TVA

Watts Bar Nuclear Plant

Unit 1

Surveillance Instruction

1-SI-68-33

Measurement Of Reactor Coolant Pump Seal Injection Flow

Revision 0012

Quality Related

Level of Use: Continuous Use

Effective Date: 08-02-2011

Responsible Organization: OPS, Operations

Prepared By: N. Lehberger

Approved By: Stephen M. Partch

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
Rev 7	5/19/06	All	Revised instrumentation used for charging header pressure (PER 101596). Changed title to reflect actual parameter measured. Minor formatting changes. 50.59 review is not required.
Rev 8	7/7/06	2, 9-13	Based on comments from Operations, added steps to enhance flexibility between Sections 6.1 and 6.2. 50.59 review is not required.
Rev 9	03/28/07	2, 11-12	Revised Section 6.2 to enhance performance. 50.59 review is not required.
Rev 10	05/09/07	2, 4, 7, 13	Added Precaution and Limitation G and performance steps related to performance of test at letdown flow of 75 gpm.
Rev. 11	03/05/10	All	This procedure has been converted from Word 95 to Word XP using Rev. 10 by the Conversion Team. A line by line verification, including minor editorial and formatting corrections, was performed by the preparer. A 10CFR50.59 screening review is not required for this revision.
Rev 12	08/02/11	2	Changed ownership from NSSS to OPS IAW PER 165897

Table of Contents

1.0 INTRODUCTION

1.1 Purpose

This Instruction provides detailed steps to measure the seal injection flow to the Reactor Coolant Pump (RCP) seals.

1.2 Scope

1.2.1 Operability Tests to be Performed

A. Verification that the controlled leakage to the RCP seals is ≤ 37.6 gpm at a Centrifugal Charging Pump discharge header pressure ≥ 2440 psig with the pressurizer level control valve full open. (2440 psig is based on Tech Spec value of 2430 psig plus the maximum inaccuracy of the M&TE of Section 4.3.)

B. Adjustment of the seal injection line needle valves to obtain a flow rate of ≤ 37.6 gpm total for all RCP loops if necessary.

1.2.2 Surveillance Requirements Fulfilled and Modes

NOTE
Performance modes are 1, 2, or 3 with Charging Pump discharge header pressure ≥ 2440 psig and the pressurizer level control valve full open.

Performance of this Instruction satisfies the following Surveillance Requirement (SR):

SURVEILLANCE REQUIREMENT	APPLICABLE MODES	PERFORMANCE MODES
SR 3.5.5.1	1, 2, 3	See Note

1.3 Frequency and Conditions

A. This Instruction is to be performed every 31 days.

B. This Instruction is required to be performed within 4 hours after the Reactor Coolant System (RCS) pressure stabilizes at ≥ 2215 psig and ≤ 2255 psig.

2.0 REFERENCES

2.1 Performance References

A. SOI-62.01, CVCS-Charging and Letdown.

2.2 Developmental References

2.2.1 TVA Drawings

A. 1-47W610-62-1, -2

B. 1-47W610-68-5

C. 1-47W809-1

D. 1-47W605-242

E. 47W600-118

2.2.2 Vendor Manuals

A. WBN-VTM-W120-0660, Reactor Coolant Pumps.

2.2.3 Other

A. N3-62-4001, Chemical and Volume Control System.

B. N3-68-4001, Reactor Coolant System.

C. Technical Specification Sections 3.3.4 and 3.5.5.

D. Westinghouse Memo from A. T. Parker to P. R. Mandava, "ECCS Flow Inconsistencies," WAT-D 8115, dated Feb 9, 1990, RIMS Number B26 90 0712 308.

E. NE SSD 1-F-62-1

F. NE SSD 1-F-62-14

G. NE SSD 1-F-62-27

H. NE SSD 1-F-62-40

3.0 PRECAUTIONS AND LIMITATIONS

A. Charging Pump discharge header pressure is ≥ 2440 psig with the pressurizer level control valve full open.

B. RCS pressure must be maintained at ≥ 2215 psig and ≤ 2255 psig throughout performance of this Instruction.

C. Automatic pressurizer level control will **NOT** be functioning during this Instruction while 1-HIC-62-93A is placed in MANUAL. Pressurizer level should be monitored periodically during performance to watch for unexpected changes.

D. Failure to meet Acceptance Criteria may result in entering Limiting Condition for Operation (LCO) 3.5.5 which includes adjusting manual seal injection throttle valves to give a flow within limits in four hours.

E. In order to obtain optimum transient control of the charging system and to ensure that charging header pressure remains in the expected range, 1-FCV-62-93 should be left throttled (rather than near full open) upon completion of this Instruction.[1]

F. Pressure transmitters 1-PT-62-92A and -92C share a common sense line and root valve. When the root valve is isolated, both transmitters will be out of service.

G. Performance of this test with letdown flow of 120 gpm might result in Acceptance Criteria **NOT** being met because the CCP will be operating at a lower head on the head-flow performance curve. Therefore the test is performed at 75 gpm letdown flow.

Data Package: Page ____ of ____ Date ________

4.0 PREREQUISITE ACTIONS

4.1 Preliminary Actions

[1] **RECORD** start date and time on Surveillance Task Sheet. ________

[2] **IF** required, **THEN**

OBTAIN RWP. ________

4.2 Approvals and Notifications

[1] **OBTAIN** Operations approval on Surveillance Task Sheet to perform this Instruction. ________

4.3 Special Tools, M&TE, Parts, and Supplies

NOTE

The reading of the pressure gauge is accurate to no more than 0.2% of the maximum range of 5000 psig, or ± 10 psig maximum inaccuracy.

[1] **ENSURE** the following M&TE is available, **AND**

COMPLETE the following table:

DESCRIPTION	MIN RANGE MAX RANGE	ACTUAL RANGE	ACCURACY	TVA ID NO.	CAL DUE DATE
Pressure Gauge (See Note)	0 to 3000 psig 0 to 5000 psig		± 0.2% full scale		

____

[2] **VERIFY** required M&TE is within its current calibration cycle as evidenced by an affixed calibration sticker. ________

[3] **ENSURE** high pressure tubing (rated for at least 3000 psig) is available. ________

Data Package: Page ____ of ____ Date ________

4.4 Field Preparations

NOTE

While 1-PT-62-92C, CVCS CHARGING HEADER PRESSURE, is out of service for connection of M&TE to 1-PT-62-92A, LCO 3.3.4 may be applicable.

[1] **OBTAIN** permission from the UO to remove 1-PT-62-92A **AND** 1-PT-62-92C from service to install test gauge.

________ UO

NOTE

Steps 4.4[2] through 4.4[4] are performed by MIG, unless otherwise noted.

[2] **LOCATE** and **IDENTIFY** the following components [PNL 1-L-112B, A5T/692, near door to CCP 1B-B room]:

UNID	DESCRIPTION	IDENTIFIED BY	CONCURRENT
1-PT-62-92A	CVCS CHARGING HEADER PRESSURE		
1-ISIV-62-341C/1	PANEL ISOLATION VALVE (1-PT-62-92A)		
1-DRIV-62-341D/1	PANEL DRAIN VALVE (1-PT-62-92A)		

[3] **LOCATE** and **IDENTIFY** 1-RTV-62-341A, 1-PT-62-92A/1-PT-62-92C ROOT [A4U/698, 692 Pipe Chase]:

________ Ops.

________ CV

[4] **INSTALL** pressure test gauge at test tee between 1-PT-62-92A and 1-ISIV-62-341C/1 as follows:

[4.1] **CLOSE** 1-RTV-62-341A.

________ Ops.

[4.2] **CLOSE** 1-ISIV-62-341C/1. ________

[4.3] **CYCLE** 1-DRIV-62-341D/1 OPEN **AND** then CLOSED to relieve pressure in the sense line. ________

4.4 Field Preparations (continued)

WARNING

Pressurized radioactive liquid may vent off during performance of next step. Personnel injury and contamination could result if safety and radiological control precautions are **NOT** observed.

[4.4] **REMOVE** cap from test tee above 1-PT-62-92A, **AND**

COLLECT any liquid in collection device. ________

[4.5] **ENSURE** pressure test gauge and its tubing are backfilled. ________

[4.6] **CONNECT** pressure test gauge to test tee. ________

[4.7] **OPEN** 1-ISIV-62-341C/1. ________

[4.8] **OPEN** 1-RTV-62-341A. ________
Ops.

[4.9] **ENSURE** no leakage at fittings. ________

[4.10] **VERIFY** 1-DRIV-62-341D/1 is CLOSED. ________
IV

[5] **VERIFY** plant is in Mode 1, 2, or 3. ________

NOTE

Because of the relationship between pump head and flow, it may NOT be possible to satisfy the Acceptance Criteria with letdown flow of 120 gpm.

[6] **ENSURE** letdown flow is at 75 gpm in accordance with SOI-62.01. ________

Data Package: Page ____ of ____ Date ________

5.0 ACCEPTANCE CRITERIA

A. Specific quantitative or qualitative requirements that are intended to be verified by this Instruction are noted in the action steps where the verifying action is performed and recorded.

B. Total flow rate to the RCP seals must be $\leq$ 37.6 gpm with Charging Pump discharge header pressure $\geq$ 2440 psig **AND** the pressurizer level control valve full OPEN.

C. If any Acceptance Criteria are **NOT** met, the SRO should be notified as soon as practical after observance of noncompliance.

Data Package: Page ____ of ____ Date ________

6.0 PERFORMANCE

6.1 Initial Actions

[1] **ENSURE** Precautions and Limitations in Section 3.0 have been reviewed. ________

[2] **ENSURE** Prerequisite Actions in Section 4.0 have been met. ________

6.2 Determination of Seal Leakage

NOTES

1) This Section is **NOT** required to be performed until 4 hours after the RCS pressure stabilizes at ≥ 2215 psig and ≤ 2255 psig.

2) It is only required to record one pressure reading in Step 6.2[1]. Readings not used may be marked **NA**.

[1] **VERIFY** the reactor coolant pressure reading is ≥ 2215 psig to ≤ 2255 psig using the corresponding Computer Point **OR** pressure indicator on 1-M-5, **AND**

RECORD the reading below:

P0481A (**COMPLIANCE**) __________ psig

P0482A (**COMPLIANCE**) __________ psig

1-PI-68-323, RCS PRZR PRESS (**COMPLIANCE**) __________ psig

1-PI-68-334, RCS PRZR PRESS (**COMPLIANCE**) __________ psig ________

[2] **VERIFY** that either Centrifugal Charging Pump (CCP) 1A-A **OR** 1B-B is operating **AND** supplying charging and seal flow in accordance with SOI-62.01, **AND**

RECORD the operating pump: CCP______________ ________

[3] **RECORD** the as-found position of 1-HIC-62-93A, CHARGING FLOW PZR LEVEL CONTROL, [1-M-5]:

As-found position:____________________________ ________

[4] **ENSURE** 1-HIC-62-93A is in MANUAL, **AND**

Fully OPEN 1-FCV-62-93, CHARGING HEADER FLOW CONT (**Acc Crit**). ________

Data Package: Page ____ of ____ Date ________

6.2 Determination of Seal Leakage (continued)

NOTE

Charging Pump discharge header pressure ≥ 2440 psig with 1-FCV-62-93 full open are the test conditions for this instruction. 1-HIC-62-89A, CHRG HDR-RCP SEALS FLOW CONTROL, may be adjusted as required to obtain proper seal injection flow of ≤ 37.6 gpm total, as long as charging header pressure indicates ≥ 2440 psig **AND** RCS pressure is between 2215 and 2255 psig.

[5] **ADJUST** 1-HIC-62-89A, CHRG HDR-RCP SEALS FLOW CONTROL, to maintain a pressure reading of ≥ 2440 psig on test gauge installed at 1-PT-62-92A. ________

[6] **ALLOW** system to stabilize, **AND**

RECORD the following pressure readings:

Test gauge at 1-PT-62-92A (**Acc Crit:** ≥ 2440 psig) __________ psig

Computer Point P0142A (information only) __________ psig ________

NOTE

Only one flow rate per pump is required for Step 6.2[7]. Data not taken may be marked **NA**.

[7] **RECORD** the seal injection flowrate to each of the four Reactor Coolant Pumps (RCPs) using the corresponding computer point or flow indicator on 1-M-5:

A. RCP #1

F0131A: (**COMPLIANCE**) __________ gpm

1-FI-62-1A, RCP 1 SEAL WATER FLOW: (**COMPLIANCE**) __________ gpm ________

B. RCP #2

F0129A: (**COMPLIANCE**) __________ gpm

1-FI-62-14A, RCP 2 SEAL WATER FLOW: (**COMPLIANCE**) __________ gpm ________

Data Package: Page ____ of ____ Date ________

6.2 Determination of Seal Leakage (continued)

C. RCP #3

F0127A: (**COMPLIANCE**) __________ gpm

1-FI-62-27A, RCP 3 SEAL WATER FLOW: (**COMPLIANCE**) __________ gpm ________

D. RCP #4

F0125A: (**COMPLIANCE**) __________ gpm

1-FI-62-40A, RCP 4 SEAL WATER FLOW: (**COMPLIANCE**) __________ gpm ________

NOTE

The completion of the next step may require entry into LCO 3.5.5 if Acceptance Criteria is **NOT** met.

[8] **CALCULATE** total flow rate below by adding seal injection flow rates recorded in Step 6.2[7] from each RCP loop (**Acc Crit:** $\leq$ 37.6 gpm total):

Total Seal Injection Flow Rate in gpm = A + B + C + D

_______+_______+_______+_______=________gpm ________ 1st

________ CV

[9] **VERIFY** Acceptance Criteria of Steps 6.2[4], 6.2[6], and 6.2[8] above were met. ________

[10] **RETURN** 1-HIC-62-93A to as-found position recorded in Step 6.2[3]. ________

[11] **RETURN** Charging, Letdown, and Seal Injection flows to as-desired values per SOI-62.01. ________

[12] **IF** Acceptance Criteria were **NOT** met, **OR** flow adjustments are desired, **THEN**

NOTIFY SRO, **AND**

OBTAIN permission to perform Section 6.3, Valve Adjustment. ________ SRO

Data Package: Page ____ of ____ Date ________

6.2 Determination of Seal Leakage (continued)

[13] **IF** Acceptance Criteria were met, **AND** flow adjustments are **NOT** desired, **THEN**

GO TO Section 7.0. ________

6.3 Valve Adjustment

NOTES

1) This Section may be marked **NA** if no valve adjustments are needed.

2) 1-HIC-62-89A, CHRG HDR-RCP SEALS FLOW CONTROL, may be adjusted as required to obtain proper seal injection flow of ≤ 37.6 gpm total, as long as charging header pressure indicates ≥ 2440 psig and RCS pressure is between 2215 and 2255 psig.

3) The goal is to have equal seal flow to each RCP and positioning of 1-FCV-62-89 and 1-FCV-62-93 to provide optimized control for normal plant operation and transients. An example is 1-FCV-62-89 throttled approximately 60-70 percent Open, 1-FCV-62-93 throttled approximately 50-60 percent Open, and Charging to RCS differential pressure between 130 to 160 psig. Other conditions may also provide acceptable results.

4) Opening throttle valves 1-INJ-62-556 through -559 will result in opening of 1-FCV-62-89 to maintain seal flow with a decrease in charging header pressure. Closing throttle valves 1-INJ-62-556 through -559 will result in closing 1-FCV-62-89 to maintain seal flow with an increase in charging header pressure.

