrect. Plausible HU5
- **B.** Incorrect. Plausible HA2 and HA5
- **C.** Correct. IAW RA-EP-01500, Emergency Classification Rev. 14. HS2 page 29. A note in DB-OP-02508 reminds the Shift manager that a site area is warranted if control from the Aux Shutdown Panel has NOT been established within 15 minutes. SRO ONLY since requires the candidate to analyze and interpret plant conditions and sequences to select the appropriate EAL. At Davis Besse this is an SRO ONLY task for the on-shift ERO.
- **D.** Incorrect. Plausible if the HA6 is inappropriately applied.

Sys #	**System**	**Category**	**KA Statement**
BW/A06	Shutdown Outside Control Room	Generic	Ability to explain and apply system limits and precautions.

K/A# 2.1.32 **K/A Importance** 4.0 **Exam Level** SRO

References provided to Candidate RA-EP-01500, Emergency Classification Rev. 14

Technical References: DB-OP-02508 Rev. 12 Att. 2 page 15 Note 3; RA-EP-01500, Emergency Classification Rev. 14. HS2 page 29

Question Source: New

Level Of Difficulty: (1-5) 3

Question Cognitive Level: High - Application

10 CFR Part 55 Content: 10 CFR: 55.43(b)(4)

Objective:

ATTACHMENT 2: SHIFT MANAGER ACTIONS OUTSIDE THE CONTROL ROOM

> NOTE 1
>
> A paper Unit Log is maintained at the Aux Shutdown Panel.

_______ 1. Obtain the time of evacuation from Command SRO __________.
Time

_______ 2. Record the time local control was established at the Aux Shutdown Panel, when notified per Attachment 1 Step 4.

____
Time

> NOTE 3
>
> As a minimum, Control Room evacuation warrants an Alert. If plant control at the Aux Shutdown Panel was not established within 15 minutes, a minimum of a Site Area Emergency is warranted.

_______ 3. Classify the event, REFER TO RA-EP-01500, Emergency Classification.

_______ 4. Complete required notifications.

- REFER TO DB-OP-00002, Operations Section Event/Incident Notifications and Actions

AND

- REFER TO NOBP-OP-0011, Fleet Reporting and Updates.

_______ 5. Refer to RA-EP-02710, Reentry, for guidance on reestablishing plant control from the Control Room.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT	
HG1 1 2 3 4 5 6 D HOSTILE ACTION resulting in loss of physical control of the facility. **EALs:** 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below: • Reactivity Control (ability to shut down the reactor and keep it shutdown). • RCS Inventory (ability to cool the core). • Secondary Heat Removal (ability to maintain heat sink). **OR** 2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.	**HS1** 1 2 3 4 5 6 D HOSTILE ACTION within the PROTECTED AREA. **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.	**HA1** 1 2 3 4 5 6 D HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor. **OR** 2. A validated notification from the NRC of an airliner attack threat within **30 minutes** of the site.	**HU1** 1 2 3 4 5 6 D Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. **EALs:** 1. SECURITY CONDITION that does NOT involve a HOSTILE ACTION as reported by the Security Shift Supervisor. **OR** 2. A credible site specific Security Threat notification. **OR** 3. A validated notification from the NRC providing information of an aircraft threat.	**1. Security**
	HS2 1 2 3 4 5 6 D Control Room evacuation has been initiated and plant control cannot be established. **EALs:** 1. a. Control Room evacuation has been initiated. **AND** b. Control of the plant cannot be established within **15 minutes**.	**HA2** 1 2 3 4 5 6 D Control Room evacuation has been initiated. **EALs:** 1. Control Room evacuation has been initiated.		**2. CTRM Evacuation**

6. The plant is operating at 100% power with all systems in normal alignment with the exception that HPI Train 2 is out of service for planned maintenance.

At 0800, a reactor trip occurs. SFAS Actuates on Low RCS Pressure, Low-Low RCS Pressure and High Containment Pressure.

At 0830, BWST level is 39 feet and lowering and level will reach 9 feet at 1630.

At 0900, LPI Train 1 **AND** 2 indicate 0 gallons per minute.

At 0930, Incore temperatures have stabilized at approximately 480ºF with RCS pressure at 500 psig.

Based on these conditions, which of the following DB-OP-02000 Attachments are **required** to be performed to mitigate this event?

A. Attachment 11, HPI Flow Balancing.

B. Attachment 12, Establishing Long Term Boron Dilution.

C. Attachment 14, Establishing HPI Alternate Minimum Recirc Flowpath.

D. Attachment 22, Cross Connect LPI Pump Discharge.

Answer: A

Explanation/Justification:

A. Correct -- Flow Balancing HPI is required during single train operation to protect against an HPI Line Break or pinch to ensure at least one HPI injection line flow is reaching the core. SRO ONLY since it requires the candidate to select the appropriate procedure section to mitigate the event.

B. Incorrect – Long term Boron dilutions is required when RCS temperatures are less than 333 ºF. At higher temperatures, the boron in the RCS will not precipitate out of solution. As a result, Long Term Boron Dilution is not required for these plant conditions.

C. Incorrect – HPI Alternate Minimum Recirc is required when BWST level is being reduce at less than 2 foot per hour.. At higher flow rates, the RCS will not repressurize above the shutoff head of the HPI Pump. As a result, HPI Alternate Minimum Recirc Flow is not required for these plant conditions.

D. Incorrect – LPI Pump Discharge is required when a single LPI train is not available. Although no LPI flow exists in this scenario, LPI flows are consistent with the current Plant conditions. As a result, cross connecting LPI discharge is not required.

Sys #	**System**	**Category**	**KA Statement**
006	Emergency Core Cooling System (ECCS)	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the ECCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	System leakage

K/A# A2.03 **K/A Importance** 3.7 **Exam Level** SRO

References provided to Candidate Steam Tables **Technical References:** DB-OP-02000 R26 Attachment 11,.page 321

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

ATTACHMENT 11: HPI FLOW BALANCING

This attachment provides guidance for balancing High Pressure Injection (HPI) flow when ONLY ONE train of HPI is in service and RCS pressure is equal to or less than 1480 psig. (Time Critical Action = 10 minutes)

1. IF either of the following conditions exist,
   THEN HPI Flow Balancing is NOT required.

   - The Makeup System is in service providing MU/HPI PORV Core Cooling.

   OR

   - Adequate Subcooling Margin exists.

2. IF **only HPI Train 1 is operating**,
   THEN perform the following:

   ______ a. Stop Makeup flow through HPI Train 1 by closing MU6421, MU ALTERNATE INJECTION LINE CTMT ISOLATION.

   b. Verify HPI Train 1 Injection Valves are fully open.

   ______ • HP2C, HIGH PRESSURE INJECTION LINE 1-1 ISOLATION

   ______ • HP2D, HIGH PRESSURE INJECTION LINE 1-2 ISOLATION

   c. REFER TO Figure 3, HPI Balancing to determine if each flow is in the acceptable region or not

   ______ • FYI HP3C - Acceptable - Yes or No

   ______ • FYI HP3D - Acceptable - Yes or No

   ______ d. IF BOTH flow lines are in the acceptable region,
   THEN HPI Flow Balancing is NOT required at the current RCS Pressure.
   GO TO step g to restore Makeup flow.

   ______ e. IF BOTH flow lines are in the unacceptable region,
   THEN HPI Flow Balancing is NOT required at the current RCS Pressure.
   GO TO step g to restore Makeup flow.

   ______ f. IF only a single flow line is NOT in the acceptable region,
   THEN throttle the higher flow line until:

   - The lower flow line is in the acceptable region

   OR

   - The high flow line reaches the lower limit of the acceptable region

   REFER TO Figure 3, HPI Balancing.

7. The plant is operating at 100% power.

The following events occur:

- A LOCA inside CTMT occurs
- The reactor automatically TRIPS.
- Reactor Coolant System pressure is 185 psig and LOWERING
- Incore temperature is 380 ºF and LOWERING.
- Containment Pressure is 37.5 psia and STABLE.
- All systems function as designed

(1) Prior to any operator actions, what will be the status of the Safety Actuation Monitor (SAM) light for CC1407A, CCW FROM CTMT?

(2) What is the Technical Specification bases for the Safety Features Actuation System (SFAS) Instrumentation?

A. (1) DIM
(2) To prevent or limit fission product and energy release from the core, to isolate the containment vessel, and to initiate the operation of ESF equipment.

B. (1) OFF
(2) To prevent or limit fission product and energy release from the core, to isolate the containment vessel, and to initiate the operation of ESF equipment.

C. (1) DIM
(2) Ensures the Emergency Core Cooling Systems (ECCS) acceptance criteria are met following a LOCA.

D. (1) OFF
(2) Ensures the Emergency Core Cooling Systems (ECCS) acceptance criteria are met following a LOCA.

Answer: B

Explanation/Justification:

A. Incorrect. Part 1 would be the correct SAM light indication if NO SFAS signal were present OR an SFAS signal was present and the equipment was NOT in the SFAS required position. Part 2 is correct.

B. Correct. IAW DB-OP-06405 Rev. 13 Attachment 2 and TS 3.3.5 bases. Part 1 is RO knowledge in that the ROs should be capable of determining which ESF functions will actuate for the conditions of the stem and they should also be capable of determining the status of the SAM lights. Part 2 is SRO only since it requires knowledge of the TS bases for SFAS.

C. Incorrect. Part 1 is correct. Part 2 is the TS bases for ECCS not ESF actuation system.

D. Incorrect. Part 1 would be the correct SAM light indication if NO SFAS signal were present OR an SFAS signal was present and the equipment was NOT in the SFAS required position. Part 2 is the TS bases for ECCS not ESF actuation system.

Sys #	**System**	**Category**	**KA Statement**
013	Engineered Safety Features Actuation System (ESFAS)	Generic	Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc.

K/A#	2.4.21	**K/A Importance**	4.6	**Exam Level**	SRO
References provided to Candidate	None			**Technical References:**	DB-OP-06405 Rev. 13 Attachment 2 and TS 3.3.5 bases page B 3.3.5-1 Revision 1
Question Source:	New			**Level Of Difficulty: (1-5)**	4
Question Cognitive Level:	High - Comprehension			**10 CFR Part 55 Content:**	10 CFR: 55.43(b)(2)

ATTACHMENT 2: SAM LIGHTS

Description of SAM Lights

Safety Actuation Monitoring (SAM) lights are located on Control Room Panels C5715, C5716, and C5717. These amber lights indicate the status of SFAS channel trip, channel block, and the related safety actuation relays and associated contacts for each channel concerned with a safety event.

1. SAM light conditions indicate equipment trip status as follows:

   OFF - 1. indicates no SFAS trip is present
   OR
   2. SFAS trip is present but equipment is NOT in its SFAS position.

   DIM - SFAS trip is present
   AND equipment is in its SFAS position.

   BRIGHT - SFAS trip is present
   AND equipment is in its SFAS position, but equipment has been blocked

   BRIGHT and FLASHING -SFAS trip is present, but equipment is NOT in the SFAS condition
   AND equipment has been blocked

B 3.3 INSTRUMENTATION

B 3.3.5 Safety Features Actuation System (SFAS) Instrumentation

BASES

BACKGROUND

The SFAS initiates necessary safety systems, based on the values of selected unit Parameters, to automatically prevent or limit fission product and energy release from the core, to isolate the containment vessel, and to initiate the operation of Engineered Safety Features (ESF) equipment in the event of a loss-of-coolant accident (LOCA) and main steam line break (MSLB).

SFAS actuates the following systems:

- High pressure injection (HPI);
- Low pressure injection (LPI);
- Containment air cooling;
- Containment spray;
- Containment isolation;
- Emergency diesel generator (EDG).

SFAS also actuates other systems and components. A detailed list of systems and components actuated by each SFAS Parameter is identified in the UFSAR, Table 7.3-2 (Ref. 1) and UFSAR, Figures 7.3-1 through 7.3-8 (Ref. 2).

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

Four Parameters are used for automatic actuation:

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

8.
- A Large Break Loss of Coolant Accident has occurred.
- Peak Containment Pressure reached following the LOCA was 50 psia.
- There is NO indication of a significant release of radioactivity from Containment.
- All SFAS Actuated equipment is operating as designed with exception of BOTH Containment Air Coolers have failed.

In accordance with DB-OP-02000, RPS, SFAS, SFRCS Trip and SG Tube Rupture, the following actions have been completed:

- High Pressure Injection and Makeup Pumps have been shutdown.
- Low Pressure Injection and Containment Spray Pump suctions have been transferred to the Emergency Sump.

The following indications are noted:

- LPI Train 1 & 2 Flows – BOTH 3900 gpm and stable
- Containment Spray Train 1 Flow – 2000 gpm and stable
- Containment Spray Train 2 Flow – flow fluctuating between 1000 gpm and top of scale
- LPI Train 1 & 2 motor amps – BOTH 60 amps and stable
- Containment Spray Train 1 motor amps 180 amps and stable
- Containment Spray Train 2 motor amps fluctuating between 80 amps and top of scale.

Which of the following actions, if any, are **required**?

A. No action is required. Containment Spray Pump 1 is operating acceptably. One train of Containment Spray provides all required Containment cooling.

B. Place CS1531, Containment Spray Train 2 Discharge Valve in the "Throttled" position.

C. Throttle closed on LPI Throttle valves DH1A and DH1B until conditions improve. Do Not throttle less than 1350 gpm/line.

D. Stop BOTH trains of Containment Spray.

Answer: B

Explanation/Justification:

A. Incorrect – One train of Containment Spray can meet the Containment Cooling function, only when coupled with at least one Containment Air Cooler. Each Containment Air Cooler or Containment Spray Pump can provide 50% of the required containment cooling following a LOCA per USAR Section 6.2.2 Containment Vessel Heat Removal Systems

B. Correct –DB-OP-02000 Attachment 7directs verifying Containment Spray Discharge Valves are positioned to the Throttle position following transfer of ECCS Pump Suctions to the Emergency Sump. USAR Section 6.2.2.2.2 describes this position is necessary to ensure adequate NPSH. SRO ONLY since this requires the additional knowledge of the procedure's content.

C. Incorrect – This is a correct action for Fluctuating Flows and Amps due to clogging of the Emergency Sump Strainer provided in DB-OP-02000 Attachment 27, Mitigation of Containment Emergency Sump Degradation. Since only Containment Spray Pump 2 is affected, and the strainer is common to both trains, clogged strainer can not be the cause of the conditions noted.

D. Incorrect – This is a correct action for Fluctuating Flows and Amps due to clogging of the Emergency Sump Strainer provided in DB-OP-02000 Attachment 27, Mitigation of Containment Emergency Sump Degradation. Since only Containment Spray Pump 2 is affected, and the strainer is common to both trains, clogged strainer can not be the cause of the conditions noted

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Sys #	System	Category	KA Statement
026	Containment Spray System (CSS)	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the CSS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding), or sump level below cutoff (interlock) limit

K/A# A2.07 **K/A Importance** 3.9

Exam Level SRO

References provided to Candidate None

Technical References: DB-OP-02000, Attachment 7 USAR Section 6.2.2.2.2 Containment Spray System

Question Source: New

Level Of Difficulty: (1-5) 3

Question Cognitive Level: High - Comprehension

10 CFR Part 55 Content: 10 CFR: 55.43(b)(5)

ATTACHMENT 7: TRANSFERRING LPI SUCTION TO THE EMERGENCY SUMP

4. IF DH9A OR DH9B is now open,
THEN restart the associated Train HPI, LPI, OR CTMT Spray Pumps that were blocked and stopped:

Train 1

____ • HPI Pump 1

____ • LPI Pump 1

____ • CTMT Spray Pump 1

Train 2

____ • HPI Pump 2

____ • LPI Pump 2

____ • CTMT Spray Pump 2

_____ 6. Check DH7A and DH7B start to close as DH9A and DH9B start to open. If an auto closure did NOT occur, do NOT manually close DH7B (DH7A) until DH9B (DH9A) is open.

_____ 7. Verify that the transfer is complete by checking the indicating lights on DH9A and DH9B and DH7A and DH7B and by checking that the low pressure injection flow was NOT significantly changed.

_____ 8. IF CS Pumps are operating,
THEN verify CS Discharge Valves CS1530 and CS1531, move to the THROTTLE position.

exposures resulting from a design basis loss-of-coolant accident (LOCA) are within the guideline values of 10CFR100.

The Containment Spray System is designed so that a single active failure during injection phase, or a single active or passive failure during the recirculation phase, cannot impair the system's ability to comply with its safety design basis.

The Containment Spray System is designed to remain functional after a safe shutdown earthquake and is protected from flooding, pipe whip, and jet impingement forces.

The Containment Spray System is placed in operation automatically following a loss-of-coolant accident. The actuation system is designed in accordance with IEEE-279.

The spray pattern of either of the two independent and redundant spray headers gives adequate volumetric coverage for containment fission product removal.

The Containment Spray System is designed to draw water from the BWST during the initial phase of operation. Water in the BWST is maintained at a pH of approximately 5.0.

Upon depletion of the water in the BWST, a recirculation phase is provided to maintain spray. Trisodium phosphate baskets in the containment maintain the spray solution pH at a minimum of 7.0 or greater during the recirculation phase.

System Design:

The spray removal of elemental and particulate iodine is discussed in Subsection 15.4.6.4. The Containment Spray System does not have a provision for additive injection for iodine removal.

The BWST contains 500,100 gallons of borated water of which 360,000 gallons are available to serve | 22
one low pressure injection/decay heat pump (3,000 gpm), one high pressure injection pump (500 gpm), and one containment spray pump (1,300 gpm). The BWST will be available for Emergency Core | 21
Cooling System operation for approximately 75 minutes.

The emergency function of reactor coolant recirculation is performed when the tank level decreases to approximately 9 feet above the bottom of the tank. The spray operation will continue without | 22
interruption during switchover. The containment spray pump will be operated throughout the operation. To assure that there is adequate NPSH available for the pump, the downstream motor-operated globe valve (isolation valve) will be automatically throttled to a preselected opening. A flow indicator and high and low flow alarms are provided to monitor the proper function of the system.
Codes and Standards:

89. The plant is operating at 80% power, with all systems in a normal lineup **EXCEPT**:

- Unit Load Demand (ULD) is in MAN

The following events occur:

- Tave begins to lower
- Generator MWs begin to lower
- Control rods begin moving OUT
- Feedwater to SG 1 begins to rises
- PZR level is slowly lowering
- Containment pressure begins to rise at 0.1 psig/minute
- Containment temperature begins to rise at 0.25 °F/minute
- Containment radiation remains constant

Based on these indications, how will Reactor power respond to these conditions, and what procedural actions will be **required**?

Reactor power will ______(1)________.

IAW the applicable abnormal procedure, the crew will be **required** to ______(2)________.

(Assume NO personnel are in Containment)

A. (1) lower
(2) Immediately trip the Reactor AND Manually actuate SFRCS

B. (1) lower
(2) Isolate letdown AND Start the standby Makeup pump

C. (1) rise
(2) Immediately trip the Reactor AND Manually isolate all feedwater to SG 1

D. (1) rise
(2) Commence a rapid shutdown AND Monitor Containment conditions

---

Answer: D

Explanation/Justification:

A. Incorrect. Wrong Rx power response, wrong actions. These are the right actions for a steam leak in containment with personnel in containment.

B. Incorrect. Wrong Rx power response, wrong actions. These are the right actions for PZR level dropping due to a small RCS leak.

C. Incorrect. Right Rx power response, wrong actions. These are the correct actions for a SG that is being overfed.

D. Correct. IAW DB-OP-02525 Rev.10 steps 4.1.2 and 4.1.3 page 10. Part 2 is SRO only since it requires the candidate to assess the plant conditions and select the appropriate procedure section and have the additional knowledge of the actions contained in that section of the procedure. In this case the appropriate section is the steam leak inside containment and the actions are for a small leak with no personnel inside containment. Part 1 of the question is RO knowledge since it can be answered with system knowledge and plant response to transients.

Sys #	System	Category	KA Statement
039	Main and Reheat Steam System (MRSS)	A2.05 Ability to (a) predict the impacts of the following malfunctions or operations on the MRSS; and (b) based on predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Increasing steam demand, its relationship to increases in reactor power

K/A# A2.05 **K/A Importance** 3.6 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02525 Rev.10 steps 4.1.2 and 4.1.3 page 10

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

4.0 SUPPLEMENTAL ACTIONS

4.1 Steam Leak Inside Containment

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.1.1 **IF AT ANY TIME** Reactor Power exceeds the maximum allowed power (normally 100% RTP) THEN reduce Reactor Power to less than or equal to the maximum allowed power.	___ 1. Trip the Reactor. ___ 2. Initiate AND Isolate SFRCS using MANUAL ACTUATION Switches. ___ 3. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture. (Isolation will be completed in Section 7, Overcooling for Unisolable Steam Leaks).
___ 4.1.2 Commence a Plant Shutdown. (Select shutdown rate to complete shutdown prior to SFAS or RPS High Containment Pressure Trips if possible). REFER TO DB-OP-02504, Rapid Shutdown.	
___ 4.1.3 **IF AT ANY TIME** SFAS OR RPS trips on High Containment Pressure, THEN GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.	