[1] **OBTAIN** permission from SRO before performing this section. ________

[2] **RECORD** the as-found position of 1-HIC-62-93A, CHARGING FLOW PZR LEVEL CONTROL, [1-M-5]:

As-found position:______________________________ ________

Data Package: Page ____ of ____ Date ________

6.3 Valve Adjustment (continued)

NOTE

Steps 6.3[3] and 6.3[4] may be performed in parallel and may be repeated as necessary to achieve the desired seal injection flows. Positioning of 1-FCV-62-93 to maintain pressurizer level between iterations in Steps 6.3[3] and 6.3[4] is acceptable.

[3] **ENSURE** 1-HIC-62-93A is in MANUAL, **AND**

Fully OPEN 1-FCV-62-93, CHARGING HEADER FLOW CONT, as necessary to check the effectiveness of seal injection needle valve position. ________

NOTES

1) 1-HIC-62-89A, CHRG HDR-RCP SEALS FLOW CONTROL, may be adjusted as required to obtain the desired seal injection flows with charging header pressure ≥ 2440 psig and RCS pressure between 2215 and 2255 psig.
2) Only one flow rate per pump is required for Step 6.3[4]. Data not taken may be marked **NA**.

[4] **ADJUST** the applicable RCP seal injection needle valves to achieve flow rate of ≤ 37.6 gpm total for all RCP loops, **AND**

RECORD flow rates below:

A. RCP #1 (1-INJ-62-556)

F0131A: (**COMPLIANCE**) __________ gpm

1-FI-62-1A, RCP 1 SEAL WATER FLOW: (**COMPLIANCE**) __________ gpm ________

B. RCP #2 (1-INJ-62-557)

F0129A: (**COMPLIANCE**) __________ gpm

1-FI-62-14A, RCP 2 SEAL WATER FLOW: (**COMPLIANCE**) __________ gpm ________

Data Package: Page ____ of ____ **Date ________**

6.3 Valve Adjustment (continued)

C. RCP #3 (1-INJ-62-558)

F0127A: (**COMPLIANCE**) ____________ gpm

1-FI-62-27A, RCP 3 SEAL WATER FLOW: (**COMPLIANCE**) ____________ gpm ________

D. RCP #4 (1-INJ-62-559)

F0125A: (**COMPLIANCE**) ____________ gpm

1-FI-62-40A, RCP 4 SEAL WATER FLOW: (**COMPLIANCE**) ____________ gpm ________

[5] **CALCULATE** total flow rate below by adding seal injection flow rates recorded in Step 6.3[4] from each RCP loop (Target of ≤ 37.6 gpm total):

Total Seal Injection Flow Rate in gpm = A + B + C + D

________+________+________+________=_________gpm ________
1st

____
CV

[6] **RECORD** pressure reading from Computer Point P0142A:

P0142A ____________ psig ________

[7] **PLACE** 1-HIC-62-93A in desired position for current plant conditions. ________

[8] **RE-PERFORM** Section 6.2 following needle valve adjustment. ________

Data Package: Page ____ of ____ Date ________

7.0 POST PERFORMANCE ACTIVITIES

[1] **VERIFY** 1-HIC-62-93A is returned to the as-found position recorded in Step 6.2[3]. ________ IV

[2] **ENSURE** letdown flow is at the desired value in accordance with SOI-62.01. ________

NOTE

While 1-PT-62-92C, CVCS CHARGING HEADER PRESSURE, is out of service for removal of M&TE, LCO 3.3.4 may be applicable.

[3] **OBTAIN** permission from the UO to remove 1-PT-62-92A AND 1-PT-62-92C from service to remove test gauge. ________ UO

NOTE

Steps 7.0[4] through 7.0[6] are performed by MIG, unless otherwise noted.

[4] **LOCATE** and **IDENTIFY** the following components [PNL 1-L-112B, A5T/692, near door to CCP 1B-B room]:

UNID	DESCRIPTION	IDENTIFIED BY	CV
1-PT-62-92A	CVCS CHARGING HEADER PRESSURE		
1-ISIV-62-341C/1	PANEL ISOLATION VALVE (1-PT-62-92A)		
1-DRIV-62-341D/1	PANEL DRAIN VALVE (1-PT-62-92A)		

[5] **LOCATE** and **IDENTIFY** 1-RTV-62-341A, 1-PT-62-92A/1-PT-62-92C ROOT [A4U/698, 692 Pipe Chase]: ________ Ops.

________ CV

[6] **REMOVE** pressure test gauge at test tee between 1-PT-62-92A and 1-ISIV-62-341C/1 as follows:

A. **CLOSE** 1-RTV-62-341A. ________ Ops.

B. **CLOSE** 1-ISIV-62-341C/1. ________

Data Package: Page ____ of ____ Date ________

7.0 **POST PERFORMANCE ACTIVITIES (continued)**

C. **CYCLE** 1-DRIV-62-341D/1 OPEN **AND** then CLOSED to relieve pressure in the sense line. ________

WARNING

Pressurized radioactive liquid may vent off during performance of next step. Personnel injury and contamination could result if safety and radiological control precautions are **NOT** observed.

D. **REMOVE** pressure test gauge from test tee, **AND**

COLLECT any liquid in collection device. ________

E. **INSTALL** cap on test tee. ________

F. **OPEN** 1-ISIV-62-341C/1. ________ 1st ________ IV

G. **OPEN** 1-RTV-62-341A. ________ Ops. ________ IV

H. **ENSURE** no leakage at fitting. ________

I. **VERIFY** 1-DRIV-62-341D/1 is CLOSED. ________ IV

[7] **NOTIFY** Operations that this Instruction is complete. ________

[8] **RECORD** completion date and time on Surveillance Task Sheet. ________

Data Package: Page ____ of ____ Date ________

8.0 RECORDS

8.1 QA Records

The Data Package is a QA record, is handled in accordance with the Document Control and Records Management Program, and contains the following:

A. Completed parts of Sections 4.0, 6.0 and 7.0.

B. Section 5.0.

C. Surveillance Task Sheet.

D. Other sheets added during the performance.

8.2 Non-QA Records

None

Source Notes
(Page 1 of 1)

Requirements Statement	Source Document	Implementing Statement
Corrective action for failure of weld at inlet to 1-RFV-62-518.	WBPER950473	1

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.5 Seal Injection Flow

BASES

BACKGROUND

The function of the seal injection throttle valves during an accident is similar to the function of the ECCS throttle valves in that each restricts flow from the charging pump header to the Reactor Coolant System (RCS).

The restriction on reactor coolant pump (RCP) seal injection flow limits the amount of ECCS flow that would be diverted from the injection path following an accident. This limit is based on safety analysis assumptions that are required because RCP seal injection flow is not isolated during SI.

APPLICABLE SAFETY ANALYSES

All ECCS subsystems are taken credit for in the large break loss of coolant accident (LOCA) at full power (Ref. 1). The LOCA analysis establishes the minimum flow for the ECCS pumps. The centrifugal charging pumps are also credited in the small break LOCA analysis. This analysis establishes the flow and discharge head at the design point for the centrifugal charging pumps. The steam generator tube rupture and main steam line break event analyses also credit the centrifugal charging pumps, but are not limiting in their design. Reference to these analyses is made in assessing changes to the Seal Injection System for evaluation of their effects in relation to the acceptance limits in these analyses.

This LCO ensures that seal injection flow of $\leq$ 40 gpm, with charging pump discharge header pressure $\geq$ 2430 psig and pressurizer level control valve full open, will be sufficient for RCP seal integrity but limited so that the ECCS trains will be capable of delivering sufficient water to match boiloff rates soon enough to minimize uncovering of the core following a large LOCA. It also ensures that the centrifugal charging pumps will deliver sufficient water for a small LOCA and sufficient boron to maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to overcome the loss and maintain RCS inventory.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

Seal injection flow satisfies Criterion 2 of the NRC Policy Statement.

LCO

The intent of the LCO limit on seal injection flow is to make sure that flow through the RCP seal water injection line is low enough to ensure that sufficient centrifugal charging pump injection flow is directed to the RCS via the injection points (Ref. 2).

The LCO is not strictly a flow limit, but rather a flow limit based on a flow line resistance. In order to establish the proper flow line resistance, a pressure and flow must be known. The flow line resistance is determined by assuming that the RCS pressure is at normal operating pressure and that the charging pump discharge pressure is greater than or equal to the value specified in this LCO. The charging pump discharge header pressure remains essentially constant through all the applicable MODES of this LCO. A reduction in RCS pressure would result in more flow being diverted to the RCP seal injection line than at normal operating pressure. The valve settings established at the prescribed charging pump discharge header pressure result in a conservative valve position should RCS pressure decrease. The additional modifier of this LCO, the pressurizer level control valve being full open, is required since the valve is designed to fail open for the accident condition. With the discharge pressure and control valve position as specified by the LCO, a flow limit is established. It is this flow limit that is used in the accident analyses.

The limit on seal injection flow, combined with the charging pump discharge header pressure limit and an open wide condition of the pressurizer level control valve, must be met to render the ECCS OPERABLE. If these conditions are not met, the ECCS flow will not be as assumed in the accident analyses.

APPLICABILITY

In MODES 1, 2, and 3, the seal injection flow limit is dictated by ECCS flow requirements, which are specified for MODES 1, 2, 3, and 4. The seal injection flow limit

(continued)

BASES

APPLICABILITY (continued)

is not applicable for MODE 4 and lower, however, because high seal injection flow is less critical as a result of the lower initial RCS pressure and decay heat removal requirements in these MODES. Therefore, RCP seal injection flow must be limited in MODES 1, 2, and 3 to ensure adequate ECCS performance.

ACTIONS

A.1

With the seal injection flow exceeding its limit, the amount of charging flow available to the RCS may be reduced. Under this Condition, action must be taken to restore the flow to below its limit. The operator has 4 hours from the time the flow is known to be above the limit to correctly position the manual valves and thus be in compliance with the accident analysis. The Completion Time minimizes the potential exposure of the plant to a LOCA with insufficient injection flow and provides a reasonable time to restore seal injection flow within limit. This time is conservative with respect to the Completion Times of other ECCS LCOs; it is based on operating experience and is sufficient for taking corrective actions by operations personnel.

B.1 and B.2

When the Required Actions cannot be completed within the required Completion Time, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions in an orderly manner and without challenging plant systems.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.5.5.1

Verification every 31 days that the manual seal injection throttle valves are adjusted to give a flow within the limit listed below ensures that proper manual seal injection throttle valve position, and hence, proper seal injection flow, is maintained:

> ≤ 40 gpm with charging pump discharge header pressure ≥ 2430 psig and the pressurizer level control valve full open (values do not account for instrument error, Ref. 3).

The Frequency of 31 days is based on engineering judgment and is consistent with other ECCS valve Surveillance Frequencies. The Frequency has proven to be acceptable through operating experience.

As noted, the Surveillance is not required to be performed until 4 hours after the RCS pressure has stabilized within a ± 20 psig range of normal operating pressure. The RCS pressure requirement is specified since this configuration will produce the required pressure conditions necessary to assure that the manual valves are set correctly. The exception is limited to 4 hours to ensure that the Surveillance is timely.

REFERENCES

1. Watts Bar FSAR, Section 6.3, "Emergency Core Cooling System," and Section 15.0, "Accident Analysis."

2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Plants," 1974.

3. Watts Bar Drawing 1-47W605-242, "Electrical Tech Spec Compliance Tables."

I. PROGRAM

WATTS BAR OPERATOR TRAINING

II. COURSE

A. License Certification
B. Onsite Lecture Series
C. License Prep
D. License Requalification

III. TITLE

T/S 3/4.5, "Emergency Core Cooling Systems," and Bases

IV. INSTRUCTION LENGTH

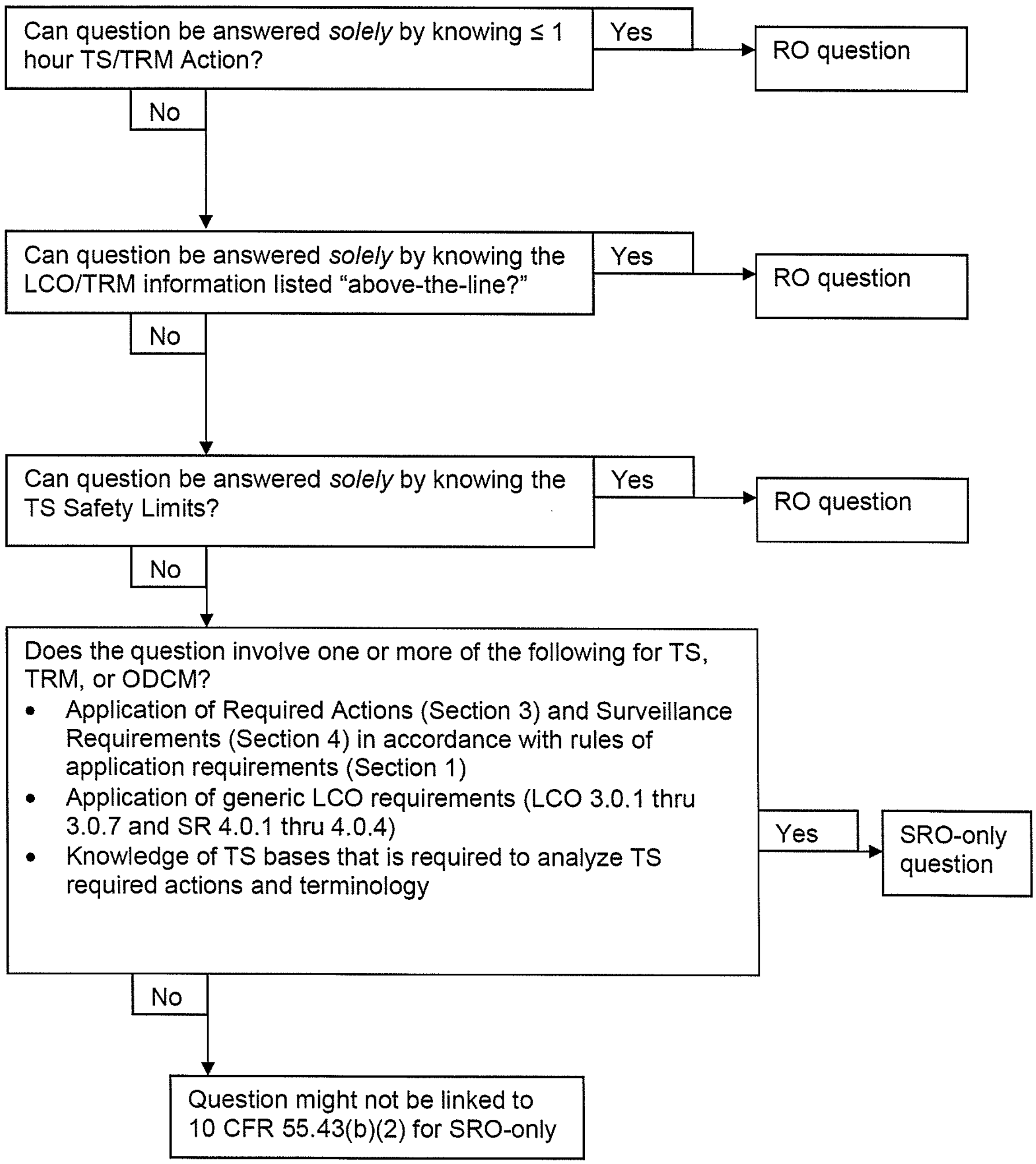
A.	License Certification	1 Hour
B.	Onsite Lecture Series	1 Hour
C.	License Prep	1 Hour

D. License Requalification time will be identified when objectives are identified.

V. TRAINING OBJECTIVES

AUO	RO	SRO	STA	
	X	X	X	1. Demonstrate the ability to extract specific information from the Technical Specifications and Technical Requirements, as they pertain to ECCS.
	X	X	X	2. Determine the bases for each specification, as applicable, to the ECCS.
	X	X	X	3. Given plant conditions/parameters correctly determine the OPERABILITY of components associated with ECCS.
	X	X	X	4. Given plant conditions and parameters correctly determine the applicable Limiting Conditions for Operation or Technical Requirements for the various components of ECCS.
	X	X	X	5. Given plant conditions and parameters determine applicable Action Conditions, Required Actions, and Completion Times associated with the ECCS.