0. The plant is operating at 100% power.

The following events occur:
- Offsite Power is lost.
- The reactor TRIPS.
- Reactor Coolant System pressure is 2350 psig and RISING
- Incore temperature is 585 ºF and RISING at 2 ºF /minute.
- **BOTH** Auxiliary Feedwater Pumps have TRIPPED and CANNOT be reset.
- C1 & D1 Electrical Busses are being supplied by their respective EDG.
- The Station Blackout Diesel is supplying the D2 Bus.
- **BOTH** Makeup Pumps are running.

(1) Which of the following DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture attachments **require** implementation to mitigate the event?

(2) What actions will be **required** by this procedure section?

A. (1) Attachment 4, MU/HPI/PORV Cooling.
(2) OPEN the PORV and commence MU/HPI/PORV cooling, WHEN Incore temperatures reach 610ºF.

B. (1) Attachment 4, MU/HPI/PORV Cooling.
(2) Immediately OPEN the PORV and commence MU/HPI/PORV cooling.

C. (1) Attachment 5, Guidelines for Restoring Feedwater.
(2) Start the MDFP and feed ONE SG to 49 inches, then take actions to feed the other SG.

D. (1) Attachment 5, Guidelines for Restoring Feedwater.
(2) Start the MDFP and feed **BOTH** SGs to 49 inches with MDFP target rock valves fully OPEN.

Answer: C

Explanation/Justification:

A. Incorrect. The actions are appropriate for a loss of all Feedwater, the initiation point is 600ºF, not 610ºF. The setpoint is plausible because this is the must implement feed and bleed cooling temperature in the Feed and Bleed analysis. The procedure uses 600ºF to ensure implemented prior to 610ºF.

B. Incorrect. This action is appropriate for a loss of all Feedwater when 2 Makeup Pumps are not available.

C. Correct These actions and SG levels are correct for a loss of all feedwater. SRO only since it requires the candidate to assess the plant conditions and select the appropriate procedure section and have the additional knowledge of the actions contained in that section of the procedure.

D. Incorrect. Although Feedwater Flow is desired, feeding in this manner would runout the MDFP since this method would provide approximately 1600 gallons per minute from a pump designed to provide a maximum flow of 1000 gallons per minute (+ 200 gpm recirc flow)

Sys #	System	Category	KA Statement
061	Auxiliary/Emergency Feedwater (AFW) System	Generic	Knowledge of EOP mitigation strategies.

K/A# 2.4.6 **K/A Importance** 4.7 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02000 Section 6, Steps 6.1 thru 6.6.

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

6.0 LACK OF HEAT TRANSFER

	ACTION/EXPECTED RESPONSE		RESPONSE NOT OBTAINED
___	6.1 **IF AT ANY TIME** feedwater flow is available from an operating feedwater pump to at least one Steam Generator THEN GO TO Step 6.7.		
___	6.2 Direct a Reactor Operator to restore Feedwater from any available source. REFER TO Attachment 5, Guidelines for Restoring Feedwater.		
	6.3 Prepare for MU/HPI Cooling as follows:		
___	1. Start the standby Makeup Pump.	___	IF two MU Pumps are NOT running THEN GO TO Attachment 4, Initiate MU/HPI Cooling **(SRO Directed)**.
___	2. Trip all but one Reactor Coolant Pump (prefer 2-2 left running).		
___	3. Verify MU, HPI, AND LPI are in service. REFER TO Attachment 8, Place HPI/LPI/MU in service.	___	Flow balancing is NOT required when HPI is being placed in service for MU/HPI Cooling.
___	4. Place all PZR Heaters in OFF.		
___	6.4 Verify RC11, PORV BLOCK is open (may require closing BE1602 at E16B).		
___	6.5 Notify the Shift Manager to REFER TO RA-EP-01500, Emergency Classification.		

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

CAUTION 6.6

IF the PORV lifts or must be opened while attempting to restore feedwater, do NOT close RC11, PORV BLOCK.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 6.6 While attempting to restore feedwater to ANY SG, monitor RCS Hot Leg temperature and RCS pressure.	
___ • IF RCS Thot reaches 600°F OR the RV P-T limit of Figure 1, Curve 1 is reached before feedwater is restored to either SG THEN GO TO Attachment 4, Initiate MU/HPI Cooling **(SRO Directed).**	
___ • IF feedwater is restored to at least one SG AND primary to secondary heat transfer is restored, THEN GO TO Step 6.18.	
___ • IF feedwater is restored to at least one SG AND primary to secondary heat transfer is NOT restored, THEN continue with Step 6.7.	

Section A: Motor Driven Feedwater Pump

_____ 1. IF Bus D2 is deenergized,
THEN REFER TO Attachment 6 to repower bus D2.

2. IF the MDFP is in the AFW Mode,
THEN perform the following:

a. Enable BOTH MDFP Discharge Valves

_____ • HIS 6460

_____ • HIS 6459

b. Close BOTH MDFP Discharge Valves

_____ • LIC 6460

_____ • LIC 6459

_____ c. Start the MDFP

CAUTION 2.d
If BOTH Steam Generators will be fed from the Motor Driven Feedwater Pump, it is preferred to establish Feedwater Flow to a single SG until level setpoint is reached prior to feeding the remaining Steam Generator in order to minimize the potential of runout for the Motor Driven Feedwater Pump.

_____ d. Establish feedwater flow to the Steam Generator(s) at less than 1000 gpm indicated flow on the MDFP Flow Indicator FI 5876.

1. The plant is operating at 100% power with all systems in normal alignment for this power level.

The following events occur:

- (2-3-A) LETDOWN TEMP HI Annunciator Alarm
- MU 32, PRESSURIZER LEVEL CONTROL, closes
- Pressurizer level rising with constant Tave
- Makeup Tank level lowering.

Which of the following actions is **required** in accordance with DB-OP-02512, Makeup System Malfunctions to mitigate this event?

A. Return MU11 to the MU Tank position to restore letdown flow.

B. Place MU19, SEAL INJECTION FLOW CONTROL in Hand to reduce Seal Injection Flow.

C. Place the MU Alternate Injection Line in service to restore Pressurizer Level Control.

D. Place the Alternate Letdown Temperature Instrument in service to restore Letdown temperature indication.

Answer: B

Explanation/Justification:

A. Incorrect. Plausible because if Letdown is diverted to Clean Waste, Makeup Tank level will lower.

B. Correct – Required action per DB-OP-02512, Makeup System Malfunctions Step 4.3.1. This is a supplemental action that does not directly mitigate the Loss of Letdown, just minimizes the amount of excess inventory being added to the Reactor Coolant System without Letdown available. SRO only since it requires the candidate to assess the plant conditions and have the additional knowledge of the actions contained in that section of the procedure.

C. Incorrect. Plausible if the candidate diagnoses the event as MU32 Failing closed. This action would restore RCS Makeup.

D. Incorrect – Although many instruments have alternate indications, indicated Letdown temperature does not have a selectable alternate instrument

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Sys #	System	Category	KA Statement
011	Pressurizer Level Control System (PZR LCS)	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the PZR LCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Isolation of letdown

K/A# A2.07 **K/A Importance** 3.3 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02512 R14, Makeup System Malfunctions

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

4.3 Loss of Letdown Flowpath

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.3.1 Reduce RCP Seal Injection flow as follows:	
___ a. Place FIC MU19 in HAND.	
___ b. Reduce RCP Seal Injection Flowrate to a minimum of 3 GPM to any RCP.	
___ c. Reduce FIC MU19 setpoint AND return MU19 to AUTO.	
4.3.2 IF **AT ANY TIME** Pressurizer Level reaches 290 inches THEN perform the following:	
___ a. Trip the Reactor.	
___ b. GO TO DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture.	
___ 4.3.3 Request Chemistry to maximize RCS sample rate from the Pressurizer Liquid Space.	
___ 4.3.4 IF **AT ANY TIME** Pressurizer level is greater than 228 inches, THEN REFER TO TS 3.4.9, Pressurizer.	
___ 4.3.5 Notify the Shift Manager to perform the following: • REFER TO DB-OP-00002, Operations Section Event/Incident Notifications and Actions. • REFER TO NOBP-OP-0011, Fleet Reporting and Updates.	

2. The plant is operating at 100% power with all systems in normal alignment for this power level EXCEPT:

- NI 5, POWER RANGE PWR (RPS CH 2) failed several days ago and ALL **required** actions of DB-OP-02505, Nuclear Instrumentation Failures have been completed.
- **NOW** NI 6, POWER RANGE PWR (RPS CH 1) fails low and the reactor does NOT trip.
- The crew re-enters DB-OP-02505, Nuclear Instrumentation Failures.

IAW the guidance provided in DB-OP-02505, Nuclear Instrumentation Failures, what additional actions will be **required**?

A. Manually Trip the Reactor.

B. Place RPS Channel 1 in Manual Bypass.

C. Manually Trip RPS Channel 1.

D. Place the Power Range Test Module for NI 6 in TEST OPERATE.

Answer: C

Explanation/Justification:

A. Incorrect. This is the required action for 3 failed power ranges.
B. Incorrect. This is the required action for a single NI failure, and has already been completed for RPS CH 2.
C. Correct. IAW DB-OP-02505 step 4.1.7 on page 12. The candidate must predict the impact of the second NI failure and then select the appropriate actions as specified in the abnormal procedure. SRO since it requires the candidate to assess the plant conditions and select the actions associated with the appropriate section of the procedure that addresses two failed power range instruments.
D. Incorrect. This is an additional required action for a single NI failure, and has already been completed for NI-5.

Sys #	System	Category	KA Statement
015	Nuclear Instrumentation System	A2. Ability to (a) predict the impacts of the following malfunctions or operations on the NIS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:	Power supply loss or erratic operation

K/A# A2.01 **K/A Importance** 3.9 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-02505 Rev. 5 step 4.1.7 on page 12

Question Source: New **Level Of Difficulty: (1-5)** 4

Question Cognitive Level: High - Analysis **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.1.7 IF only two Power Range Instruments are failed, THEN perform the following: ___ • Within one hour, place one RPS Channel in Manual Bypass. REFER TO DB-OP-06403, Reactor Protection System (RPS) and Nuclear Instrumentation (NI) Operating Procedure. ___ • Within one hour, manually trip the other affected RPS Channel. REFER TO DB-OP-06403, Reactor Protection System (RPS) and Nuclear Instrumentation (NI) Operating Procedure. ___ • Evaluate placing the Power Range Test Module in Test Operate if an NI is failed high.	
4.1.8 IF only one Power Range Instrument is failed, THEN perform the following: ___ • Within one hour, place the affected RPS Channel in Manual Bypass (will allow 2 of 3 trip logic). REFER TO DB-OP-06403, Reactor Protection System (RPS) and Nuclear Instrumentation (NI) Operating Procedure. ___ • Place the Power Range Test Module for the affected channel in TEST OPERATE. (will remove failed NI signal from high auctioneer circuit restoring RFR and TBV bias).	

3. Fuel handling operations in the spent fuel pool are in progress.
   - A loss of Spent fuel pool inventory due to a Spent Fuel Pool Cooling System pipe break occurs.
   - Spent Fuel Pool temperature is 130 °F.

IAW DB-OP-02547, Spent Fuel Pool Cooling Malfunctions which of the following actions will be taken to mitigate this event?

1. Stop the operating SFP Cooling Pumps.
2. Align the operating DH Removal Pump to provide SFP Cooling.
3. Suspend Fuel Handling operations in the Spent Fuel Pool.
4. Suspend Spent Fuel Pool Crane Operations.
5. Restore the Component Cooling Water Non-Essential Header to service.
6. Manually initiate Emergency Ventilation on the Spent Fuel Pool.

A. 1, 2, 3, & 5 only

B. 1, 3, 4, & 6 only

C. 2, 4, 5, & 6 only

D. 3, 4, 5 & 6 only

Answer: B

Explanation/Justification:

A. Incorrect – Plausible because all actions are from DB-OP-02547, Spent Fuel Pool Cooling Malfunctions. Actions 2 and 5 are correct for a loss of cooling, not a loss of inventory.

B. Correct – These are the supplemental actions from DB-OP-02547, Spent Fuel Pool Cooling Malfunctions, Section 4.2, Loss of SFP Inventory. SRO only since it requires the candidate to assess the plant conditions and have the additional knowledge of the actions contained in that procedure.

C. Incorrect – Plausible because all actions are from DB-OP-02547, Spent Fuel Pool Cooling Malfunctions. Actions 2 and 5 are correct for a loss of cooling, not a loss of inventory

D. Incorrect – Plausible because all actions are from DB-OP-02547, Spent Fuel Pool Cooling Malfunctions. Actions 2 and 5 are correct for a loss of cooling, not a loss of inventory

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Sys #	System	Category	KA Statement
033	Spent Fuel Pool Cooling System (SFPCS)	Generic	Ability to interpret and execute procedure steps.

K/A# 2.1.20 **K/A Importance** 4.6 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-2547R02 Sect 4.2, Loss of SFP Inventory

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

4.2 Loss Of Spent Fuel Pool Inventory

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4.2.1 IF **AT ANY TIME** the loss of SFP inventory is determined to be from the SFP Cooling System, THEN stop BOTH SFP Cooling Pumps: ___ • SFP Pump 1 ___ • SFP Pump 2	
___ 4.2.2 IF the loss of SFP Inventory is due to a Security Event, THEN REFER TO DB-OP-02544, Security Events or Threats.	
4.2.3 IF Fuel Handling, Fuel Maintenance Activities, or Crane Operations are in progress in the Spent Fuel Pool or Spent Fuel Pool Area, THEN perform the following: ___ 1. Place Fuel in a safe condition or position (safe locations in SFP: Fuel Storage Racks or Transfer Mechanism with Basket down). ___ 2. Suspend Fuel Handling AND Fuel Maintenance Activities. ___ 3. Suspend Crane Operations in the Spent Fuel Pool Area except to install SFP Gates as necessary.	

CARRY-OVER STEPS	
Condition	**Step**
IF AT ANY TIME the loss of inventory is determined to be from the SFP Cooling System, THEN stop BOTH SFP Cooling Pumps. • SFP Pump 1 • SFP Pump 2	4.2.1

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.2.4 IF SFP Purification is in service, THEN close SF 78, SFP PUMPS DISCHARGE TO THE SFP CLEANUP SYSTEM (SFP Pump Room).	
___ 4.2.5 Locate AND Isolate the leak if possible including installing AND inflating SFP Gate(s) if necessary.	___ Use Damage Control measures to stop or reduce the SFP Leak. REFER TO Pre-Fire Plan PFP-YD-STRAT, Protected Area Yard Strategy.
___ 4.2.6 IF SF1 OR SF2 (Fuel Transfer Tube Isolation) are open with the Refueling Canal filled, THEN perform Operator Actions for Falling Refueling Canal Level. REFER TO DB-OP-00030, Fuel Handling Operations.	
4.2.7 IF **AT ANY TIME** SFP Level reaches 12 feet (LI1600 or L872 or local monitoring) OR there are indications of cavitation (such as abnormal noise, fluctuating amps or flow) on the SFP OR DHR Pump providing SFP Cooling, THEN stop the pump(s) **in service on the Spent Fuel Pool only**. ___ • SFP Pump 1 ___ • SFP Pump 2 ___ • DHR Pump 1 ___ • DHR Pump 2	

CARRY-OVER STEPS	
Condition	**Step**
<u>IF</u> **AT ANY TIME** the loss of inventory is determined to be from the SFP Cooling System, <u>THEN</u> stop BOTH SFP Cooling Pumps. • SFP Pump 1 • SFP Pump 2	4.2.1
<u>IF</u> **AT ANY TIME** SFP Level reaches 12 feet (LI1600 or L872 or local monitoring) <u>OR</u> there are indications of cavitation (such as abnormal noise, fluctuating amps or flow) on the SFP <u>OR</u> DHR Pump providing SFP Cooling, <u>THEN</u> stop the pump(s) **in service on the Spent Fuel Pool only**. • SFP Pump 1 • SFP Pump 2 • DHR Pump 1 • DHR Pump 2	4.2.7

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.2.8 Evacuate the affected area. <u>REFER</u> <u>TO</u> RA-EP-02861, Radiological Incidents (spills section).	
___ 4.2.9 Notify the Shift Manager to: • <u>REFER</u> <u>TO</u> RA-EP-01500, Emergency Classification. • <u>REFER</u> <u>TO</u> DB-OP-00002, Operations Section Event/Incident Notifications and Actions. • <u>REFER</u> <u>TO</u> NOBP-OP-0011, Fleet Reporting and Updates.	
___ 4.2.10 Notify the Shift Manager to have offsite dose assessed. <u>REFER</u> <u>TO</u> RA-EP-02240, Offsite Dose Assessment.	
___ 4.2.11 Notify Radiation Protection to perform appropriate radiological surveys <u>AND</u> to control the affected area access. <u>REFER</u> <u>TO</u> RA-EP-02861, Radiological Incidents.	
___ 4.2.12 Monitor and trend SFP temperature (TI1601 or T874 – when SFP Level greater than 18.5 feet SFP Level - or local monitoring) to estimate time to reach 200°F. <u>REFER</u> <u>TO</u> DB-PF-06703 Miscellaneous Operation Curves, CC14.2, Spent Fuel Pool Heat-Up to 200°F	

CARRY-OVER STEPS	
Condition	**Step**
IF AT ANY TIME the loss of inventory is determined to be from the SFP Cooling System, THEN stop BOTH SFP Cooling Pumps. • SFP Pump 1 • SFP Pump 2	4.2.1
IF AT ANY TIME SFP Level reaches 12 feet (LI1600 or L872 or local monitoring) OR there are indications of cavitation (such as abnormal noise, fluctuating amps or flow) on the SFP OR DHR Pump providing SFP Cooling, THEN stop the pump(s) **in service on the Spent Fuel Pool only**. • SFP Pump 1 • SFP Pump 2 • DHR Pump 1 • DHR Pump 2	4.2.7

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.2.13 **IF AT ANY TIME** SFP temperature rises to 125°F (TI1601 or T874 –when SFP Level greater than 18.5 feet SFP Level - or local monitoring) THEN manually initiate EVS to the Spent Fuel Pool Area by tripping RI8446 AND RI8447 (depress CHECK SOURCE and then ALARM ACK).	___ Manually align EVS Train 1 AND 2 to the Fuel Handling Ventilation System. REFER TO DB-OP-06504, Emergency Ventilation System.
4.2.14 REFER TO Technical Specifications ___ • 3.7.14, Spent Fuel Pool Water Level ___ • 3.7.15, Spent Fuel Pool Boron Concentration.	
___ 4.2.15 IF the Loss of SFP Inventory OR efforts to add inventory to the SFP have resulted in internal flooding, THEN REFER TO RA-EP-02880, Internal Flooding.	

CARRY-OVER STEPS	
Condition	**Step**
IF **AT ANY TIME** the loss of inventory is determined to be from the SFP Cooling System, THEN stop BOTH SFP Cooling Pumps. • SFP Pump 1 • SFP Pump 2	4.2.1
IF **AT ANY TIME** SFP Level reaches 12 feet (LI1600 or L872 or local monitoring) OR there are indications of cavitation (such as abnormal noise, fluctuating amps or flow) on the SFP OR DHR Pump providing SFP Cooling, THEN stop the pump(s) **in service on the Spent Fuel Pool only**. • SFP Pump 1 • SFP Pump 2 • DHR Pump 1 • DHR Pump 2	4.2.7
IF **AT ANY TIME** SFP temperature rises to 125°F (TI1601 or T874 or local monitoring) THEN manually initiate EVS to the Spent Fuel Pool Area by tripping RI8446 AND RI8447 (depress CHECK SOURCE and then ALARM ACK).	4.2.13

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
___ 4.2.16 Add borated inventory to the Spent Fuel Pool to restore SFP Level to normal (23.5 feet). REFER TO DB-OP-06021, Spent Fuel Pool Operating Procedure. (Attachment 1, Spent Fuel Pool Level Monitoring provides information on SFP Levels and Inventory requirements). Consider the following sources: • Clean Waste Receiver Tanks 1 or 2 • BWST using DHR Pump 1 or 2 • BWST using BWST Recirc Pump • BWST using gravity fill options • Batch Boric Acid from BAATs with Demin Water	___ 1. Add any available inventory (borated sources preferred) to the SFP as necessary to maintain SFP Level as high as possible (make up for boil-off). REFER TO DB-OP-06021, Spent Fuel Pool Operating Procedure (includes gravity fill from BSWT options). ___ 2. Evaluate and implement contingency actions to provide inventory and cooling to the Spent Fuel Pool. REFER TO DB-OP-02600, Operational Contingency Response Action Plan (includes Fire Protection inventory options).
___ 4.2.17 WHEN Spent Fuel level has been restored to normal (preferred) OR greater than 12 feet, THEN restore SFP Cooling, venting any pump that indicated cavitation during operation using the SFP Cooling Pumps. REFER TO DB-OP-06021, Spent Fuel Pool Operating Procedure.	___ WHEN Spent Fuel level has been restored to normal, THEN restore SFP Cooling, venting any pump that indicated cavitation during operation using the DHR Pumps. REFER TO DB-OP-06012, Decay Heat and Low Pressure Injection System Operating Procedure.
___ 4.2.18 WHEN the SFP Cooling System has been restored, THEN return to normal operations. REFER TO NOP-OP-1002, Conduct of Operations.	