Figure 1: Screening for SRO-only linked to 10 CFR 55.43(b)(2) (Tech Specs)



84. 068 AG2.1.7 084

Given the following:

0900 - Conditions require the Unit 1 Main Control Room (MCR) to be abandoned.

0902 - All MCR actions of AOI-27, "Main Control Room Inaccessibility," have been completed and the crew leaves the MCR.

0903 - Offsite power is lost.

0915 - The crew establishes control in the Auxiliary Control Room.

0915 - DG 2A-A trips and Tech Spec 3.0.3 is entered.

1030 - The crew initiates a natural circulation cooldown and the following S/G pressure trends are observed:

Time	S/G Pressures
1030	1040 psig
1050	825 psig
1110	550 psig
1130	470 psig
1150	385 psig

Which ONE of the following identifies...

(1) whether the RCS cooldown rate has violated the Tech Spec limit

and

(2) the latest time allowed by Tech Specs to place the unit in Mode 5?

A. (1) Cooldown rate limit has been violated
   (2) 1515 the next day.

B. (1) Cooldown rate limit has been violated
   (2) 2215 the next day.

C. (1) Cooldown rate limit has **NOT** been violated
   (2) 1515 the next day.

D✓ (1) Cooldown rate limit has **NOT** been violated
   (2) 2215 the next day.

DISTRACTOR ANALYSIS:

A. *Incorrect, Plausible if the candidate mistakes the Admin limit on cooldown rate which is 50°F/hr for the Tech Spec cooldown rate of 100°F/hr. Also the time to be in Mode 5 for Tech Spec 3.0.3 is 37 hrs. (Mode 3 within 7 hrs, Mode 4 within 13 hrs). Since the plant was in Mode 3 at the time of entering 3.0.3, the candidate may determine that the 7 hrs would not be allowed and reduce the time to Mode 5 by that amount, thus Mode 5 would be at 1515 the next day.*

B. *Incorrect, Plausible if the candidate mistakes the Admin limit on cooldown rate which is 50°F/hr for the Tech Spec cooldown rate of 100°F/hr. The second part is correct; the crew has 37 hrs from the time of discovery to enter Mode 5, thus 2315 the next day.*

C. *Incorrect, Plausible since the first part is correct. The Tech Spec limit of 100°F/hr was never violated during the cooldown, however the Admin limit of 50°F/hr was. The second part of the answer is not correct as explained in distractor A analysis.*

D. *Correct, The Tech Spec cooldown rate limit of 100°F/hr was never violated during the cooldown. The operators are directed by AOI-27 to use the saturation temperature for the S/G pressure to determine the RCS temperature when on natural circulation. Also the plant has 37 hrs from the time of discovery to enter Mode 5. Time of discovery was listed at 0915. (0915 plus 37 hrs = 2215 the next day)*

Question Number: 84

Tier: 1 **Group** 2

K/A: 068 AG2.1.7
Control Room Evacuation
Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior, and instrument interpretation.

Importance Rating: 4.4 / 4.7

10 CFR Part 55: 41.5 / 43.5 / 45.12 / 45.13

10CFR55.43.b: 2

K/A Match: This question matches the K/A by having the applicant evaluate the plant data on S/G pressures and relate that information to RCS temperature to determine if RCS Tech Spec cooldown rate has been violated. SRO by having the applicant apply the times for Mode entry when Tech Spec 3.0.3 has been applied to current plant conditions.

Technical Reference: AOI-27, Main Control Room Inaccessibility, Revision 0028
Tech Spec LCO 3.0.3, Amendment 55

Proposed references to be provided: None

Learning Objective: 3-OT-AOI2700
12. Demonstrate ability/knowledge of AOI, to correctly:
a. Recognize Entry conditions.
b. Respond to Action steps.
c. Respond to Contingencies (RNO column).
d. Respond to Notes & Cautions.
3-OT-T/S0000
13. Briefly discuss what the term LCO 3.0.3 means to plant operation

Cognitive Level:
Higher X
Lower ___

Question Source:
New ___
Modified Bank ___
Bank X

Question History: SQN bank question from SQN 2009 exam (068 AG2.4.7) with procedure title and Tech Spec completion times changed to make applicable for WBN.

Comments:

3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

LCO 3.0.1

LCOs shall be met during the MODES or other specified conditions in the Applicability, except as provided in LCO 3.0.2.

LCO 3.0.2

Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 3.0.5 and LCO 3.0.6.

If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required unless otherwise stated.

LCO 3.0.3

When an LCO is not met and the associated ACTIONS are not met, an associated ACTION is not provided, or if directed by the associated ACTIONS the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable. Action shall be initiated within 1 hour to place the unit, as applicable, in:

a. MODE 3 within 7 hours;

b. MODE 4 within 13 hours; and

c. MODE 5 within 37 hours.

Exceptions to this Specification are stated in the individual Specifications.

Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the actions required by LCO 3.0.3 is not required.

LCO 3.0.3 is only applicable in MODES 1, 2, 3, and 4.

LCO 3.0.4

When an LCO is not met, entry into a MODE or other specified condition in the Applicability shall only be made:

a. When the associated ACTIONS to be entered permit continued operation in the MODE or other specified condition in the Applicability for an unlimited period of time;

(continued)

TVA

Watts Bar Nuclear Plant

Unit 1

Abnormal Operating Instruction

AOI-27

Main Control Room Inaccessibility

Revision 0028

Quality Related

Level of Use: Continuous Use

Effective Date: 02-22-2011

Responsible Organization: OPS, Operations

Prepared By: Nicholas Armour

Approved By: Brian McIlnay

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
23	3/15/04	2, 9, 11, 36, 39	Non-intent. Changed note to caution prior to Step 16 and various editorial changes. Operator feedback.
24	11/19/04	2, 17, 23, 93, 94, 95	Intent. Removed references to use of loop 4 Hot Leg Pen on 1-XR-68-3C to support Exigent Technical Specification Change WBN-TS-04-20 due to 1-TI-68-65C, RCS Loop 4 Hot Leg Temperature, inoperability.
25	3/23/05	2, 79	Revised to incorporate EDC 51860A which provides DI water to the PWMS when the PWST is out of service.
26	9/11/08	2, 96	Revised to incorporate EDC 52884-A (implemented by WO 08-817141-000) which changed 1-FIT-62-142 to 1-FT-62-142. Deleted the option to use the 1-FIT-62-142 to monitor the Emergency Boration line flush flow because 1-FT-62-142 has no local indication.
27	9/15/09	2, 7, 10, 11, 17, 23, 26, 35, 38, 69, 71, 79, 93-95	Minor/editorial revision. Corrected format to comply with Writer's Guide. Corrected nomenclature and UNIDs to agree with approved documentation. Corrected step numbering and edited note to state correct RCPs to run to achieve spray flow. Reformatted step for correct usage as an IF/THEN step. Removed strike through of Loop 4 Thot instrument due to Tech Spec no longer being applicable.
28	02/22/11	All	Minor/editorial revision: Converted procedure to Word 2007 using Rev 27 (PCR 5103). Corrected typo in ACR Checklist for 1-XS-62-237 (PCR 4367). Reformatted source notes and added end of section identification.

1.0 PURPOSE

This Instruction provides actions to evacuate the Main Control Room (MCR) for conditions other than a 10CFR50 Appendix R Fire and for maintaining plant control from the Auxiliary Control Room (ACR).

If the Aux Control Room has been used to control the plant during either a test or during a planned shutdown, portions of this procedure may be marked N/A as necessary to assure equipment operability (Tech Spec operability). Under no circumstances shall plant safety be jeopardized during the performance of this instruction for testing.

ACR checklists will be performed to completion on manning the ACR by OAC. Portions of AUO checklists 1-4 will be performed as necessary AT THE DISCRETION OF THE SRO IN THE ACR as components are addressed in the applicable plant instructions (GOs, SOIs, AOIs, Es) or as deemed necessary based on existing plant conditions.

2.0 SYMPTOMS

2.1 Alarms

None

2.2 Indications

Any conditions requiring MCR abandonment other than an Appendix R fire.

2.3 Automatic Actions

None

Step	Action/Expected Response	Response Not Obtained

3.0 OPERATOR ACTIONS

3.1 Main Control Room Inaccessibility

NOTE If MCR is inaccessible due to an Appendix R fire, AOI-30.2 shall be used instead of this instruction.

1. **WHEN** it has been decided to abandon the MCR, **THEN**:

   a. **TRIP** Reactor.

   b. **PERFORM** Immediate Action Steps of E-0.

   c. **IF** time permits, **THEN**

      PERFORM ES-0.1.

NOTE S/G PORV controller setpoints should be the same.

2. **CLOSE** MSIVs as follows:

   a. **LOWER** S/G PORV setpoints until PORVs open enough to allow steam dump closure.

   b. **PLACE** Steam Dump Controls OFF.

   c. **CLOSE** MSIVs.

3.1 Main Control Room Inaccessibility (continued)

3. **ANNOUNCE** "Unit 1 Reactor Trip", and "Abandoning Control Room" over PA system.

NOTE

- All procedures addressed in this instruction are maintained in the ACR locker.
- SM's Clerk may be contacted for radio and charger retrieval.
- All Operations personnel should maintain adequate information (instructions performed, step completion times, etc.) to construct a log of activities while this instruction is in use.

4. **WHEN** plant conditions are stable or controlled and the MCR is no longer accessible, **THEN**

   TAKE all available radios, and at least one charger, and the key set normally maintained by Incident Commander, **AND**

   EVACUATE the MCR.

3.1 Main Control Room Inaccessibility (continued)

NOTE

- Checklists are assigned by the UO in the ACR (CRO).
- ACR Checklist is to be completed on implementing AOI-27.
- Portions of the AUO Checklists are to be completed as directed by ACR SRO as equipment operation becomes necessary based on plant instructions or plant conditions.
- Operations Assembly Area (inside security) for this Instruction is the 6.9kV SD Bd Rooms.
- SM's Clerk will report to SM and be available for record keeping and further instructions.
- Radios are the preferred form of communication.

5. **WHEN** personnel have assembled at the Auxiliary Control Room, **THEN**

   DISTRIBUTE the area checklists as listed, **AND**

   ENSURE AUOs establish communication with ACR awaiting further instructions:

   - ACR Checklist, Operator at the Controls (OAC) in the ACR [1-L-11A and 1-L-11B]
   - AUO Checklists in accordance with Attachment 1.

Step	Action/Expected Response	Response Not Obtained

3.1 Main Control Room Inaccessibility (continued)

6. **IF** in hot standby or hot shutdown conditions, **THEN**

   THROTTLE AFW as necessary to maintain stable RCS temperature as AFW components are transferred to AUX on 1-L-11B and 1-L-11A (ACR Checklists).

   Response Not Obtained: **IF** in cold shutdown conditions or refueling, **THEN**

   MAINTAIN RCS temperature using the following RHR valve controllers (1-L-10):

   - 1-HIC-74-16C (1-FCV-74-16)
   - 1-HIC-74-28C (1-FCV-74-28)
   - 1-HIC-74-32C (1-FCV-74-32)

   GO TO Section 3.2.

7. **MONITOR** charging flow on 1-L-10 as OAC transfers 1-XS-62-93, 1-XS-62-89, and 1-XS-62-81 from NORMAL control to AUX control [1-L-11B and 1-L-11A].

   Response Not Obtained: **IF** 1-FCV-62-93, 1-PCV-62-81, or 1-FCV-62-89 operates erratically, **THEN**

   ESTABLISH local control using SOI-62.01.

NOTE In the Aux Mode, tying the DG to the Shutdown Board is a manual action to be performed at the 6.9kV Shutdown Board.

8. **IF** offsite power is lost, **THEN**:

   a. **ENSURE** DGs running (AUO# 3) and connected to the 6.9kV SD Bds (AUO# 1).

   b. **REFER TO** AOI-35.

Step	Action/Expected Response	Response Not Obtained

3.1 Main Control Room Inaccessibility (continued)

NOTE Steps 9 and 10 are SM Duties.

9. **ENSURE** ACR checklist is being performed and AUOs standing by at assigned stations awaiting further instructions. (AUO Checklists 1-4).

NOTE REP classification must be upgraded to a Site Area Emergency if it takes more than 15 minutes to reestablish control of all necessary equipment after manning the ACR.

10. **EVALUATE** REP using EPIP-1.

CAUTION When controls are transferred to AUX, most Auto functions are **NOT** operable. ESF Actuation will require manual operator action in accordance with E-0.

NOTE COPS cannot be armed in AUX mode.

11. **ENSURE** ACR Checklist complete (OAC).

3.1 Main Control Room Inaccessibility (continued)

NOTE

- ACR annunciation does **NOT** have audible clearing of alarms or reflash capability.
- Periodically attempting to reset alarms will verify when alarmed condition cleared.

12. **ENERGIZE** ACR alarms by placing the following switches to ON (OAC):
    - 1-HS-55-L10
    - 0-HS-55-L4A
    - 0-HS-55-L4B

NOTE

- All Aux Control Stations (as defined by Checklists 1 through 4, AUO #5 List of Local Manual Actions, and the ACR Checklist) should be manned (at CRO discretion) until total control (all stations) is returned to the MCR or the plant enters cold shutdown conditions.
- MCR accessibility should be monitored. If at any time during this instruction it becomes possible or necessary to return control to the MCR, Appendix A should be used for the transfer of control back to the MCR.

13. **ESTABLISH** communication with the areas listed in Attachment 1.

Step	Action/Expected Response	Response Not Obtained

3.1 Main Control Room Inaccessibility (continued)

NOTE

- Auto make-up to the VCT is disabled when ACR Checklist is complete.
- VCT level will rise with letdown in service and the VCT isolated.
- To support minimum RCS cooldown, swapover to the RWST is preferred. RWST Tech Spec levels must be addressed.
- Transfer to RWST may occur automatically due to Low-Low VCT Level in Normal or Aux Modes.

14. **MONITOR** VCT level within normal range (20-41%):

a. **IF** charging pump suction remains aligned to VCT, **THEN**

DIRECT AUO # 5 to locally make-up to VCT, as required.

b. **IF** the decision is made to transfer CCP suction to the RWST, **THEN**:

1) **DIRECT** AUO #1 to:

MONITOR CCP amps during swap to RWST, **AND**

TRIP running CCP if loss of Suction is apparent.

2) **DIRECT** AUO #2 to transfer CCP suction from VCT to RWST per Checklist #2.