CARRY-OVER STEPS	
Condition	**Step**
<u>IF</u> **AT ANY TIME** the loss of inventory is determined to be from the SFP Cooling System, <u>THEN</u> stop BOTH SFP Cooling Pumps. • SFP Pump 1 • SFP Pump 2	4.2.1
<u>IF</u> **AT ANY TIME** SFP Level reaches 12 feet (LI1600 or L872 or local monitoring) <u>OR</u> there are indications of cavitation (such as abnormal noise, fluctuating amps or flow) on the SFP <u>OR</u> DHR Pump providing SFP Cooling, <u>THEN</u> stop the pump(s) **in service on the Spent Fuel Pool only**. • SFP Pump 1 • SFP Pump 2 • DHR Pump 1 • DHR Pump 2	4.2.7
<u>IF</u> **AT ANY TIME** SFP temperature rises to 125°F (TI1601 or T874 or local monitoring) <u>THEN</u> Manually initiate EVS to the Spent Fuel Pool Area by tripping RI8446 <u>AND</u> RI8447 (depress CHECK SOURCE and then ALARM ACK).	4.2.13

4. The plant is in Mode 6 with Fuel Handling in progress.

Fuel Handling will be suspended for approximately 30 hours.

All Fuel Handling Surveillances will be maintained current.

Which one of the following requirements must be observed during the suspension?

A. A qualified individual must be assigned to monitor Refueling Canal Level and notify the Control Room of any lowering Refueling Canal Level.

B. A dedicated Reactor Operator must be assigned to monitor the reactivity of the core (neutron count rate).

C. At least one Emergency Ventilation System Fan must be in service on the Spent Fuel Pool.

D. The gate between the Spent Fuel Pool and the Transfer Pool shall be installed and the gate valves on the transfer tubes closed as far as possible without damaging the transfer equipment cable.

Answer: D

Explanation/Justification:

A. Incorrect – Lowering of Refueling Canal level requires suspension of the Fuel Handling activities. Suspending fuel handling activities does not require continuous monitoring of refueling canal level.
B. Incorrect – A dedicated individual is only required to be assigned to monitor the reactivity of the core (neutron count rate) during fuel handling activities that add positive reactivity to the reactor core.
C. Incorrect – This action would be required if the SFP Ventilation system was not in service.
D. Correct – This is a required action when suspending fuel handling operations for greater than 24 hours. SRO ONLY in that it requires knowledge of administrative requirements associated with refueling activities.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of new and spent fuel movement procedures.

K/A# 2.1.42 **K/A Importance** 3.4 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-00030 R12, Fuel Handling Operations Step 6.3.3.

Question Source: New **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(6)

Objective:

6.3.2 Actions to Suspend Fuel/Control Component Movement in Containment

a. Notify the Shift Manager that fuel/control component movement in Containment is being suspended.

b. Make a plant announcement that fuel/control component movement in Containment is suspended.

c. Make an entry in the Unit Log and the Fuel Handling Directors Log stating the reason for suspension and indicate whether the Periodic Verifications are to continue.

d. Place Fuel Assemblies, Control Components, SFP Gates and valves in a safe condition. Refer to Step 6.3.3.

6.3.3 Placing Fuel / Control Components in a Safe Condition:

a. In order to reduce the potential effects of a Permanent Canal Seal Plate Access Port Cover leak or a SG Nozzle Dam failure, perform the following when suspending fuel handling operations:

- Do not leave a fuel assembly in the mast of an unattended fuel handling bridge.
- Do not leave a fuel assembly unattended in an upender mechanism in the vertical position.
- Do not leave fuel assemblies stored in the Refueling Canal racks.
- IF Fuel Handling evolutions are suspended for greater than 24 hours, THEN the gate between the Spent Fuel Pool and the Transfer Pool shall be installed and the gate valves on the transfer tubes closed as far as possible without damaging the transfer equipment cable.

6.4 Resuming Fuel/Control Component Movement in Containment after Suspension when Periodic Verifications have been maintained

6.4.1 Verify that all required Periodic Verifications required by DB-NE-03292, Refueling Prerequisites and Periodic Checks have been performed.

6.4.2 Notify the Shift Manager to verify the Unit is in compliance with all Technical Specification LCOs and that none will preclude movement of fuel and/or control components in Containment.

6.4.3 Notify Radiation Protection Manager that fuel/control component movement in Containment is about to resume.

5. During Plant Startup, which of the following describes the required alignment of the Steam Generator Blowdown system and the basis for that alignment?

A. The SG Blowdown System must be removed from service prior to exceeding 5% power in order to ensure TS 3.7.18 Steam Generator Level requirements can be met in Mode 1.

B. The SG Blowdown System must be removed from service prior to exceeding 14.7% power to comply with analysis assumptions for Steam Generator Blowdown System Pipe Rupture in the Auxiliary Building.

C. The SG Blowdown System must be placed in service prior to exceeding 5% power in order to ensure TS 3.7.17 Secondary Specific Activity can be met in Mode 1.

D. The SG Blowdown System must be placed in service prior to exceeding 14.7% power in order to ensure contaminates introduced to the SGs during Turbine Warming are removed.

Answer: B

Explanation/Justification:

A. Incorrect - Plausible because Mode 1 is entered at 5% and SG Blowdown is not permitted to be in service during power operations, and SG Blowdown affects SG Level.

B. Correct - Steam Generator Blowdown System pipe ruptures in room 314 are analyzed assuming an initial power level of less than or equal to 14.7% Rated Thermal Power (RTP). As a result, the system must be removed from service to comply with analysis assumptions. SRO only since it requires knowledge of the TS bases

C. Incorrect – Plausible because Mode 1 is entered at 5% and SG Blowdown would provide a method to reduce Secondary Specific Activity by routing SG water to the Condenser to be cleaned by Condensate Polishers.

D. Incorrect – Plausible because secondary chemistry excursions are likely when idle equipment is place in service and DB-OP-06901, Plant Startup contains a number of actions that must be completed prior to 15%.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Ability to perform pre-startup procedures for the facility, including operating those controls associated with plant equipment that could affect reactivity.

K/A# 2.2.1
K/A Importance 4.4
Exam Level SRO
References provided to Candidate None
Technical References: DB-OP-06901R35, Plant Startup Step 2.2.1,
Question Source: New
Level Of Difficulty: (1-5) 3
Question Cognitive Level: High - Comprehension
10 CFR Part 55 Content: 10 CFR: 55.43(b)(2)
Objective:

1.0 PURPOSE

1.1 This procedure provides operating instructions to maneuver the plant from Tave of 530°F and RCS pressure of 2155 psig to a power level just prior to Turbine startup. Three and four RCP startups are covered.

2.0 LIMITS AND PRECAUTIONS

2.1 Administrative

2.1.1 In Modes 1, 2 and 3 Steam Generator water levels shall be maintained within the limits of Technical Specification 3.7.18.

2.1.2 Conservative actions and strict compliance with this procedure are required during any evolution that will alter reactivity conditions. If at any time an unanticipated change in reactivity occurs, borate to establish SDM within the limits specified in the COLR.

2.1.3 Plant Operating Procedures (6900 series) may be performed in the sequence directed by the Control Room SRO, with the concurrence of the Shift Manager by maintaining an oversight role during the evolution.

2.2 Equipment

2.2.1 Steam Generator Blowdown System pipe ruptures in room 314 are analyzed assuming an initial power level of less than or equal to 14.7% Rated Thermal Power (RTP). Engineering recommends isolating the Steam Generator Blowdown System at power levels greater than 14.7% RTP. This ensures operation of the Steam Generator Blowdown System only at a power level low enough to monitor the Startup FW Flow indicators and be able to identify a leaking Steam Generator in the event of a single Steam Generator Blowdown System pipe rupture. At 14.7% RTP, the Steam Generators should still be on Low Level Limits.

2.2.2 SGs may continue to be fed with a 0% control signal to the FW Startup Valves due to design valve leakage.

6. Prior to draining the Reactor Coolant system during an outage, which of the following describes the controls that are established for the BWST Outlet Valves:

- DH7A, BORATED WATER STORAGE TANK OUTLET LINE 2 ISOLATION

<u>AND</u>

- DH7B, BORATED WATER STORAGE TANK OUTLET LINE 1 ISOLATION

A. In accordance with DB-OP-06904, Shutdown Operations, DH7A and DH7B are Closed with power removed to prevent accidental flooding of the RCS when the RCS is drained.

B. In accordance with NOP-OP-1005, Shutdown Defense in Depth, DH7A and DH7B are Closed but remain powered up to allow Gravity Drain of the Reactor Coolant System as a diverse cooling method for the Decay Heat Removal system.

C. In accordance with NOP-OP-1005, Shutdown Defense in Depth, DH7A and DH7B are Open with power removed to guarantee a suction source for the Decay Heat Removal System.

D. In accordance with DB-OP-06904, Shutdown Operations, DH7A and DH7B are Open but remain powered up to allow leak isolation of DHR System if necessary.

<u>Answer: A</u>

Explanation/Justification:

A. Correct answer per DB-OP-06904, Shutdown Operations Step 3.18. SRO ONLY since this requires knowledge of Administrative requirements associated with refueling activities.

B. Incorrect – The candidate could select this option since gravity draining from the BWST to provide RCS inventory is a method of core cooling when no AC power is available.

C. Incorrect – This alignment is used in NOP-OP-1005 to guarantee a suction source can be made available but only when the RCS is full.

D. Incorrect – The candidate could select this response since a system alignment is changed by DB-OP-06904, Shutdown Operations to facilitate the response to a loss of DHR event..

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of the process for managing maintenance activities during shutdown operations, such as risk assessments, work prioritization, etc.

K/A# 2.2.18 **K/A Importance** 3.9 **Exam Level** SRO

References provided to Candidate None **Technical References:** DB-OP-06904 R42, Shutdown Operations, step 3.18.