Continued on next page

Appendix C
(Page 1 of 3)

RCS / PZR Cooldown Rate Determination*

TIME/DATE ❊	RCS TEMPERATURE (Maximum Hourly ΔT is 50°F) (Tech Spec Limit is 100°F)					PZR TEMPERATURE (Maximum Hourly ΔT is 50°F) (Tech Spec Limit is 200°F)					RCS SUBCOOLING	INITIALS	
	(1) RCS TEMP (°F) ♦	(2) HOURLY ΔT(°F)	ACCEPTANCE CRITERIA MET?		(3) T_{hot} (hottest) (°F) ♠	(4) PZR PRESS (psig) ♣	(5) Pzr Tsat	(6) HOURLY ΔT(°F)	ACCEPTANCE CRITERIA MET?		Difference between Pzr Tsat & (hottest) T_{hot} [column(5) - column(3)] (°F)		
			YES	NO					YES	NO		1st	2nd
/		N/A	N/A	N/A				N/A	N/A	N/A			
/													
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* Use additional sheets as required.
❊ Monitoring cooldown every 15 minutes is recommended.
♠ Use 1-XR-68-3C, pens 1 through 4 for RCS Loops 1 through 4 respectively.
♦ To monitor RCS cooldown rate, any one of the following can be used (indicate choice in Remarks):

Loop 1		Loop 2		Loop 3		Loop 4	
Tsat from 1-PI-1-1C	1-XR-68-3C Pen 1, Thot (if RCP 1 running)	Tsat from 1-PI-1-8C	1-XR-68-3C Pen 2, Thot (if RCP 2 running)	Tsat from 1-PI-1-19C	1-XR-68-3C Pen 3, Thot (if RCP 3 running)	Tsat from 1-PI-1-26C	1-XR-68-3C Pen 4, Thot (if RCP 4 running)

♣ Use 1-PI-68-336C or 1-PI-68-337C (indicate choice in Remarks).
Remarks: ______________________________

Given the following plant conditions:

SQN BANK QUESTION

0900 - Conditions require the Unit 2 Main Control Room (MCR) to be abandoned.
0902 - All MCR actions of AOP-C.04, "Shutdown From Auxiliary Control Room" have been completed and the crew leaves the MCR.
0915 - The crew establishes control in the Auxiliary Control Room.
0915 - Tech Spec 3.0.3 is entered.
1130 - The crew initiates a natural circulation cooldown and the following SG pressure trends are observed.

Time		SG Pressures
1130	-	1040 psig
1150	-	825 psig
1210	-	550 psig
1230	-	470 psig
1250	-	385 psig

Which of the following identifies...
(1) whether the RCS cooldown rate has violated the Tech Spec limit
and
(2) the latest time allowed by Tech Specs to place the unit in Mode 5?

a. (1) Cooldown rate limit has been violated.
(2) 1515 the next day.

b. (1) Cooldown rate limit has been violated.
(2) 2215 the next day.

c.✓ (1) Cooldown rate limit has NOT been violated.
(2) 1515 the next day.

d. (1) Cooldown rate limit has NOT been violated.
(2) 2215 the next day.

I. PROGRAM

WATTS BAR OPERATOR TRAINING

II. COURSES

A. LICENSE TRAINING

B. NOTP

C. LICENSE REQUALIFICATION

D. NAUO REQUALIFICATION

III. TITLE

AOI-27, MAIN CONTROL ROOM INACCESSIBILITY

IV. LENGTH OF LESSON

1. LICENSE TRAINING 1.5 HOURS
2. NOTP 1 HOUR

LICENSE OPERATOR AND NAUO REQUAL TIMES WILL BE DETERMINED WHEN OBJECTIVES ARE IDENTIFIED.

V. TRAINING OBJECTIVES

AUO	RO	SRO	STA	
X	X	X	X	1. Demonstrate knowledge of Purpose/goal of AOI-27.
				2. Deleted (7/16/97)
				3. Deleted (12/15/93)
	X	X	X	4. Describe Operator Actions taken before leaving the Main Control Room (MCR) per AOI-27.
	X	X	X	5. Identify items which must be carried to the Auxiliary Control Room when the Main Control Room is abandoned.

V. TRAINING OBJECTIVES (CONTINUED)

AUO	RO	SRO	STA	
X	X	X	X	6. Identify Assignments given to Operators after assembling at ACR.
X	X	X	X	7. Explain the reason for performing local RCP inspections each shift while RCPs are in service.
	X	X	X	8. Identify the primary factors that determine the length of time the unit can remain in HOT STANDBY.
				9. Deleted (7/16/97)
	X	X	X	10. Explain cautions to be taken before going to Cold Shutdown from Hot Standby in the Auxiliary Mode per AOI-27.
X	X	X	X	11. Describe the cautions observed when returning to MCR from Test of the AOI per AOI-27.
	X	X	X	12. Demonstrate ability/knowledge of AOI, to correctly: a. Recognize Entry conditions. b. Respond to Action steps. c. Respond to Contingencies (RNO column). d. Respond to Notes & Cautions.
	X	X	X	13. Identify the action required with regard to the REP if control of necessary equipment is not established within 15 minutes after manning the ACR.
X	X	X	X	14. Explain when all Aux Control Stations are no longer required to be manned during implementation of AOI-27.

I. PROGRAM

Operator Training

II. COURSE:

A. License Training
B. Non-License Training

III. TITLE:

Technical Specifications Overview

IV. LENGTH OF LESSON:

8 hours

V. TRAINING OBJECTIVES:

AUO	RO	SRO	STA	
X	X	X	X	1. Identify the legal requirements for having and using Technical Specifications and the Technical Requirements Manual (TRM).
X	X	X	X	2. Explain the relationship of the Technical Specifications and the Technical Requirements Manual to the operating license and the Final Safety Analysis Report (FSAR).
X	X	X	X	3. List the five (5) major sections of Technical Specifications.
X	X	X	X	4. Explain how "defined terms" can be identified.
	X	X	X	5. Given a copy of the Technical Specifications and the Technical Requirements Manual, determine the following: a. Applicable Technical Requirements or Limiting Condition for Operation for a given plant condition. b. If a Safety Limit or Limiting Safety System Setting has been exceeded.

V. TRAINING OBJECTIVES: (continued)

AUO	RO	SRO	STA	
	X	X	X	6. Given a copy of Technical Specifications and the Technical Requirements Manual, determine the following: a. Applicable Actions for Technical Requirement or Limiting Condition for Operation for a given plant condition. b. The appropriate actions to be taken for given plant conditions.
	X	X	X	7. Given a copy of Technical Specifications, determine specific plant Design Features and Administrative Controls requirements.
X	X	X	X	8. Explain briefly what is contained in the Core Operating Limits Report (COLR), Offsite Dose Calculation Manual (ODCM), Pressure and Temperature Limits Report (PTLR).
X				9. State the number and respective title of the different operational modes according to Technical Specifications.
X				10. Define "OPERABLE - OPERABILITY" for a safety related systems.
X				11. Indentify where the justification for the "Limiting Condition of Operation" for components and systems identified in Technical Specifications can be found.
X				12. Explain briefly the information that can be found in the Technical Specification and Technical Requirements "Surveillance Requirements" section.
X				13. Briefly discuss what the term LCO 3.0.3 means to plant operation.

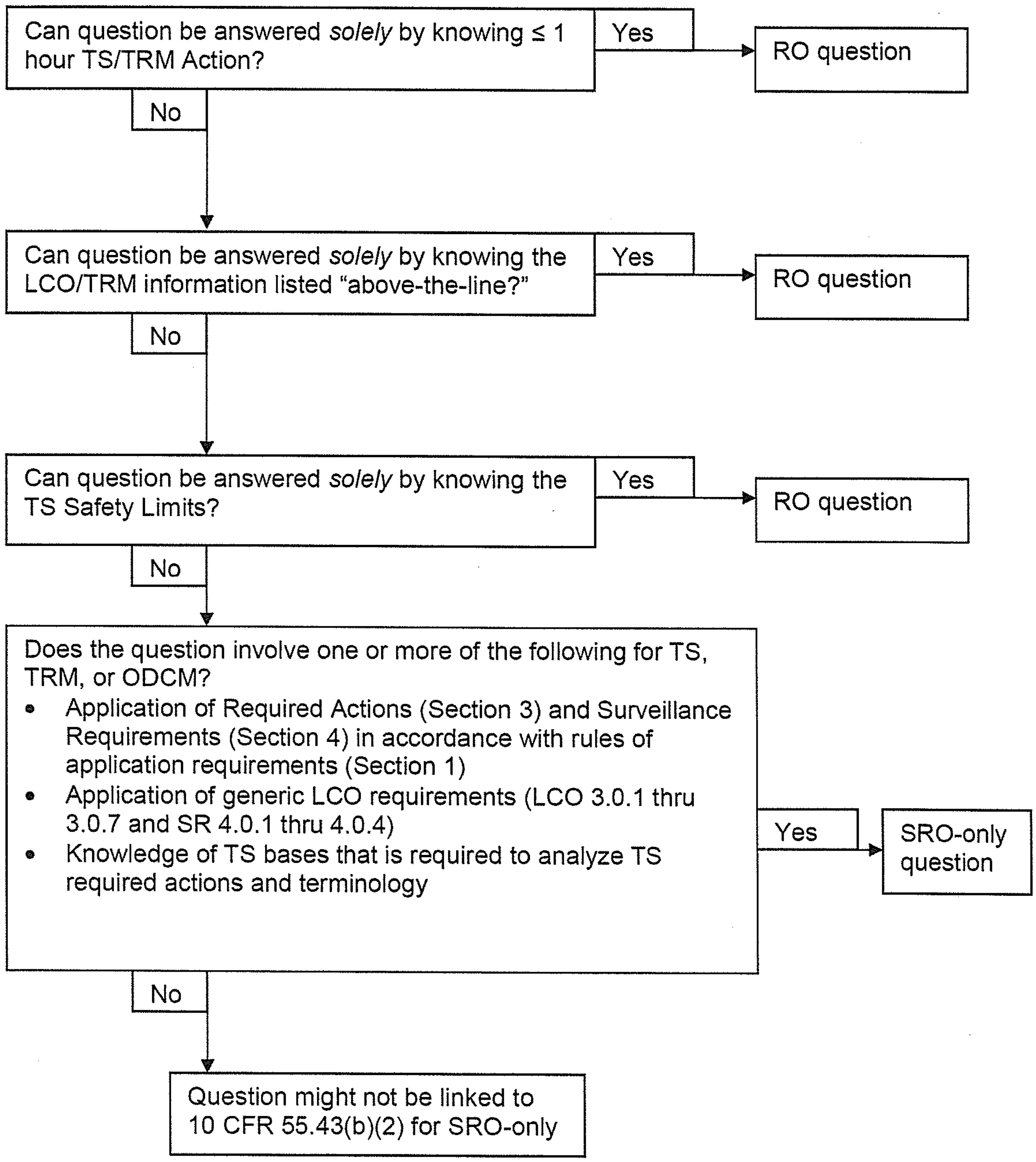
VI. TRAINING AIDS:

A. Whiteboard and Markers.

B. Multimedia Projector.

C. Overhead Projector.

Figure 1: Screening for SRO-only linked to 10 CFR 55.43(b)(2) (Tech Specs)



85. W/E10 EG2.4.8 085

Given the following:

- The Unit 1 operating crew is performing ES-0.3, "Natural Circulation Cooldown with Steam Void In Vessel (With RVLIS)."
- The Chem Lab reports increasing radiation level in Steam Generator #3.

Which ONE of the following identifies...

(1) the appropriate procedure usage by the crew

and

(2) the minimum amount of tube leakage that, if exceeded, would exceed the System Degradation EAL criteria in EPIP-1, "Emergency Plan Classification Logic?"

(Assume the tube leakage is the only RCS leakage present.)

A. (1) Transition to E-3, "Steam Generator Tube Rupture."
(2) 10 gpm

B. (1) Transition to E-3, "Steam Generator Tube Rupture."
(2) 25 gpm

C. (1) Implement AOI-33, "Steam Generator Tube Leak," in parallel with the performance of ES-0.3.
(2) 10 gpm

D✓ (1) Implement AOI-33, "Steam Generator Tube Leak," in parallel with the performance of ES-0.3.
(2) 25 gpm

DISTRACTOR ANALYSIS:

A. *Incorrect, Plausible if the applicant thinks that transitioning to E-3, (which is the correct procedure to address a SGTR), is a correct procedure transition. However, E-3 in not a direct entry EOP. E-3 can only be entered after an SI has been initiated and after completing E-0, "Reactor Trip or Safety Injection." However, 10 gpm is the threshold for unidentified leakage (as defined in Tech Specs). Steam generator tube leakage is identified in Tech Specs as "identified" leakage.*

B. *Incorrect, Plausible if the applicant thinks that transitioning to E-3, (which is the correct procedure to address a SGTR), is a correct procedure transition. However, E-3 in not a direct entry EOP. E-3 can only be entered after an SI has been initiated and after completing E-0, "Reactor Trip or Safety Injection." Also 25 gpm is the threshold value for an NOUE due to identified leakage.*

C. *Incorrect, Plausible because using AOI-33 in parallel with ES-0.2 is correct. However 10 gpm is the threshold for unidentified leakage (as defined in Tech Specs). Steam generator tube leakage is identified in Tech Specs as "identified" leakage.*

D. *Correct, AOIs can be used in parallel with the emergency procedures after ES-0.1 is entered. Also 25 gpm is the threshold value for an NOUE due to identified leakage.*

Question Number: 85

Tier: 1 **Group** 2

K/A: W/E10 G 2.4.8
Natural Circulation with Steam Void in Vessel with/without RVLIS
Knowledge of how abnormal operating procedures are used in conjunction with EOPs.

Importance Rating: 3.8 / 4.5

10 CFR Part 55: N/A

10CFR55.43.b: 5

K/A Match: This question matches the K/A by having the candidate determine the correct use of AOPs and EOPs in conjunction with one another. SRO because it requires 'Assessing plant conditions (normal, abnormal, or emergency) and then selecting a procedure or section of a procedure to mitigate, recover, or with which to proceed by having the candidate determine the criteria for an emergency classification' and because it requires knowledge of the criteria which

K/A Match: This question matches the K/A by having the candidate determine the correct use of AOPs and EOPs in conjunction with one another. SRO because it requires 'Assessing plant conditions (normal, abnormal, or emergency) and then selecting a procedure or section of a procedure to mitigate, recover, or with which to proceed by having the candidate determine the criteria for an emergency classification' and because it requires knowledge of the criteria which would result in declaring an emergency classification.

Technical Reference: ES-0.3, Natural Circulation Cooldown With Steam Void in Vessel (with RVLIS), Revision 0011
AOI-33, Steam Generator Tube Leak, Revision 0034
E-3, Steam Generator Tube Rupture, Revision 0023
TI-12.04 User's Guide For Abnormal And Emergency Operating Instructions, Revision 0010
EPIP-1, Emergency Plan Classification Logic, Revision 0035 Attach 2

Proposed references to be provided: None

Learning Objective: 3-OT-PCD-048C
1. Classify emergency events

Cognitive Level:

Higher ____
Lower X

Question Source:

New ____
Modified Bank ____
Bank X

Question History: WBN bank question W/E09 AG2.3.11 modified.

Comments:

1.0 PURPOSE

This Instruction provides actions to terminate leakage of reactor coolant into the secondary system following a Steam Generator Tube Rupture.

2.0 SYMPTOMS AND ENTRY CONDITIONS

2.1 Indications

A. Steam generator radiation high:

1. Condenser vacuum exhaust radiation,
2. Steam generator blowdown radiation,
3. Steam generator discharge radiation,
4. Radiation Protection survey of main steam or blowdown lines, or
5. Chemistry sample of steam generator blowdown. PLAUSIBLE

B. Rising steam generator level with no AFW flow.

But

2.2 Transitions

A. E-0, Reactor Trip or Safety Injection.

B. E-1, Loss of Reactor or Secondary Coolant.

C. E-2, Faulted Steam Generator Isolation.

D. ES-1.2, Post LOCA Cooldown and Depressurization.

E. ES-3.1, Post-SGTR Cooldown Using Backfill.

F. ES-3.2, Post-SGTR Cooldown Using Blowdown.

G. ES-3.3, Post-SGTR Cooldown Using Steam Dump.

H. ECA-2.1, Uncontrolled Depressurization of All Steam Generators.

I. ECA-3.1, SGTR And LOCA - Subcooled Recovery.

J. ECA-3.2, SGTR And LOCA - Saturated Recovery.

K. ECA-3.3, SGTR Without Pzr Pressure Control.

L. FR-H.3, Steam Generator High Level.

NO TRANSISTION FROM ES-0.3

2.0 SYMPTOMS

2.1 Alarms

A. VAC PMP EXH 1-RM-119 RAD HI [175-B]

B. SG BLDN 1-RM-120/121 LIQ RAD HI [178-A]

C. SG 1 DISCH RE-421 RAD HI [265-C]

D. SG 2 DISCH RE-422 RAD HI [266-C]

E. SG 3 DISCH RE-423 RAD HI [267-C]

F. SG 4 DISCH RE-424 RAD HI [268-C]

G. PZR LEVEL HI/LO [92-A]

2.2 Indications

A. Vacuum Pump exhaust rad monitor RISING

B. SG Blowdown rad monitors RISING

C. SG Discharge rad monitors RISING

D. Chemistry analysis indicates SG tube leak

E. Feedwater flow to all four loops NOT EQUAL

F. Charging flow RISING

G. Makeup to VCT ELEVATED

2.3 Automatic Actions

A. High radiation diverts SGBD from cooling tower blowdown to condensate demineralizer inlet.

2.7 Prudent Operator Actions (continued)

10. When an ATWS event is in progress and after the crew has attempted to open the reactor trip breakers from the second reactor trip hand switch and the trip is unsuccessful, the response should be as follows:

    a. The RO starts inserting control rods.

    b. The BOP/CRO immediately trips the turbine, then starts AFW,

B. In deciding if taking prudent action is appropriate, the following elements should be considered as a whole:

1. Plant safety status should be maintained or enhanced. Prudent mitigation or preemptive action should **NOT** degrade plant status or put the plant in a less safe state or challenge it more than the initiating event. It should **NOT** cause a RED or ORANGE path critical safety function condition. For example, closing the MSIV's to isolate the steam dumps at 100% power would challenge the plant more than the original problem by lifting pressurizer and S/G safeties and causing an overheat and load rejection event. However, in Modes 3, closing the MSIV's to stop an uncontrolled cooldown and positive reactivity addition would have minimal impact on plant status, while enhancing reactor safety.

2. Prudent operator actions should be consistent with procedural guidance for similar situations. For example, if a steamline break occurs in Mode 3 and S/G pressure is approaching 675 psig, a manual MSIV Isolation would anticipate the automatic response and is consistent with procedural guidance and plant design response.

3. The operator should consult nearby personnel who are suitably qualified and notify them of their proposed actions. If no disagreement is forthcoming, he should then take the necessary mitigation or preemptive actions to terminate the event.

4. The STAR principle should be applied --Stop, Think, Act, Review. Ask yourself: If I take this action, could I inadvertently cause other more severe problems? Am I better off taking no action at all? How will safety status be affected?

2.8 Use of AOIs While in EOIs

1. During performance of the ES-0.1, if plant conditions warrant implementation of an AOI, then the required AOI may be performed concurrently (on a not-to-interfere basis) with the EOIs.

2.8 Use of AOIs While in EOIs (continued)

2. When running an AOI concurrently with an EOI (ECA-0.0, ES-0.1, etc.) the Unit Supervisor/SRO will assign the BOP/CRO operator responsibility for the AOI if another Unit Supervisor is **NOT** available. If the BOP/CRO operator performs an AOI, he/she should consult directly with the Unit Supervisor and give them the status as required by the AOI.

3. When an AOI in effect directs a Reactor Trip, then the performance of the AOI should continue immediately following transition to ES-0.1. Performance assignments will be at the discretion of the SM/US based on the status and importance of events in progress.

4. When implementing an AOI outside the "horseshoe" in the control room, the Unit Supervisor should accompany the board operator to read the procedure steps and direct actions of the operator, unless higher priority conditions demanding the Unit Supervisor's attention exist; in which case the BOP/CRO should implement the AOI using the single performer method. The actively licensed STA may serve as a reader unless the crew is in progress of performing actions within the EOI network.

3.0 RECORDS

None.

4.0 DEFINITIONS

This section contains definitions of terms presented in this Instruction and is applicable to this instruction only.

CONTINGENCY ACTIONS - Operator actions provided by the EOIs that are to be performed when the preferred actions can **NOT** be performed. Contingency actions are normally presented in the RNO column. Contingency actions are normally presented in the **IF...THEN** logic format when multiple contingency actions are provided.

CONTROL ROOM TEAM - Those personnel assigned to duties in the Main Control Room as a normal part of their position. These personnel are primarily responsible for ensuring that accident mitigation progresses smoothly and is technically accurate. The team is normally headed by an SM who has primary responsibility for progression of the accident mitigation. Additionally, the team normally consists of one US, one STA and two UOs.

EMERGENCY OPERATING INSTRUCTION (EOI) - The individual instructions making up the EOI network. These instructions fall into two basic categories: event based instructions and symptom based instructions.

Attachment 2
(Page 5 of 7)

	2.5 RCS Unidentified Leakage	
	Mode	**Initiating/Condition**
GENERAL		*Refer to "Fission Product Barrier Matrix"*
SITE		*Refer to "Fission Product Barrier Matrix"*
ALERT		*Refer to "Fission Product Barrier Matrix"*
UNUSUAL EVENT	1,2 3,4, *5	**Unidentified <u>or</u> pressure boundary RCS leakage >10 GPM** 1. Unidentified or pressure boundary leakage (as defined by Tech. Spec.) >10 GPM as indicated below **(a or b)** a. 1-SI-68-32 results b. With RCS Temperature <u>**and**</u> PZR Level Stable, VCT Level Dropping at a Rate >10 GPM **Note: Applies to Mode 5 if RCS Pressurized*

Distractor

2.6 RCS Identified Leakage	
Mode	**Initiating/Condition**
	Refer to "Fission Product Barrier Matrix"
	Refer to "Fission Product Barrier Matrix"
	Refer to "Fission Product Barrier Matrix"
1,2, 3,4, *5	**Identified RCS leakage >25 GPM** 1. Identified RCS leakage (as defined by Tech. Spec.) >25 GPM **(a or b)** *a.* 1-SI-68-32 results b. Level rise in excess of 25 GPM total into PRT, RCDT or CVCS Holdup Tank **Note: Applies to Mode 5 if RCS Pressurized*

CORRECT

Given the following: WBN BANK QUESTION

- The Unit 1 operating crew is performing ES-0.2, "Natural Circulation Cooldown," following a fire in the RCP Electrical Board housing that prevents the use of the RCPs.

- The Chem Lab reports increasing radiation level in Steam Generator #2.

Which ONE of the following identifies...

(1) the appropriate procedure usage by the crew

and

(2) the minimum amount of tube leakage that if exceeded would result in the initiation of an NOUE. (Assuming the tube leakage is the only RCS leakage present.)

A. (1) Transition to ES-0.3, "Natural Circulation Cooldown With Steam Void in Vessel (with RVLIS)."
(2) 10 gpm

B. (1) Transition to ES-0.3, "Natural Circulation Cooldown With Steam Void in Vessel (with RVLIS)."
(2) 25 gpm

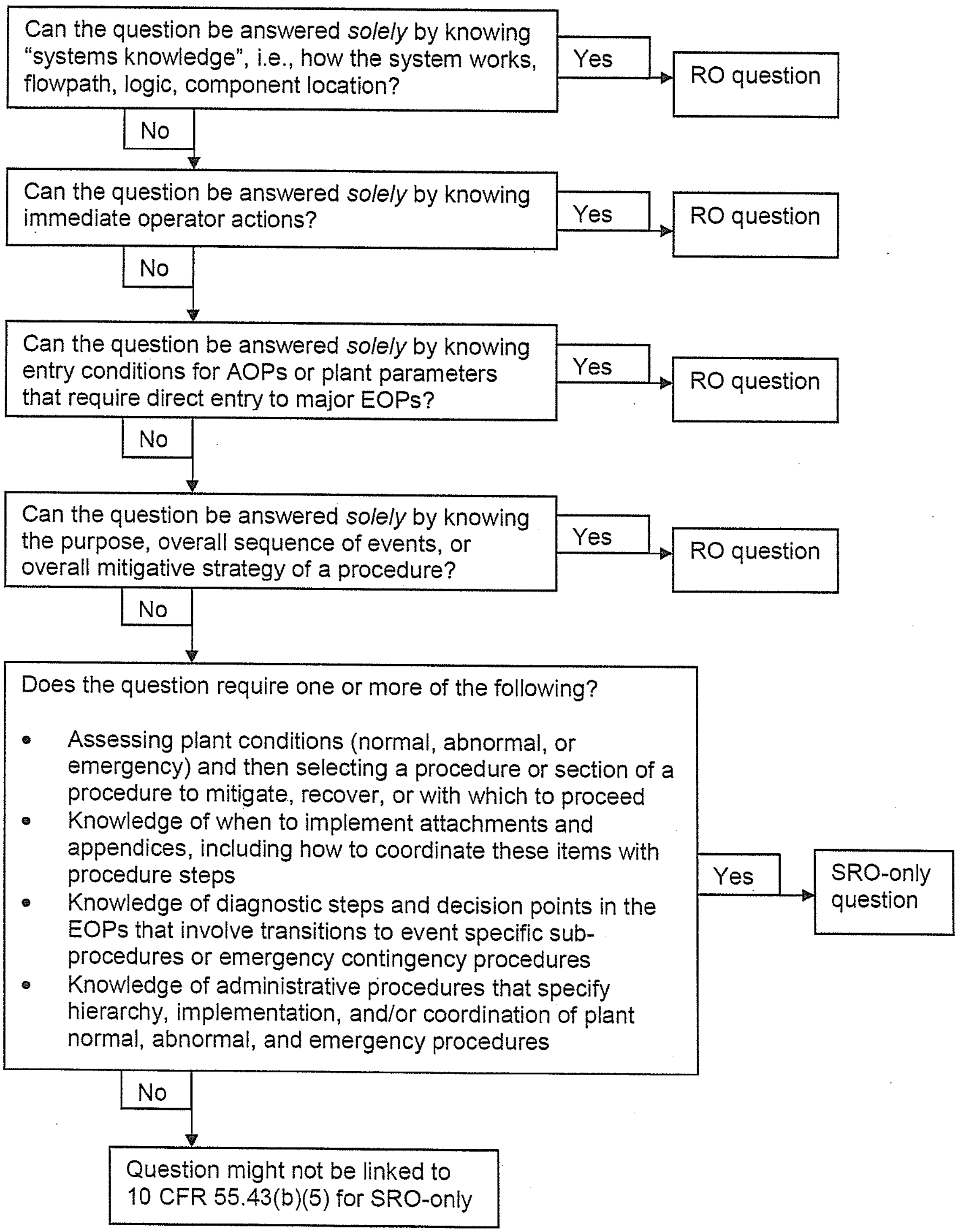
C. (1) Implement AOI-33, "Steam Generator Tube Leak," in parallel with the performance of ES-0.2.
(2) 10 gpm

D.✓ (1) Implement AOI-33, "Steam Generator Tube Leak," in parallel with the performance of ES-0.2.
(2) 25 gpm

V. TRAINING OBJECTIVES

1. Classify emergency events.
2. Recognize the reasons for having the Radiological Emergency Plan (REP).
3. Identify the functions of the onsite emergency response facilities.
4. Formulate Protective Action Recommendations (PARs).
5. Use the WBN Emergency Plan Implementing Procedures (EPIPs).
6. State three Site Emergency Director responsibilities that cannot be delegated.
7. Identify Operation's responsibilities for the following emergency response positions:
   - Site Emergency Director (who is initially the SM)
   - Operations Manager in the TSC
   - Control Room Communicator in the Control Room
   - Operations Communicator in the TSC
   - OSC Operations Advisor
   - Operation's emergency response team assignments
   - NOMS Logkeeper in the Control Room (when available)
   - Technical Advisor
   - Designated Phone Talker
8. Recognize how AUOs are dispatched and controlled during radiological emergencies.
9. Recognize REP communications guidelines (OPDP-1).
10. Demonstrate effective communication techniques used in emergency response.
11. Identify lessons learned from TVA/industry events, drills and exercises.
12. Recall where radios can and cannot be used at WBN (BP-364).
13. Use the Integrated Computer System (ICS).
14. Identify <u>all locations</u> where the Emergency Paging System (EPS) may be activated from and demonstrate the use of the EPS to include the printed report from the TSC.
15. Using WBN EPIPs 2, 3, 4, and 5, recognize who is responsible to activate the Emergency Paging System.
16. Recognize conditions which constitute activation of the emergency response facilities regardless of the time of day when an emergency has been declared.
17. Identify and use the back-up Emergency Response Organization call lists used when the Emergency Paging System has failed.

Figure 2: Screening for SRO-only linked to 10 CFR 55.43(b)(5) (Assessment and selection of procedures)



86. 003 G2.2.25 086

Given the following:

- A heatup is being performed on Unit 1 with the RCS temperature currently at 365°F.
- All Shutdown Bank Rods are withdrawn to the full out position.

Which ONE of the following identifies the required status of the Reactor Coolant Pumps and the bases for the requirement?

A. Two RCPs operable with at least one in service to ensure adequate decay heat removal capability.

B. Two RCPs operable with at least one in service due to the postulation of a power excursion because of an inadvertent control rod withdrawal.

C. Two RCPs operable with both in service to ensure adequate decay heat removal capability.

D✓ Two RCPs operable with both in service due to the postulation of a power excursion because of an inadvertent control rod withdrawal.

DISTRACTOR ANALYSIS:

A. *Incorrect, Plausible because in Mode 3 if the reactor trip breakers had been open the minimum RCP required status is for two RCPs to be operable with at least one in service and the bases for the current conditions is due to the postulation of a power excursion because of an inadvertent control rod withdrawal.*

B. *Incorrect, Plausible because in Mode 3 if the reactor trip breakers had been open the minimum RCP required status is for two RCPs to be operable with at least one in service and the bases is to ensure adequate decay heat removal capability. While one RCP can provide the circulation to remove the heat, the second RCP is required to be in operable prior to closing the reactor trip breakers for redundancy.*

C. *Incorrect, Plausible because in Mode 3, Tech Spec LCO 3.4.5 does require two RCPs to be operable and a bases is to ensure adequate decay heat from removal. But one RCP running can provide the circulation to remove the decay heat. With the Reactor trip breakers closed and the control rod capable of being withdrawn, two operable RCPs are required to be in service due to the postulation of a power excursion because of an inadvertent control rod withdrawal.*

D. *Correct, The unit is in Mode 3 with the Reactor trip breakers closed and the control rod capable of being withdrawn. Tech Spec LCO 3.4.5 requires two RCPs to be operable with both in service and a bases is due to the postulation of a power excursion because of an inadvertent control rod withdrawal.*

Question Number: 86

Tier: 2 **Group** 1

K/A: G2.2.25
Reactor Coolant Pump System
Equipment Control
Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.

Importance Rating: 3.2 / 4.2

10 CFR Part 55: 41.5 / 41.7 / 43.2

10CFR55.43.b: 2

K/A Match: K/A is matched and is SRO because the question requires knowledge of the bases in Technical Specifications for the RCPs.

Technical Reference: Tech Spec LCO 3.4.5 RCS Loops - MODE 3, Amendment 61
Tech Spec B 3.4.5 RCS Loops - MODE 3, Revision 82

Proposed references to be provided: None

Learning Objective: 3-OT-T/S0304
1. Demonstrate the ability to extract specific information from the Technical Specifications and Technical Requirements, as they pertain to RCS.
2. Determine the bases for each specification, as applicable, to the RCS.