Question Source: New **Level Of Difficulty: (1-5)** 3.5

Question Cognitive Level: High - Comprehension **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(6)

Objective:

3.14.8 Notify I&C to calibrate the following:

____/____ • LT10596, RCS Hot Leg Medium Range Level

____/____ • LT10577A, RCS Hot Leg Level Channel B

____/____ • LT10577B, RCS Hot Leg Level Channel A

> NOTE 3.14.9
>
> 40 ft. tygon tubing is zero referenced at 567 ft., 7 in. (41 inches below the centerline of the Hot Leg exit from the vessel). 100 ft. tygon tubing is zero referenced at 567 ft., 7 in., and at 632 ft., 3 in. (top of the SG upper tube sheet access grating).

3.14.9 IF the RCS is to be drained below 25 ft as indicated on LI10596, THEN install 40 ft length (100 ft length if OTSG Tubes will be leak checked) of tygon tubing on at least one loop of each SG at the Reactor Coolant Cold Leg Pressure Test Connections. Do NOT valve the Tygon tubing in service at this time.

____/____ • PP218 or PP219 for SG 1

____/____ • PP203 or PP204 for SG 2

____/____ 3.15 Verify I&C has set both DH cooler outlet temperature annunciators (3-4-H and 3-4-I) to alarm at 140°F. REFER TO DB-MI-04701, Resetting the Decay Heat Cooler Outlet Temperature Alarms.

____/____ 3.16 IF Radiation Protection requires use of poly bottles on the RCS, THEN verify at least six vent rigs (filtered poly bottles) will be available prior to draining below 25 feet indicated RCS level.

____/____ 3.17 Verify Chemistry has sampled the RCS to determine if the hydrogen concentration is $\leq$15 cc/Kg H_2 to vent the RCS to the CTMT atmosphere.

3.18 Verify the BWST is isolated from the RCS to prevent accidental flooding of the RCS during the drain by performing the following.

3.18.1 Verify the following breakers are closed:

____/____ • BF1148, BORATED WATER STORAGE TANK OUTLET LINE 2 ISOLATION DH7A, on MCC F11B

____/____ • BE1157, BORATED WATER STORAGE TANK OUTLET LINE 1 ISOLATION DH7B, on MCC E11A

3.18.2 Close the following valves:

____/____ • DH7B, BWST ISOLATION LINE 1, using HISDH7B.

____/____ • DH7A, BWST ISOLATION LINE 2, using HISDH7A.

3.18.3 Open the following breakers:

____/____ • BF1148, BORATED WATER STORAGE TANK OUTLET LINE 2 ISOLATION DH7A, on MCC F11B

____/____ • BE1157, BORATED WATER STORAGE TANK OUTLET LINE 1 ISOLATION DH7B, on MCC E11A

3.18.4 Verify OPS Info Tags are on the Control Switches and breakers stating that the valves are closed and depowered to prevent accidental flooding in case of an inadvertent SFAS actuation.

____/____ • HISDH7B

____/____ • HISDH7A

____/____ • BF1148

____/____ • BE1157

____/____ 3.19 IF the SGs and Cold Legs will be drained,
AND the RCPs are uncoupled,
THEN notify Mechanical Maintenance to prepare to lift the rotating assembly with a come-along.

3.20 Deactivate DH1517 and DH1518 to prevent inadvertent valve operation.

3.20.1 Open the valve breakers,
AND verify Protected Equipment Tags are hung on the breakers:

____/____ • BE1126 (E11D) DH1517, DH Pump 1-1 Suction from RCS

____/____ • BF1129 (F11C) DH1518, DH Pump 1-2 Suction from RCS

3.20.2 Verify Protected Equipment Tags are hung on the valve handwheels:

____/____ • DH1517, DH Pump 1-1 Suction from RCS

____/____ • DH1518, DH Pump 1-2 Suction from RCS

3.20.3 Verify Caution Tags or OPS Info Tags are on the Control Switches stating proper position:

____/____ • HIS1517, DH1517

____/____ • HIS1518, DH1518

7. The Miscellaneous Waste Monitor Tank (MWMT) has been prepared for batch discharge.

The following radiation monitors and flow elements are out of service and INOPERABLE.

- Miscellaneous RE 1878A
- Miscellaneous RE 1878B
- Clean RE 1770B
- FE 4687 Storm Sewer Flow

All other instrumentation is OPERABLE.

Based on these conditions, what Offsite Dose Calculation Manual (ODCM) actions will be **required** in order to discharge this tank?
(Refer to attached reference)

A. The system/process flow rate is estimated at least once per 4 hours during the actual release.

B. At least two independent samples of the tank's content are analyzed and at least two independent verifications of the release rate calculations and discharge valve lineups are performed AND the system/process flow rate is estimated at least once per 4 hours during the actual release.

C. Grab samples are collected, at least once per 12 hours, and analyzed, at least once per 12 hours, for gross radioactivity (beta or gamma) at a lower limit of detection no greater than 1.0^{-07} μCi/ml or a gamma isotopic analysis meeting the LLD Requirement of Table 2-3.

D. At least two independent samples of the tank's content are analyzed and at least two independent verifications of the release rate calculations and discharge valve lineups are performed.

Answer: D

Explanation/Justification:

- **A.** Incorrect. Plausible if the candidate believes the tank being discharged will pass thru the storm sewer FE and that having Clean RE 1770A operable meets the one RM channel operable requirement.
- **B.** Incorrect. Storm sewer FE is not required for this discharge flowpath. Independent actions are correct.
- **C.** Incorrect. These are the correct compensatory actions for the liquid waste flow indicator being out of service.
- **D.** Correct. IAW ODCM Rev. 26 Table 2-1 pages 19 and 20. SRO ONLY since it requires the SRO to have knowledge of the SRO responsibilities for approving liquid waste releases.

Sys # N/A
System N/A
Category Generic
KA Statement Ability to approve release permits.
K/A# 2.3.6
K/A Importance 3.8
Exam Level SRO
References provided to Candidate ODCM Rev. 27 Table 2-1 and 2-2 pages 19 thru 22
Technical References: ODCM Rev. 27 Table 2-1 pages 19 and 20
Question Source: New
Level Of Difficulty: (1-5) 3
Question Cognitive Level: High - Application
10 CFR Part 55 Content: 10 CFR: 55.43(b)(4)
Objective:

Table 2-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	REQUIRED CHANNELS	APPLICABILITY	ACTION
1. Gross Radioactivity Monitors Providing Alarms and Automatic Termination of Release			
a. Liquid Radwaste Effluent Line (either Miscellaneous (RE 1878A, B) or Clean (RE 1770A, B), but not both simultaneously)*	1	(1)	A
2. Flow Rate Measurement Devices			
a. Liquid Radwaste Effluent Line	1	(1)	B
b. Dilution Flow to Collection Box	1	(1)	B
c. FE 4687 Storm Sewer	1	(1)	B
3. Gross Beta or Gamma Radioactivity Monitors Providing Alarm But Not Providing Automatic Termination of Release			
a. Storm Sewer Drain (RE 4686)	1	(1)	C

* Only one release (either MWMT or CWMT) at a time can be in progress.

Table 2-1 (continued)

TABLE NOTATION

(1) During radioactive releases via this pathway

ACTION A With less than the number of required channels FUNCTIONAL, effluent releases may be resumed, provided that prior to initiating a release:

1. At least two independent samples are analyzed in accordance with Table 2-3 for analyses performed with each batch;

2. At least two independent verification of the release rate calculations are performed;

3. At least two independent verifications of the discharge valving are performed;

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION B With less than the number of required channels FUNCTIONAL, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump curves may be used to estimate flow.

ACTION C With less than the number of required channels FUNCTIONAL, or if high alarm is locked in on RE, effluent releases via this pathway may continue provided that during effluent releases, grab samples are collected, at least once per 12 hours, and analyzed, at least once per 12 hours, for gross radioactivity (beta or gamma) at a lower limit of detection no greater than 1.0E-07 μCi/ml or a gamma isotopic analysis meeting the LLD Requirement of Table 2-3.

8. The plant is in MODE 6 with core off-load in progress.
   - A spent fuel assembly is dropped in the Spent Fuel pool and gases are observed escaping from the assembly.

   The following alarms are now present in the control room:
   - (9-1 -G) FIRE OR RADIATION TRBL
   - (9-3-A) UNIT VENT RAD HI
   - High alarm on RE5403A, FUEL HDLG EXH SYS, PARTICULATE
   - High alarm on RE8446, FUEL HDLG EXH SYS, Channel 1
   - High alarm on RE8447, FUEL HDLG EXH SYS, Channel 2

   The following radiation monitor indications are present:
   - Fuel Handling Area (RE 8417 and 8418) 1100 mr/hr and stable
   - Control Room Area 10 mr/hr and stable
   - Station vent Channel 1 Noble Gas (RE 4598) 3.2 μCi/cc
   - Spent Fuel Area (RE 8426 and 8427) 1200 mr/hr and stable

   The plant technical staff has confirmed that these indications WILL continue for the next 45 minutes before any of these indications will begin to decrease.

   Based on these indications, and the fact that they will continue for at least 45 minutes, what is the **HIGHEST** Emergency Classification?
   (Refer to attached reference)

A. Unusual Event

B. Alert

C. Site Area Emergency

D. General Emergency

Answer: C

Explanation/Justification:

A. Incorrect. RU1 has been exceeded. However, this is not the highest classification.
B. Incorrect. RA1 and RA2 have both been exceeded. However, this is not the highest classification.
C. Correct. IAW RA-EP-01500, Emergency Classification Rev. 14 Tab RS1 item 1 on page 27. SRO ONLY since requires the candidate to analyze and interpret fixed radiation monitor readings to select the appropriate EAL. At Davis Besse this is an SRO ONLY task for the on-shift ERO.
D. Incorrect. RG1 has not been exceeded.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc.

K/A# 2.3.15 **K/A Importance** 3.1 **Exam Level** SRO

References provided to Candidate RA-EP-01500, Emergency Classification Rev. 14

Technical References: RA-EP-01500, Emergency Classification Rev. 14 Tab RS1 item 1 on page 27.

Question Source: New

Level Of Difficulty: (1-5) 3

Question Cognitive Level: High - Application

10 CFR Part 55 Content: 10 CFR: 55.43(b)(4)

Objective:

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

1. Radiological Effluent

GENERAL EMERGENCY

RG1 — 1 2 3 4 5 6 D

Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem Child Thyroid CDE for the actual or projected duration of the release using actual meteorology.

EALs:

Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. Station Vent Channel 1 Noble Gas (RE 4598) **> 2.86E+01 µCi/cc** for **15 minutes** or longer.

OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 1000 mRem** TEDE.
   - **> 5000 mRem** CDE Child Thyroid.

OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 1000 mR/hr** for **60 minutes** or longer.
   - Air sample analysis **> 5000 mRem** CDE Child Thyroid for one hour of inhalation.

SITE AREA EMERGENCY

RS1 — 1 2 3 4 5 6 D

Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem Child Thyroid CDE for the actual or projected duration of the release.

EALs:

Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. Station Vent Channel 1 Noble Gas (RE 4598) **> 2.86E+00 µCi/cc** for **15 minutes** or longer.

OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 100 mRem** TEDE.
   - **> 500 mRem** CDE Child Thyroid.

OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 100 mR/hr** for **60 minutes** or longer.
   - Air sample analysis **> 500 mRem** CDE Child Thyroid for one hour of inhalation.

ALERT

RA1 — 1 2 3 4 5 6 D

Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer.

EALs:

Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. Station Vent Channel 1 Noble Gas (RE 4598) **> 2.29E-01 µCi/cc** for **15 minutes** or longer.

OR

2. **ANY** of the following effluent monitors **> 200 times the high alarm setpoint, not to exceed 8 E+6 CPM,** as established by a current radioactivity discharge permit for **15 minutes** or longer:
   - Waste Gas System Outlet (RE 1822A or B).
   - Clean Waste System Outlet (RE 1770A or B).
   - Miscellaneous Waste System Outlet (RE 1878A or B).
   - Discharge permit specified monitor.

OR

3. Confirmed sample analysis for gaseous or liquid releases **> 200 times the ODCM limit** for **15 minutes** or longer.

UNUSUAL EVENT

RU1 — 1 2 3 4 5 6 D

Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer.

EALs:

Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. Station Vent Channel 1 Noble Gas (RE 4598) **> 1.84E-02 µCi/cc** for **60 minutes** or longer.

OR

2. **ANY** of the following effluent monitors **> 2 times the high alarm setpoint** established by a current radioactivity discharge permit for **60 minutes** or longer:
   - Waste Gas System Outlet (RE 1822A or B).
   - Clean Waste System Outlet (RE 1770A or B).
   - Miscellaneous Waste System Outlet (RE 1878A or B).
   - Discharge permit specified monitor.

OR

3. Confirmed sample analysis for gaseous or liquid releases **> 2 times the ODCM limit** for **60 minutes** or longer.

9. The plant is operating at 30% power with all systems in normal alignment for this power level.
    - The current wind direction is out of the South.
    - The outside operator contacts the control room and reports a serious fire in DIESEL GEN 2 ROOM that has spread to the upper level.
    - The crew has entered DB-OP-02501, Serious Station Fire.

Based on these conditions, what actions will be **required** to address these conditions?

A. Trip the Reactor, Initiate AFW flow AND isolation of BOTH SGs, continue in this procedure.

B. Trip the Reactor, transition to DB-OP-02519, Serious Control Room Fire

C. Trip the Reactor, transition to DB-OP-02000, "RPS, SFAS, SFRCS TRIP, OR SG TUBE RUPTURE

D. Perform a rapid shutdown to 20% RTP for Low Level Limits, Trip the Reactor, continue in this procedure.

Answer: A

Explanation/Justification:

A. Correct. IAW DB-OP-02501 Revision 17 Att. 1 page 7 of 8 and Att. 9 step 2.1. SRO ONLY since it requires the candidate to know the hierarchy of procedures that will be implemented to address the situation. Also the actions contained in the procedure are NOT immediate actions which would be RO knowledge.

B. Incorrect. Right initial action, wrong procedure transition. This procedure transition would only be required if the smoke/toxic flames from the EDG room fire were to threaten the habitability of the CR. Since the wind direction is from the south, the smoke/toxic flames are being blown away from the CR.

C. Incorrect. Right action, wrong procedure transition. Transitioning to DB-OP-02000 is in most cases the right transition anytime a reactor trip occurs. However, in the case of a serious fire, the governing procedure is DB-OP-02501 and the SRO must remain in this procedure. This is an exception to the normal rule.

D. Incorrect. Wrong action, correct procedure transition. Since power is only at 30%, it may seem prudent to perform a rapid shutdown to the low level limits before tripping the reactor.

Sys #	System	Category	KA Statement
N/A	N/A	Generic	Knowledge of "fire in the plant" procedures.

K/A# 2.4.27 **K/A Importance** 3.9

Exam Level SRO

References provided to Candidate None

Technical References: DB-OP-02501 Revision 18 Att. 1 page 7 of 8 and Att. 9 step 2.1

Question Source: New

Level Of Difficulty: (1-5) 3

Question Cognitive Level: High - Comprehension

10 CFR Part 55 Content: 10 CFR: 55.43(b)(5)

Objective:

ATTACHMENT 1: DETERMINATION OF FIRE AREA

ROOM NUMBER	DESCRIPTION	GO TO ATTACHMENT
FIRE AREA J 319 319A 320A	 DIESEL GEN 2 ROOM DIESEL GEN 2 ROOM UPPER LVL DIESEL OIL DAY TANK 2 ROOM	9
FIRE AREA K 318 318UL 321A	 DIESEL GEN 1 ROOM DIESEL GEN 1 ROOM UPPER LVL DIESEL OIL DAY TANK 1 ROOM	22
FIRE AREA MA MH3001	MANHOLE MH3001	For a fire affecting Train One, use Attachment 5. For a fire affecting Train Two, use Attachment 9.
FIRE AREA MB MH3004	MANHOLE MH3004	5
FIRE AREA MC MH3005	MANHOLE MH3005	5
FIRE AREA ME MH3041	MANHOLE MH3041	9
FIRE AREA MF MH3042	MANHOLE MH3042	9
FIRE AREA MG JB30D4	JUNCTION BOX JB30D4	5
FIRE AREA MH MH3009	MANHOLE 3009 BY TRANSFORMERS	N/A No Safe Shutdown circuits in this area.
FIRE AREA OS --- 030 031 330 703 OS	 H2 TRAILER AREA MISC DIESEL ROOM OIL TANK ROOM NORTH TURB BLDG VESTIBULE PASSAGE ELEVATOR NO. 2 OUTSIDE	9
FIRE AREA P 320 321 322	 MAINTENANCE ROOM CHARGE ROOM PASSAGE TO DG ROOMS	23
FIRE AREA Q 323	HIGH VOLTAGE SWGR ROOM B	24
FIRE AREA R 324 324DC	 AUX SD PNL & TRANS SW RM DUCT CHASE	25
FIRE AREA S 325	HIGH VOLTAGE SWGR ROOM A	26

ATTACHMENT 1: DETERMINATION OF FIRE AREA

ROOM NUMBER	DESCRIPTION	GO TO ATTACHMENT
FIRE AREA T 328	 CCW HEAT EXCHNGR & PMP RM	For a fire affecting Train One CCW Equipment, use Attachment 5. For a fire affecting Train Two CCW Equipment, use Attachment 9.
FIRE AREA U 310 312 313	 PASSAGE SPENT FUEL POOL PMP RM MIX TANKS & HATCH AREA	27
FIRE AREA UU 327 329 AB1 EL2	 TURB ELEV MACHINE ROOM TURB BLDG ELEVATOR VESTIBULE AUX BLDG STAIRWELL (MAIN) AUX BLDG ELEVATOR (MAIN)	5
FIRE AREA V 222 223 224 300 300A 300B 301 302 304 305 306 400 401 404 405 406	 FUEL TRANSFER TUBE AREA CASK PIT SPENT FUEL STORAGE AREA FUEL HANDLING AREA CASK WASH AREA DRUM STORAGE SOLID WASTE BALER AREA DRUMMING AREA CORRIDOR TO MPRS 3 & 4 DURATEK VESSEL AREA NEW FUEL STORAGE EQUIP HATCH AREA PASSAGE FUEL HAND SUPPLY UNIT RM SPENT FUEL POOL CORRIDOR STORAGE HOT INSTRUMENT SHOP	28
FIRE AREA X 428 428A 428B	 LOW VOLT SWGR RM 2 (F BUS) BATTERY ROOM B NO. 1 ELECT ISOLATION RM	29
FIRE AREA Y 429 429A 429B	 LOW VOLT SWGR RM 1 (E BUS) NO. 2 ELECT ISOLATION RM BATTERY ROOM A	30

ATTACHMENT 9: FIRE IN AREA BN, J, MA1, ME, MF, OS, T1

1.0 Accredited safe shutdown systems:

FUNCTION	SYSTEM	TRAIN	INSTRUMENTATION*
RCS Makeup	MU Pump	1	FI-6425, FI-6435
RC Pzr Lvl		1	LI-RC14-3
RC Loop 1 Temp.			TI-RC3B6, TI-RC4B4
RC Loop 2 Temp.			TI-RC3A6, TI-RC4A4
RC Pressure		1	PI-RC2B3
Source Range		1	NI-NI2
SG 1 Press/Level	AFW	1	PI-SP12B, LI-SP09B1
SG 2 Press/Level			PI-SP12A, LI-SP09A1

2.0 Initial response steps:

		ACTIONS	DETAILS
______	2.1	Trip the Reactor AND continue in THIS procedure.	Use either Reactor Trip pushbutton. (HSNI45 or HSNI46) Do not go to DB-OP-02000, indications can not be assumed to be valid, actions can not be taken credit for.
______	2.2	Initiate AFW flow AND isolation of BOTH SGs by depressing SFRCS MANUAL ACTUATION switches HIS 6403 (AFP 1 TO SG 1 & ISO SG 1) AND HIS 6404 (AFP 2 TO SG 2 & ISO SG 2).	
______	2.3	Isolate letdown.	Close MU2B or MU3 using HISMU2B, HISMU3.
	2.4	IF MU Pump flow is greater than 250 gpm OR NPSH can not be verified with available instrumentation, THEN perform the following:	
______		• Trip Makeup Pump 2 using HIS MU24B	
______		• Trip Makeup Pump 1 using HIS MU24A	

* Attachment 69, Available Instrumentation lists instruments that may be affected by the fire.

0. A Large Break LOCA occurred coincident with some fuel damage.

- C1 bus is energized; D1 bus is de-energized and cannot be energized
- The Shift Manager/Emergency Director has declared a General Emergency
- Station Isolation has been declared IAW RA-EP-02245
- One train of HPI, LPI and AFW are all operating
- An unisolable gaseous release is in progress, from a failed containment penetration
- The expected duration of the leakage is ~ 2 hours
- Wind direction is from 18°
- Dose projections at 5 miles are 0.5 rem and 1.5 rem CDE thyroid

Based on these conditions, what Protective Action Recommendation (PAR) is **required**?
(Refer to attached reference)

A. Shelter 2 mile radius & 10 mile downwind subareas 1, 2, 4, & 5
Evacuate 2 mile radius & 10 mile downwind subarea 12

B. Shelter 2 mile radius & 5 mile downwind subareas 1, & 2
Evacuate 2 mile radius & 5 mile downwind subarea 12

C. Evacuate 2 mile radius & 5 mile downwind subareas 1, 2, 4, 5, &12

D. Evacuate 2 mile radius & 5 mile downwind subareas 1, 2, &12

Answer: B

Explanation/Justification:

A. Incorrect. Plausible if the candidate mis-applies RA-EP-02245 Rev. 5 Attachment 1 by answering yes to station isolation and yes to the dose projections greater than 1 rem. .