Cognitive Level:
Higher X
Lower ___

Question Source:
New X
Modified Bank ___
Bank ___

Question History: New question for the WBN 10/2011 NRC exam

Comments:

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.5 RCS Loops - MODE 3

LCO 3.4.5 Two RCS loops shall be OPERABLE, and either:

a. Two RCS loops shall be in operation when the Rod Control System is capable of rod withdrawal; or

b. One RCS loop shall be in operation when the Rod Control System is not capable of rod withdrawal.

-----NOTE-----
All reactor coolant pumps may be de-energized for ≤ 1 hour per 8 hour period provided:

a. No operations are permitted that would cause reduction of the RCS boron concentration; and

b. Core outlet temperature is maintained at least 10°F below saturation temperature.

APPLICABILITY: MODE 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TI
A. One required RCS loop inoperable.	A.1 Restore required RCS loop to OPERABLE status.	72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 4.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One required RCS loop not in operation, and reactor trip breakers closed and Rod Control System capable of rod withdrawal.	C.1 Restore required RCS loop to operation. <u>OR</u> C.2 De-energize all control rod drive mechanisms (CRDMs).	1 hour 1 hour
D. All RCS loops inoperable. <u>OR</u> No RCS loop in operation.	D.1 De-energize all CRDMs. <u>AND</u> D.2 Suspend all operations involving a reduction of RCS boron concentration. <u>AND</u> D.3 Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.5.1	Verify required RCS loops are in operation.	12 hours

(continued)

SURVEILLANCE		FREQUENCY
SR 3.4.5.2	Verify steam generator secondary side water levels are greater than or equal to 32% narrow range for required RCS loops.	12 hours
SR 3.4.5.3	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	7 days

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.5 RCS Loops - MODE 3

BASES

BACKGROUND

In MODE 3, the primary function of the reactor coolant is removal of decay heat and transfer of this heat, via the steam generator (SG), to the secondary plant fluid. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops, connected in parallel to the reactor vessel, each containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The reactor vessel contains the clad fuel. The SGs provide the heat sink. The RCPs circulate the water through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and prevent fuel damage.

In MODE 3, RCPs are used to provide forced circulation for heat removal during heatup and cooldown. The MODE 3 decay heat removal requirements are low enough that a single RCS loop with one RCP running is sufficient to remove core decay heat. However, two RCS loops are required to be OPERABLE to ensure redundant capability for decay heat removal. Distraction

APPLICABLE SAFETY ANALYSES

Whenever the reactor trip breakers (RTBs) are in the closed position and the control rod drive mechanisms (CRDMs) are energized, an inadvertent rod withdrawal from subcritical, resulting in a power excursion, is possible. Such a transient could be caused by a malfunction of the rod control system. In addition, the possibility of a power excursion due to the ejection of an inserted control rod is possible with the breakers closed or open. Such a transient could be caused by the mechanical failure of a CRDM.

Therefore, in MODE 3 with RTBs in the closed position and Rod Control System capable of rod withdrawal, accidental control rod withdrawal from subcritical is postulated and requires at least two RCS loops to be OPERABLE and in operation to ensure that the accident analyses limits are

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

met. For those conditions when the Rod Control System is not capable of rod withdrawal, two RCS loops are required to be OPERABLE, but only one RCS loop is required to be in operation to be consistent with MODE 3 accident analyses.

Failure to provide decay heat removal may result in challenges to a fission product barrier. The RCS loops are part of the primary success path that functions or actuates to prevent or mitigate a Design Basis Accident or transient that either assumes the failure of, or presents a challenge to, the integrity of a fission product barrier.

RCS Loops - MODE 3 satisfy Criterion 3 of the NRC Policy Statement.

LCO

The purpose of this LCO is to require that at least two RCS loops be OPERABLE. In MODE 3 with the RTBs in the closed position and Rod Control System capable of rod withdrawal, two RCS loops must be in operation. Two RCS loops are required to be in operation in MODE 3 with RTBs closed and Rod Control System capable of rod withdrawal due to the postulation of a power excursion because of an inadvertent control rod withdrawal. The required number of RCS loops in operation ensures that the Safety Limit criteria will be met for all of the postulated accidents.

ANSWER

With the RTBs in the open position, or the CRDMs de-energized, the Rod Control System is not capable of rod withdrawal; therefore, only one RCS loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. An additional RCS loop is required to be OPERABLE to ensure adequate decay heat removal capability.

The Note permits all RCPs to be de-energized for ≤ 1 hour per 8 hour period. The purpose of the Note is to perform tests that are designed to validate various accident analyses values. One of these tests is validation of the pump coastdown curve used as input to a number of accident analyses including a loss of flow accident. This test is generally performed in MODE 3 during the initial startup testing program, and as such should only be performed once.

(continued)

BASES

LCO (continued)

If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values of the coastdown curve must be revalidated by conducting the test again. The 1 hour time period specified is adequate to perform the desired tests, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of the Note is permitted provided the following conditions are met, along with any other conditions imposed by initial startup test procedures:

a. No operations are permitted that would dilute the RCS boron concentration, thereby maintaining the margin to criticality. Boron reduction is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and

b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

An OPERABLE RCS loop consists of one OPERABLE RCP and one OPERABLE SG, which has the minimum water level specified in SR 3.4.5.2. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 3, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. The most stringent condition of the LCO, that is, two RCS loops OPERABLE and two RCS loops in operation, applies to MODE 3 with RTBs in the closed position. The least stringent condition, that is, two RCS loops OPERABLE and one RCS loop in operation, applies to MODE 3 with the RTBs open.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2";
LCO 3.4.6, "RCS Loops - MODE 4";
LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";

(continued)

BASES

APPLICABILITY (continued)

LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1

If one required RCS loop is inoperable, redundancy for heat removal is lost. The Required Action is restoration of the required RCS loop to OPERABLE status within the Completion Time of 72 hours. This time allowance is a justified period to be without the redundant, nonoperating loop because a single loop in operation has a heat transfer capability greater than that needed to remove the decay heat produced in the reactor core and because of the low probability of a failure in the remaining loop occurring during this period.

B.1

If restoration is not possible within 72 hours, the unit must be brought to MODE 4. In MODE 4, the unit may be placed on the Residual Heat Removal System. The additional Completion Time of 12 hours is compatible with required operations to achieve cooldown and depressurization from the existing plant conditions in an orderly manner and without challenging plant systems.

C.1 and C.2

If the required RCS loop is not in operation, and the RTBs are closed and Rod Control System capable of rod withdrawal, the Required Action is either to restore the required RCS loop to operation or to de-energize all CRDMs by opening the RTBs or de-energizing the motor generator (MG) sets. When the RTBs are in the closed position and Rod Control System capable of rod withdrawal, it is postulated that a power excursion could occur in the event of an inadvertent control rod withdrawal. This mandates having the heat transfer capacity of two RCS loops in operation. If only one loop is in operation, the RTBs must be opened. The Completion Times of 1 hour to restore the required RCS loop to operation or de-energize all CRDMs is adequate to perform these operations in an orderly manner without exposing the unit to risk for an undue time period.

(continued)

BASES

ACTIONS (continued)

D.1, D.2, and D.3

If all RCS loops are inoperable or no RCS loop is in operation, except as during conditions permitted by the Note in the LCO section, all CRDMs must be de-energized by opening the RTBs or de-energizing the MG sets. All operations involving a reduction of RCS boron concentration must be suspended, and action to restore one of the RCS loops to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and opening the RTBs or de-energizing the MG sets removes the possibility of an inadvertent rod withdrawal. The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.5.1

This SR requires verification every 12 hours that the required loops are in operation. Verification includes flow rate, temperature, and pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS loop performance.

SR 3.4.5.2

SR 3.4.5.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is greater than or equal to 32% (value does not account for instrument error, Ref. 1) for required RCS loops. If the SG secondary side narrow range water level is less than 32%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink for removal of the decay heat. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to a loss of SG level.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.5.3

Verification that the required RCPs are OPERABLE ensures that safety analyses limits are met. The requirement also ensures that an additional RCP can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power availability to the required RCPs.

REFERENCES

1. Watts Bar Drawing 1-47W605-242, "Electrical Tech Spec Compliance Tables."

I. **PROGRAM**

WATTS BAR OPERATOR TRAINING

II. **COURSE**

A. License Training
B. Licensed Requalification

III. **TITLE**

T/S 3.4, "Reactor Coolant System," Bases, and Technical Requirements Manual

IV. **LENGTH OF LESSON**

A. License Training 1 Hour

Licensed Requalification time will be determined after objectives are identified.

V. **TRAINING OBJECTIVES**

AUO	RO	SRO	STA	
	X	X	X	00. Demonstrate an understanding of NUREG 1122 knowledge's and abilities associated with the Reactor Vessel that are rated $\geq$2.5 during Initial License Training and $\geq$3.0 during License Operator Requalification Training for the appropriate license position as identified in Appendix A.
	X	X	X	1. Demonstrate the ability to extract specific information from the Technical Specifications and Technical Requirements, as they pertain to RCS.
		X	X	2. Determine the bases for each specification, as applicable, to the RCS.
		X	X	3. Given plant conditions/parameters correctly determine the OPERABILITY of components associated with RCS.
	X	X	X	4. Given plant conditions and parameters correctly determine the applicable Limiting Conditions for Operations or Technical Requirements for the various components of the RCS.

Figure 1: Screening for SRO-only linked to 10 CFR 55.43(b)(2) (Tech Specs)

Can question be answered *solely* by knowing ≤ 1 hour TS/TRM Action?

Yes → RO question

No

Can question be answered *solely* by knowing the LCO/TRM information listed "above-the-line?"

Yes → RO question

No

Can question be answered *solely* by knowing the TS Safety Limits?

Yes → RO question

No

Does the question involve one or more of the following for TS, TRM, or ODCM?

- Application of Required Actions (Section 3) and Surveillance Requirements (Section 4) in accordance with rules of application requirements (Section 1)
- Application of generic LCO requirements (LCO 3.0.1 thru 3.0.7 and SR 4.0.1 thru 4.0.4)
- Knowledge of TS bases that is required to analyze TS required actions and terminology

Yes → SRO-only question

No

Question might not be linked to 10 CFR 55.43(b)(2) for SRO-only

87. 006 A2.12 087

Given the following:

- A Reactor Trip and Safety Injection occurred while Unit 1 was operating at 100% power.
- The crew is currently performing ECA-3.1, "SGTR and LOCA Subcooled Recovery," with safety injection termination in progress.
- RCS T-hot is 400°F.
- Maximum containment pressure reached during the event is 2.3 psid.
- After stopping the first charging pump, RCS subcooling drops and stabilizes at 64°F.

Which ONE of the following identifies the action required in accordance with ECA-3.1?

A.✓ Restart the charging pump and continue with ECA-3.1.

B. Leave charging pump off and continue with ECA-3.1.

C. Restart the charging pump and transition to ECA-3.2, "SGTR and LOCA Saturated Recovery."

D. Leave charging pump off and transition to ECA-3.2, "SGTR and LOCA Saturated Recovery."

DISTRACTOR ANALYSIS:

A. *Correct, With RCS subcooling less than 85°F, ECA-3.1, via the foldout page, will direct the charging pump to be restarted and the procedure will be continued.*

B. *Incorrect, Plausible because the next actions in the procedure are to determine if an SI pump can be stopped. But to stop the pump, at least 85°F subcooling is required.*

C. *Incorrect, Plausible because restarting the charging pump is correct and the transition to ECA-3.2 is plausible because there are conditions that if encountered while performing ECA-3.1 that will result in a transition to ECA-3.2.*

D. *Incorrect, Plausible because the next actions in the procedure are to determine if an SI pump can be stopped. But to continue, at least 85°F subcooling is required. The transition to ECA-3.2 is plausible because there are conditions that if encountered while performing ECA-3.1 that will result in a transition to ECA-3.2.*

Question Number: 87

Tier: 2 **Group** 1

K/A: 006 A2.12
Emergency Core Cooling System
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:
Conditions requiring actuation of ECCS

Importance Rating: 4.5 / 4.8

10 CFR Part 55: 41.5 / 45.5

10CFR55.43.b: 5

K/A Match: K/A is matched because the question requires the ability to recognize action requiring actuation of the ECCS as directed on the emergency instruction fold out page and is SRO because it requires knowledge of the requirements for selecting the procedure with which to proceed or implement.

Technical Reference: ECA-3.1, SGTR and LOCA Subcooled Recovery, Revision 0012

Proposed references to be provided:	None
Learning Objective:	3-OT-ECA0301 2. Given a set of plant conditions, use procedures ECA-3.1, 3.2, and 3.3 to identify any required procedure transition.

Cognitive Level:

Higher	X
Lower	

Question Source:

New	X
Modified Bank	
Bank	

Question History: New question for the WBN 10/2011 NRC exam.

Comments:

NOTE

- After a charging pump is stopped, RCS press should be allowed to stabilize or rise before stopping another ECCS pump.
- The CCPs and SI pumps should be stopped on alternate trains when possible.

Step	Action/Expected Response	Response Not Obtained
23.	**DETERMINE** if charging pump shutdown criteria met:	
	a. **CHECK** both Charging pumps RUNNING.	a. **IF** one or both charging pumps stopped, **THEN** ** **GO TO** Notes prior to Step 25.
	b. **CHECK** at least one SI pump RUNNING.	b. **IF** both SI pumps stopped, **THEN** ** **GO TO** Step 24.

	c. **CHECK** RCS subcooling greater than 81°F [102°F ADV].	c. **IF** T-hot greater than 340°F, **THEN**
		** **GO TO** Step 36.
		IF T-hot less than 340°F **AND** both RHR pumps stopped, **THEN**
		START one RHR pump.
		IF NOT able to start one RHR pump, **THEN**
		** **GO TO** Step 36.

Step continued on next page

Step	Action/Expected Response	Response Not Obtained
23.	(continued)	
	d. **CHECK** pzr level greater than 29% [47% ADV].	d. ** **GO TO** Caution prior to Step 20.
	e. **STOP** one Charging pump.	
	f. ** **GO TO** Notes prior to Step 25.	

Step	Action/Expected Response	Response Not Obtained
24.	**DETERMINE** if one charging pump should be shutdown:	
	a. **CHECK** both Charging pumps RUNNING.	a. **IF** one or both charging pumps stopped, **THEN** ** **GO TO** Notes prior to Step 25.
	b. **CHECK** both SI pumps STOPPED.	b. **IF** at least one SI pumps running, **THEN** ** **GO TO** Notes prior to Step 23.

	c. **CHECK** RCS subcooling greater than 118°F [141°F ADV].	c. **IF** T-hot greater than 340°F, **THEN**
		
		** **GO TO** Step 36.
		
		IF T-hot less than 340°F **AND** both RHR pumps stopped, **THEN**
		
		START one RHR pump.
		
		IF NOT able to start one RHR pump, **THEN**
		
		** **GO TO** Step 36.

	d. **CHECK** pzr level greater than 29% [47% ADV].	d. ** **GO TO** Caution prior to Step 20.
	e. **STOP** one Charging pump.	

Step	Action/Expected Response	Response Not Obtained

NOTE

- If RCS subcooling greater than 85°F [106°F ADV], then RCS depressurization may be continued to maintain pzr level.
- RCS press should be allowed to stabilize or rise before SI pump stopped.

Step	Action/Expected Response	Response Not Obtained
25.	**DETERMINE** if SI pump shutdown criteria met:	
	a. **CHECK** both SI pumps RUNNING.	a. **IF** both SI pumps stopped, **THEN** ** **GO TO** Notes prior to Step 27. **IF** one SI pump stopped, **THEN** ** **GO TO** Notes prior to Step 26.

	b. **CHECK** RCS subcooling greater than 85°F [106°F ADV].	b. **IF** T-hot greater than 340°F, **THEN**
		** **GO TO** Step 36.
		IF T-hot less than 340°F **AND** both RHR pumps stopped, **THEN**
		START one RHR pump.
		IF NOT able to start one RHR pump, **THEN**
		** **GO TO** Step 36.

	c. **CHECK** pzr level greater than 29% [47% ADV].	c. ** **GO TO** Caution prior to Step 20.
	d. **STOP** one SI pump.	

" "

Either PATH will continue in ECA-1.1 & eventually restart the CCP

NOTE

- If RCS subcooling greater than 188°F [213°F ADV], then RCS depressurization may be continued to maintain pzr level.
- RCS press should be allowed to stabilize or rise before SI pump stopped.

Step	Action/Expected Response	Response Not Obtained
26.	**DETERMINE** if remaining SI pump should be stopped:	
	a. **CHECK** one SI pump RUNNING.	a. **IF** both SI pumps stopped, **THEN** ** **GO TO** Notes prior to Step 27.
	b. **CHECK** one Charging pump RUNNING.	b. **IF** both charging pumps stopped, **THEN** ** **GO TO** Step 36.

	c. **CHECK** RCS subcooling greater than 188°F [213°F ADV].	c. **IF** T-hot greater than 340°F, **THEN**
		** **GO TO** Step 36.
		IF T-hot less than 340°F **AND** both RHR pumps stopped, **THEN**
		START one RHR pump.
		IF NOT able to start one RHR pump, **THEN**
		** **GO TO** Step 36.

	d. **CHECK** pzr level greater than 29% [47% ADV].	d. ** **GO TO** Caution prior to Step 20.
	e. **STOP** remaining SI pump.	

NOTE

- If RCS subcooling greater than 57°F [77°F ADV] and pzr level less than 63% [58% ADV], then RCS depressurization may be continued.
- RCS pressure should be allowed to stabilize or rise before charging is established.

Step	Action/Expected Response	Response Not Obtained
27.	**CHECK** if normal charging should be established:	
	a. **CHECK** both of the following criteria met: • Both SI pumps STOPPED. • ONLY one charging pump RUNNING.	a. **DO NOT** align charging. ** **GO TO** Step 36.

	b. **CHECK** RCS subcooling greater than 57°F [77°F ADV].	b. **IF** T-hot greater than 340°F, **THEN**
		** **GO TO** Step 36.
		IF T-hot less than 340°F **AND** both RHR pumps stopped, **THEN**
		START one RHR pump.
		IF NOT able to start one RHR pump, **THEN**
		** **GO TO** Step 36.

	c. **CHECK** pzr level greater than 29% [47% ADV].	c. ** **GO TO** Caution prior to Step 20.

Step	Action/Expected Response	Response Not Obtained
28.	**ALIGN** charging:	
	a. **CLOSE** RCP seal flow control 1-FCV-62-89.	
	b. **OPEN** charging isolation valves 1-FCV-62-90 and 1-FCV-62-91.	
	c. **ENSURE** charging valve 1-FCV-62-85 or 1-FCV-62-86 OPEN.	
	d. **CHECK** RHR Suction aligned from RWST.	d. **IF** on RHR Containment Sump Recirc, **THEN** ** **GO TO** Step 29.
	e. **OPEN** seal return valves 1-FCV-62-61 and 1-FCV-62-63.	
29.	**CLOSE** BIT outlet valves 1-FCV-63-25 and 1-FCV-63-26.	
30.	**CONTROL** charging flow:	
	a. **ADJUST** 1-FCV-62-89 and 1-FCV-62-93 to establish: • Seal injection flow between 8 and 13 gpm for each RCP. • Pzr level stable or rising.	

Step	Action/Expected Response	Response Not Obtained
31.	**DETERMINE** if charging flow will maintain pzr level:	
	a. **IF** RHR pumps delivering flow to RCS in ECCS mode, **THEN** ** **GO TO** Step 36.	a. **IF** RHR pump **NOT** delivering flow due to RCS press higher than RHR pump discharge press, **OR** RHR pump aligned for RHR cooling, **THEN** **PERFORM** Substep 31b.
	b. **CONTROL** charging flow to maintain pzr level.	

CAUTION

- If seal injection and thermal barrier cooling had previously been lost to any RCP, that pump should **NOT** be started prior to TSC evaluation.
- Inadvertent critically may occur following any natural circulation cooldown if the first RCP started is in the Ruptured loop.

NOTE Either Loop 1 or 2 pzr spray valve is effective for Loop 2 RCP in service or for Loops 1, 3, & 4 RCPs in service.

32. **DETERMINE** RCP status:

CHECK RCP(s) RUNNING to provide normal pzr spray.

Response Not Obtained:

ESTABLISH normal pzr spray, Loop 2 preferred:

a. **IF** RVLIS less than 95%,**THEN**:

- **RAISE** pzr level greater than 90% **OR** UNTIL level stops rising.
- **RAISE** RCS subcooling to greater than 101°F [121°F ADV].
- **CONTROL** pzr heaters as necessary.

b. **ESTABLISH** RCP restart conditions (Loop 2 **OR** Loops 1, 3, and 4):

1) **REFER TO** Attachment 1, RCP Emergency Restart Criteria.

2) **START** RCP(s) oil lift pump two minutes prior to starting RCP.

Step continued on next page

32. (continued)

c. **WHEN** RCP restart conditions established, **THEN**:

   1) **START** RCP(s) to provide normal pzr spray (Loop 2 **OR** Loops 1, 3, and 4).

   2) **STOP** RCP(s) oil lift pump one minute after RCP start.

d. **IF** RCP can **NOT** be started, **THEN**

   MONITOR natural circulation:

   - RCS subcooling greater than 65°F [85°F ADV].
   - S/G press controlled or dropping.
   - T-hot stable or dropping.
   - Incore T/Cs stable or dropping.
   - T-cold at saturation temp for S/G press.

   IF natural circulation **NOT** established, **THEN**

   DUMP steam at a greater rate.

e. ** **GO TO** Step 33.

Step	Action/Expected Response	Response Not Obtained
33.	**CHECK** if RCS depressurization allowed: • RCS Subcooling greater than 75°F [95°F ADV]. • Pzr level less than 63% [58% ADV].	**IF** RCS depressurization **NOT** allowed, **THEN** ** **GO TO** Step 36.
34.	**IF** SI has been terminated, **THEN** **ISOLATE** cold leg accumulators prior to depressurizing the RCS to less than 950 psig:	
	a. **ENSURE** power to isolation valves restored USING Appendix B (ECA-3.1), CLA Breaker Operation.	
	b. **CLOSE** cold leg accumulator isolation valves.	b. **OPEN** any unisolated accumulator nitrogen makeup valve: • 1-FCV-63-127 accumulator 1. • 1-FCV-63-107 accumulator 2. • 1-FCV-63-87 accumulator 3. • 1-FCV-63-63 accumulator 4. **THEN** **OPEN** 1-FCV-63-65 vent header. **IF** accumulator can **NOT** be isolated or vented, **THEN** **CONSULT** TSC for contingency actions.

CAUTION Cycling of the pzr PORV should be minimized to ensure PORV reliability.

NOTE If RCPs are **NOT** running, the upper head region may void during RCS depressurization. This will result in a rapidly rising pzr level.

Step	Action/Expected Response	Response Not Obtained
35.	**CONTINUE** RCS depressurization:	
	a. **USE** normal pzr sprays to reduce break flow.	a. **IF** normal sprays **NOT** available, **THEN** **USE** one pzr PORV, **AND** **MONITOR** the following: • Vessel head void formation. • PRT rupture. **IF** both normal sprays **AND** PORVs **NOT** available, **THEN** **ALIGN** aux spray USING Appendix E (ECA-3.1) ALIGN AUX SPRAY.
	b. **OPERATE** pzr heaters as necessary.	

Step continued on next page

Step	Action/Expected Response	Response Not Obtained

35. (continued)

c. **WHEN** either of the following conditions met:

- RCS Subcooling less than 75°F [95°F ADV].

OR

- Pzr level greater than 63% [58% ADV],

THEN

STOP RCS depressurization.

36. **MONITOR** RCS makeup flow adequate:

Action/Expected Response	Response Not Obtained
a. **CHECK** RCS subcooling greater than 65°F [85°F ADV].	a. **RESTART** charging pumps or SI pumps as necessary. ** **GO TO** Step 37.
b. **CHECK** pzr level greater than 15% [33% ADV].	b. **RESTART** charging pumps or SI pumps as necessary. ** **GO TO** Caution prior to Step 20.

Step	Action/Expected Response	Response Not Obtained
37.	**DETERMINE** if cold leg accumulators should be isolated:	
	a. **ENSURE** power to isolation valves restored USING Appendix B (ECA-3.1), CLA Breaker Operation.	
	b. **CHECK** RCS pressure less than 1000 psig.	b. **WHEN** RCS pressure is less than 1000 psig, **THEN** **PERFORM** Substeps 37c thru e. ** **GO TO** Step 38.
	c. **CHECK** RCS subcooling greater than 65°F [85°F ADV].	c. **WHEN** RCS pressure is less than 250 psig, **THEN** **PERFORM** Substeps 37d and e. ** **GO TO** Step 38.
	d. **CHECK** pzr level greater than 15% [33% ADV].	d. ** **GO TO** Caution prior to Step 20.

Step continued on next page

Step	Action/Expected Response	Response Not Obtained
37.	(continued)	
	e. **CLOSE** cold leg accumulator isolation valves.	e. **OPEN** any unisolated accumulator nitrogen makeup valve: • 1-FCV-63-127 accumulator 1. • 1-FCV-63-107 accumulator 2. • 1-FCV-63-87 accumulator 3. • 1-FCV-63-63 accumulator 4. **THEN** **OPEN** 1-FCV-63-65, vent header. **IF** accumulator can **NOT** be isolated or vented, **THEN** **CONSULT** TSC for contingency actions.

Foldout Page
(Page 1 of 1)

SI REINITIATION CRITERIA

Manually **START** ECCS pumps as necessary:

- Pzr level can **NOT** be maintained greater than 15% [33% ADV],

  OR

- RCS subcooling less than 65°F [85°F ADV]

EVENT DIAGNOSTIC TRANSITIONS

- **IF** any S/G press low or dropping uncontrolled **AND**

  S/G has **NOT** been isolated, unless needed for RCS cooldown, **THEN**

  ** **GO TO** E-2, Faulted Steam Generator Isolation.

SUMP RECIRC SWITCHOVER CRITERIA

- **IF** RWST level less than 34%, **THEN**

  ** **GO TO** ES-1.3, Transfer to RHR Containment Sump.

AFW OPERATION

- **IF** CST volume less than 5000 gal, **THEN**

  MONITOR AFW pumps to ensure suction transfer.

I. PROGRAM

Watts Bar Operator Training

II. COURSE

A. License Training
B. Licensed Operator Requal

III. TITLE

Emergency Contingency Action Instruction (ECA)

- ECA-3.1, SGTR and LOCA - Subcooled Recovery
- ECA-3.2, SGTR and LOCA - Saturated Recovery
- ECA-3.3, SGTR Without PZR Pressure Control

IV. LENGTH OF LESSON

A.	License Training	4 Hours
B.	Licensed Operator Requal	(varies with number of objectives covered)

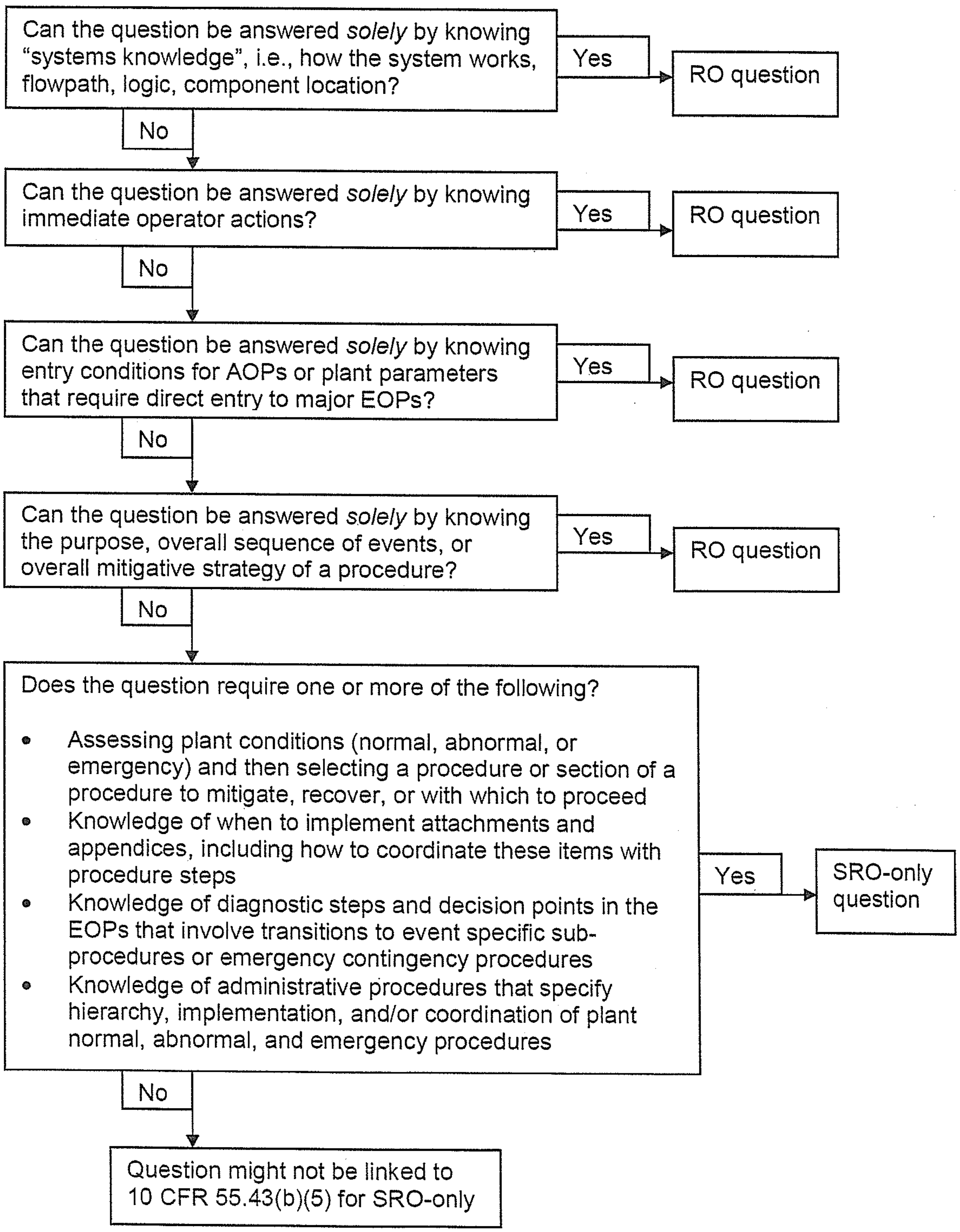
V. TRAINING OBJECTIVES

AUO	RO	SRO	STA	
	X	X	X	1. Describe the major actions of procedures ECA-3.1, 3.2, and 3.3 including the basis for each of the major actions.
	X	X	X	2. Given a set of plant conditions, use procedures ECA-3.1, 3.2, and 3.3 to identify any required procedure transition.
	X	X	X	3. Explain the purpose for stopping the cntmt spray pumps when cntmt press is verified less than 2.0 psid.
	X	X	X	4. Discuss the importance of maintaining NR level > 29% in a ruptured (non-faulted) S/G.
	X	X	X	5. Discuss the requirement to check RCS subcooling greater than 65°F prior to RCS depressurization.