B. Correct IAW RA-EP-02245 Rev. 5 Attachment 1. SRO only in that it requires the implementation of administrative procedures that specify implementing emergency procedures. Specifically the offsite PAR which at Davis Besse is an SRO task for the on-shift ERO.

C. Incorrect. Plausible if the candidate mis-applies RA-EP-02245 Rev. 5 Attachment 1 by using column B instead of column A.

D. Incorrect. Plausible if the candidate mis-applies RA-EP-02245 Rev. 5 Attachment 1 by answering no to station isolation.

Sys #	**System**	**Category**	**KA Statement**
N/A	N/A	Generic	Knowledge of emergency plan protective action recommendations.

K/A# 2.4.44 **K/A Importance** 4.4 **Exam Level** SRO

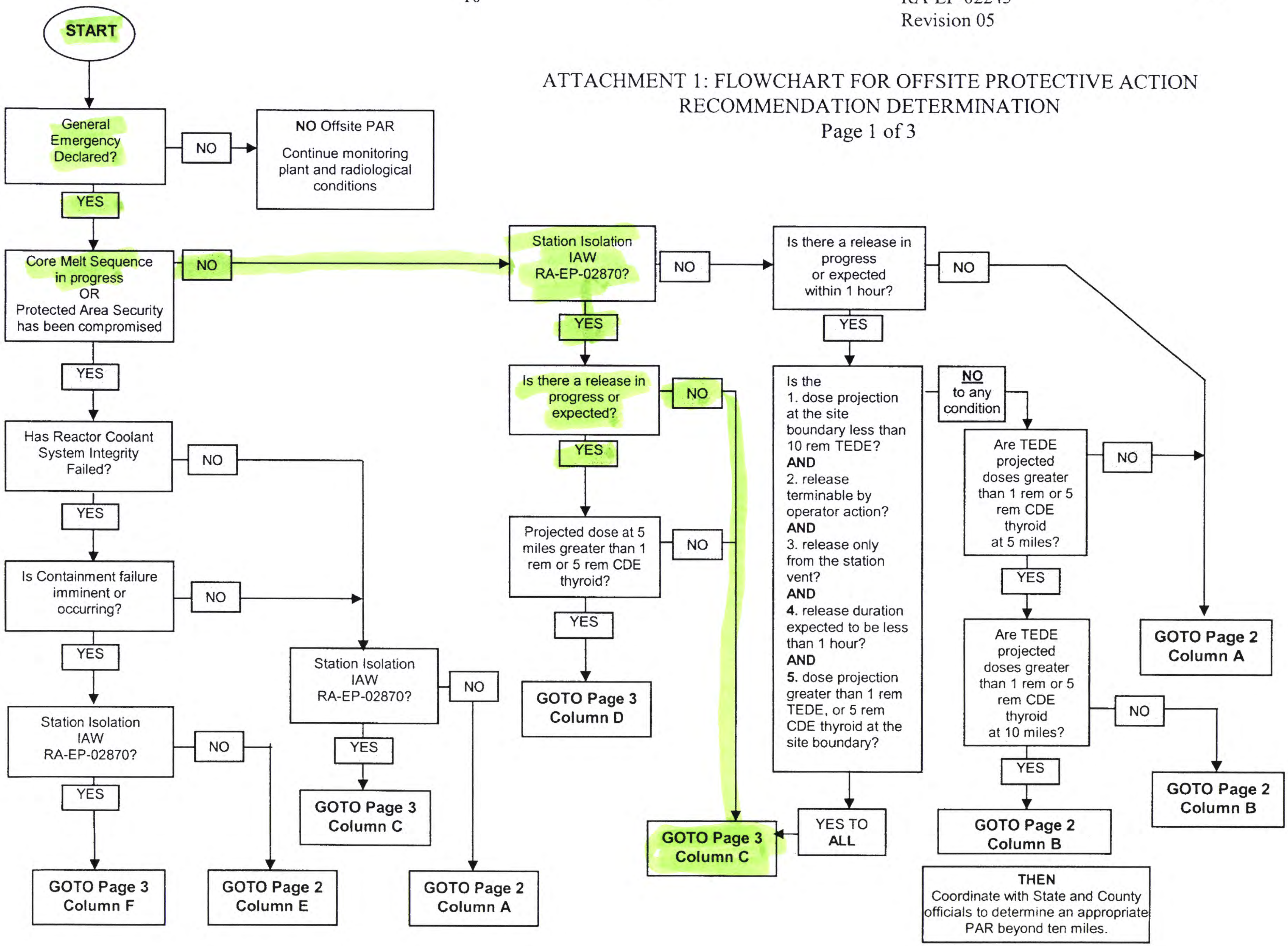
References provided to Candidate RA-EP-02245 Rev. 5 **Technical References:** RA-EP-02245 Rev. 5 Attachment 1

Question Source: New **Level Of Difficulty: (1-5)** 3

Question Cognitive Level: High Application **10 CFR Part 55 Content:** 10 CFR: 55.43(b)(5)

Objective:

ATTACHMENT 1: FLOWCHART FOR OFFSITE PROTECTIVE ACTION RECOMMENDATION DETERMINATION
Page 1 of 3



ATTACHMENT 1: FLOWCHART FOR OFFSITE PROTECTIVE ACTION RECOMMENDATION DETERMINATION
Page 2 of 3

Evacuate

Wind Direction From	A 2-Mile Radius & 5-Miles Downwind Subareas	B 2-Mile Radius & 10-Miles Downwind Subareas	E 5-Mile Radius & 10-Miles Downwind Subareas
Unknown or Lake Breeze	1, 2, 6, 10, 12	ALL Subareas	ALL Subareas
141° to 278°	1, 12	1, 12	1, 2, 6, 10, 12
279° to 286°	1, 6, 12	1, 6, 7, 9, 12	1, 2, 6, 7, 9, 10, 12
287° to 293°	1, 6, 12	1, 6, 7, 8, 9, 12	1, 2, 6, 7, 8, 9, 10, 12
294° to 330°	1, 2, 6, 12	1, 2, 6, 7, 8, 9, 12	1, 2, 6, 7, 8, 9, 10, 12
331° to 005°	1, 2, 6, 12	1, 2, 5, 6, 7, 8, 12	1, 2, 5, 6, 7, 8, 10, 12
006° to 013°	1, 2, 6, 12	1, 2, 4, 5, 6, 7, 8, 12	1, 2, 4, 5, 6, 7, 8, 10, 12
014° to 020°	1, 2, 12	1, 2, 4, 5, 12	1, 2, 4, 5, 6, 10, 12
021° to 065°	1, 2, 12	1, 2, 3, 4, 5, 12	1, 2, 3, 4, 5, 6, 10, 12
066° to 072°	1, 2, 12	1, 2, 3, 4, 12	1, 2, 3, 4, 6, 10, 12
073° to 078°	1, 2, 10, 12	1, 2, 3, 10, 12	1, 2, 3, 6, 10, 12
079° to 117°	1, 2, 10, 12	1, 2, 3, 10, 11, 12	1, 2, 3, 6, 10, 11, 12
118° to 122°	1, 10, 12	1, 3, 10, 11, 12	1, 2, 3, 6, 10, 11, 12
123° to 140°	1, 10, 12	1, 10, 11, 12	1, 2, 6, 10, 11, 12

Once the PAR and subareas are selected **GOTO** Step 6.2.2

ATTACHMENT 1: FLOWCHART FOR OFFSITE PROTECTIVE ACTION RECOMMENDATION DETERMINATION
Page 3 of 3

Shelter/Evacuate

Wind Direction From		C	D	F
		2-Mile Radius & 5-Miles Downwind	2-Mile Radius & 10-Miles Downwind	5-Mile Radius & 10-Miles Downwind
		Subareas	Subareas	Subareas
Unknown or Lake Breeze	Shelter	1, 2, 6	1, 2, 3, 4, 5, 6. 7, 8, 9, 11	1, 2, 3, 4, 5, 6. 7, 8, 9, 11
	Evacuate	10, 12	10, 12	10, 12
141° to 278°	Shelter	1	1	1, 2, 6
	Evacuate	12	12	10, 12
279° to 286°	Shelter	1, 6	1, 6, 7, 9	1, 2, 6, 7, 9
	Evacuate	12	12	10, 12
287° to 293°	Shelter	1, 6	1, 6, 7, 8, 9	1, 2, 6, 7, 8, 9
	Evacuate	12	12	10, 12
294° to 330°	Shelter	1, 2, 6	1, 2, 6, 7, 8, 9	1, 2, 6, 7, 8, 9
	Evacuate	12	12	10, 12
331° to 005°	Shelter	1, 2, 6	1, 2, 5, 6, 7, 8	1, 2, 5, 6, 7, 8
	Evacuate	12	12	10, 12
006° to 013°	Shelter	1, 2, 6	1, 2, 4, 5, 6, 7, 8	1, 2, 4, 5, 6, 7, 8
	Evacuate	12	10, 12	10, 12
014° to 020°	Shelter	1, 2	1, 2, 4, 5	1, 2, 4, 5, 6
	Evacuate	12	12	10, 12
021° to 065°	Shelter	1, 2	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 6
	Evacuate	12	12	10, 12
066° to 072°	Shelter	1, 2	1, 2, 3, 4	1, 2, 3, 4, 6
	Evacuate	12	12	10, 12
073° to 078°	Shelter	1, 2	1, 2, 3	1, 2, 3, 6
	Evacuate	10, 12	10, 12	10, 12
079° to 117°	Shelter	1, 2	1, 2, 3, 11	1, 2, 3, 6, 11
	Evacuate	10, 12	10, 12	10, 12
118° to 122°	Shelter	1	1, 3, 11	1, 2, 3, 6, 11
	Evacuate	10, 12	10, 12	10, 12
123° to 140°	Shelter	1	1, 11	1, 2, 6, 11
	Evacuate	10, 12	10, 12	10, 12

Once the PAR and subareas are selected **GOTO** Step 6.2.2