V. TRAINING OBJECTIVES (continued)

AUO	RO	SRO	STA	
	X	X	X	6. Given values for RWST and Cntmt Sump levels, use ECA-3.1, Figure 1 to determine if subcooled recovery is appropriate and identify the basis for this criteria.
	X	X	X	7. Analyze and explain the process that leads to a new RCS equilibrium pressure following the shutdown of an ECCS pump during the SI reduction sequence.
	X	X	X	8. Describe how depressurization of the RCS might result in the capability to maintain PZR level when PZR level could not be maintained prior to depressurization.
	X	X	X	9. Explain why subcooling is minimized following the alignment of normal charging in procedures ECA-3.1 and 3.2.
	X	X	X	10. Explain the basis for using ruptured SG level greater than or equal to 85% as a basis for transition to ECA-3.2 SGTR and LOCA-saturated recovery.
	X	X	X	11. Given RCS incore T/C max temp, use ECA-3.2, Appendix D to determine saturation pressure for the RCS.
	X	X	X	12. Explain the major purpose in utilizing ECA-3.2 (Saturated Recovery) as compared to ECA-3.1 (Subcooled Recovery).
	X	X	X	13. Identify the 1 parameter that determines when SI should be terminated when performing procedure ECA-3.3.
	X	X	X	14. Explain the basis for terminating SI flow and balancing charging with letdown and seal leakoff flows during performance of ECA-3.3.

**Figure 2: Screening for SRO-only linked to 10 CFR 55.43(b)(5)
(Assessment and selection of procedures)**



88. 010 A2.01 088

Given the following:

- Unit 1 is operating at 100% power.
- Control Heater Bank 'D' is out of service and its breaker is tagged.
- The following annunciators alarm:

  90-B - PZR PRESS LO-DEVIN BACKUP HTRS ON
  14-E - M-1 THRU M-6 MOTOR TRIPOUT

- Backup Heater Bank 'C' 6.9kv breaker is determined to be tripped.

Assuming no operator action is taken, which ONE of the following identifies...

(1) how the heater failures would affect the control of pressurizer pressure

and

(2) the Basis for the Tech Spec LCO required to be entered?

A. (1) The pressure will be controlled less than 2235 psig.
(2) To maintain the RCS at or near normal operating pressure when accounting for heat losses through the pressurizer insulation.

B✓ (1) The pressure will be controlled less than 2235 psig.
(2) To ensure the core operates within the limits assumed in the safety analyses.

C. (1) The pressure will be returned to and controlled at 2235 psig.
(2) To maintain the RCS at or near normal operating pressure when accounting for heat losses through the pressurizer insulation.

D. (1) The pressure will be returned to and controlled at 2235 psig.
(2) To ensure the core operates within the limits assumed in the safety analyses.

DISTRACTOR ANALYSIS:

A. *Incorrect, Plausible because the pressurizer pressure being controlled by the other 2 sets of backup heaters cycling on and off at a nominal pressure of 2210-2118 psig is correct. The Bases stated is plausible because it is the bases for the pressure heater Tech Spec which can be improperly determined to be the LCO entered for the conditions.*

B. *Correct, The pressurizer pressure will be controlled by the other 2 sets of backup heaters cycling on and off at a nominal pressure of 2210- 2118 psig (as controlled by the output of the master controller). This will result is an entry into the RCS DNB Tech Spec due to the pressure being less than minimum and the basis for the Tech Spec minimum pressure is to ensure the core operates within the limits assumed in the safety analyses.*

C. *Incorrect, Plausible because the pressurizer pressure would be controlled 2235 psig if the heater failures had involved the failure of any other 2 sets of heaters. Those conditions would have left either C or D banks in service. D heaters are the variable heaters which would be controlled by the master controller to maintain pressure at 2235 psig and the C bank would have remained energized causing the master controller to open the pressurizer sprays to maintain pressure at 2235 psig. Also plausible because the Bases stated is the bases for the pressure heater Tech Spec which can be improperly determined to be the LCO entered for the conditions.*

D. *Incorrect, Plausible because the pressurizer pressure would be controlled 2235 psig if the heater failures had involved the failure of any other 2 sets of heaters. Those conditions would have left either C or D banks in service. D heaters are the variable heaters which would be controlled by the master controller to maintain pressure at 2235 psig and the C bank would have remained energized causing the master controller to open the pressurizer sprays to maintain pressure at 2235 psig. Second part plausible because the bases stated is correct as the DNB Tech Spec is the LCO that will be entered.*

Question Number: 88

Tier: 2 **Group** 1

K/A: 010 A2.01
Pressurizer Pressure Control System (PZR PCS)
Ability to (a) predict the impacts of the following malfunctions or operations on the PZR PCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations:
Heater failures

Importance Rating: 3.3 / 3.6

10 CFR Part 55: 41.5 / 43.5 / 45.3 / 45.13

10CFR55.43.b: 2

K/A Match: K/A is matched because the question requires the ability predict the impact on the Pressurizer Pressure Control System due to a pressurizer heater failure as well as the Tech Spec that would be required to be entered. The question is SRO because it requires knowledge of Tech Spec Bases that is required to be entered because of the pressurizer heater failure.

Technical Reference: AOI-18, Malfunction of Pressurizer Pressure Control System, Revision 0023
SOI-68.03, Pressurizer Pressure and Spray Control System, Revision 0021
Tech Spec 3.4.1 Bases
Tech Spec 3.4.9 Bases

Proposed references to be provided: None

Learning Objective: 3-OT-068C
5. Identify each setpoint and resulting automatic action for the Pressurizer Pressure Program.

3-OT-T/S0304
3. Given plant conditions/parameters correctly determine the OPERABILITY of components associated with RCS.

Cognitive Level:
- **Higher** X
- **Lower** ___

Question Source:
- **New** X
- **Modified Bank** ___
- **Bank** ___

Question History: New question for the WBN 10/2011 NRC exam

Comments:

4.0 DISCUSSION

4.1 General

This procedure covers failures within the PZR pressure control system which could result in abnormal PZR pressure. Since this is a system AOI, failures considered include sensing instrument failures, circuitry failures, controller failures and equipment failures such as stuck open valves. This procedure is designed to allow the operator to gain control of PZR pressure and return the unit to normal operation within Operator capabilities. An example of a condition outside operator capabilities would be the case of a stuck open PZR Safety valve.

120 AC VITAL PWR BD 1-IV [breaker 2] supplies the plugmold power strip associated with both PZR spray valves and several other instruments required to respond to this event. [C.1]

4.2 Pressurizer Pressure Control Channels

Selector switch 1-XS-68-340D is a 3 position switch which is used to select two of four PZR pressure instruments for control. One channel (normally 340) is used for control of PZR heaters, sprays and PORV 1-PCV-68-340A. The other channel (normally 334) is used for control of PORV 1-PCV-68-334.

Channel 323 may be substituted for channel 340 for control of PZR heaters, sprays and PORV 1-PCV-68-340A.

Channel 322 may be substituted for channel 334 for control of PORV 1-PCV-68-334.

4.3 Instrument or Control Circuitry Failure

Instrument failures can be quickly diagnosed by a channel check. Control responses occur <u>only</u> if a failed instrument is selected for control. Failure of any channel, however, affects the safeguards system capability. Failure of controllers or control circuitry can be compensated for by manual control of heaters and/or sprays or PORVs.

4.4 Pressurizer PORV or Safety

An inadvertently opened or stuck open PZR safety or PORV will result in a rapid drop in RCS pressure, yet PZR level will rise. A failed open PORV can be compensated for by closing the associated block valve. A PZR safety failed open or leaking to such an extent that this procedure is entered would result in a PZR pressure drop in an uncontrolled manner. In this case, a Rx trip and Safety Injection should be manually initiated. This is to prevent boiling in the core and hot legs. The events should be handled as a LOCA with the same criteria for SI operation and termination.

4.5 Pressurizer Spray Valves

PZR spray valves are designed to fail closed. A malfunction of a PZR spray valve that causes the valve to open would be due to a control circuit failure. Once open, it is possible that mechanical failure could result in a stuck open valve. This results in a dropping PZR pressure. Spray valves have the capacity to depressurize greater than the heaters' capacity to pressurize. If a spray valve were to fail closed, the redundant spray valve would still be able to maintain PZR pressure.

The PZR normal spray valves should begin opening at 2260 psig and be full open at 2310 psig. The Aux Spray valve will operate to maintain RCS pressure at 2310 psig only when the NORM/AUX switch [1-L-11A] is placed in the AUX position. In the NORMAL position, the valve is either in the open or close position from the 1-M-6 handswitch.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.1 RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits

BASES

BACKGROUND

These Bases address requirements for maintaining RCS pressure, temperature, and flow rate within limits assumed in the safety analyses. The safety analyses (Ref. 1) of normal operating conditions and anticipated operational occurrences assume initial conditions within the normal steady state envelope. The limits placed on RCS pressure, temperature, and flow rate ensure that the minimum departure from nucleate boiling ratio (DNBR) will be met for each of the transients analyzed.

The RCS pressure limit is consistent with operation within the nominal operational envelope. Pressurizer pressure indications are averaged to come up with a value for comparison to the limit. A lower pressure will cause the reactor core to approach DNB limits.

The RCS coolant average temperature limit is consistent with full power operation within the nominal operational envelope. Indications of temperature are averaged to determine a value for comparison to the limit. A higher average temperature will cause the core to approach DNB limits.

The RCS flow rate normally remains constant during an operational fuel cycle with all pumps running. The minimum RCS flow limit corresponds to that assumed for DNB analyses. Flow rate indications are averaged to come up with a value for comparison to the limit. A lower RCS flow will cause the core to approach DNB limits.

Operation for significant periods of time outside these DNB limits increases the likelihood of a fuel cladding failure in a DNB limited event.

APPLICABLE SAFETY ANALYSES

The requirements of this LCO represent the initial conditions for DNB limited transients analyzed in the plant safety analyses (Ref. 1). The safety analyses have shown that transients initiated from the limits of this LCO will result in

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

meeting the DNBR criterion. This is the acceptance limit for the RCS DNB parameters. Changes to the unit that could impact these parameters must be assessed for their impact on the DNBR criteria. The transients analyzed for include loss of coolant flow events and dropped or stuck rod events. A key assumption for the analysis of these events is that the core power distribution is within the limits of LCO 3.1.7, "Control Bank Insertion Limits;" LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD);" and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)."

The pressurizer pressure limit of 2214 psig and the RCS average temperature limit of 593.2°F correspond to analytical limits of 2185 psig and 594.2°F used in the safety analyses, with allowance for measurement uncertainty.

The RCS DNB parameters satisfy Criterion 2 of the NRC Policy Statement.

LCO

This LCO specifies limits on the monitored process variables — pressurizer pressure, RCS average temperature, and RCS total flow rate — to ensure the core operates within the limits assumed in the safety analyses. Operating within these limits will result in meeting the DNBR criterion in the event of a DNB limited transient.

RCS total flow rate contains a measurement error of 1.6% (process computer) or 1.8% (control board indication) based on performing a precision heat balance and using the result to calibrate the RCS flow rate indicators. Potential fouling of the feedwater venturi, which might not be detected, could bias the result from the precision heat balance in a nonconservative manner. Therefore, a penalty of 0.1% for undetected fouling of the feedwater venturi raises the nominal flow measurement allowance to 1.7% (process computer) or 1.9% (control board indication).

Any fouling that might bias the flow rate measurement greater than 0.1% can be detected by monitoring and trending various plant performance parameters. If detected, either the effect of the fouling shall be quantified and compensated for in the RCS flow rate measurement or the venturi shall be cleaned to eliminate the fouling. The LCO numerical values for pressure, temperature, and flow rate are given for the measurement location and have been adjusted for instrument error.

Use of the elbow tap Δp methodology to measure RCS flow rate results in a measurement uncertainty of ±1.7% flow (process computer) or ±1.9% flow (control board indication) based on the utilization of eight elbow taps

(continued)

BASES

LCO (continued)

correlated to the three baseline precision heat balance measurements of Cycles 1, 2,and 3. Correlation of the flow indication channels with this previously performed heat balance measurement is documented in Reference 3. Use of this elbow tap Δp method provides an alternative to performance of a precision RCS flow calorimetric.

APPLICABILITY

In MODE 1, the limits on pressurizer pressure, RCS coolant average temperature, and RCS flow rate must be maintained during steady state operation in order to ensure DNBR criteria will be met in the event of an unplanned loss of forced coolant flow or other DNB limited transient. In all other MODES, the power level is low enough that DNB is not a concern.

A Note has been added to indicate the limit on pressurizer pressure is not applicable during short term operational transients such as a THERMAL POWER ramp increase > 5% RTP per minute or a THERMAL POWER step increase > 10% RTP. These conditions represent short term perturbations where actions to control pressure variations might be counterproductive. Also, since they represent transients initiated from power levels < 100% RTP, an increased DNBR margin exists to offset the temporary pressure variations.

Another set of limits on DNB related parameters is provided in SL 2.1.1, "Reactor Core SLs." Those limits are less restrictive than the limits of this LCO, but violation of a Safety Limit (SL) merits a stricter, more severe Required Action. Should a violation of this LCO occur, the operator must check whether or not an SL may have been exceeded.

ACTIONS

A.1

RCS pressure and RCS average temperature are controllable and measurable parameters. With one or both of these parameters not within LCO limits, action must be taken to restore parameter(s).

RCS total flow rate is not a controllable parameter and is not expected to vary during steady state operation. If the indicated RCS total flow rate is below the LCO limit, power must be reduced, as required by Required Action B.1, to restore DNB margin and eliminate the potential for violation of the accident analysis bounds.

The 2 hour Completion Time for restoration of the parameters provides sufficient time to adjust plant parameters, to determine the cause for the off normal condition, and to restore the readings within limits, and is based on plant operating experience.

(continued)

BASES

ACTIONS (continued)

B.1

If Required Action A.1 is not met within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 2 within 6 hours. In MODE 2, the reduced power condition eliminates the potential for violation of the accident analysis bounds. The Completion Time of 6 hours is reasonable to reach the required plant conditions in an orderly manner.

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1 *

Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits, the 12 hour Surveillance Frequency for verifying that the pressurizer pressure is sufficient to ensure the pressure can be restored to a normal operation, steady state condition following load changes and other expected transient operations. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.

SR 3.4.1.2 *

Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits, the 12 hour Surveillance Frequency for verifying RCS average temperature is sufficient to ensure the temperature can be restored to a normal operation, steady state condition following load changes and other expected transient operations. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.

SR 3.4.1.3 *

The 12 hour Surveillance Frequency to verify the RCS total flow rate is performed using the installed flow instrumentation. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess potential degradation and to verify operation within safety analysis assumptions.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.1.4 *

Measurement of RCS total flow rate by performance of a precision calorimetric heat balance or by using the elbow tap Δp method described in Reference 3 once every 18 months allows the installed RCS flow instrumentation to be calibrated and verifies the actual RCS flow rate is greater than or equal to the minimum required RCS flow rate.

The Frequency of 18 months reflects the importance of verifying flow after a refueling outage when the core has been altered, which may have caused an alteration of flow resistance.

This SR is modified by a Note that allows entry into MODE 1, without having performed the SR, and placement of the unit in the best condition for performing the SR. The Note states that the SR is not required to be performed until 24 hours after $\geq$ 90% RTP. This exception is appropriate since the heat balance or elbow tap Δp method requires the plant to be at a minimum of 90% RTP to obtain the stated RCS flow accuracies. The Surveillance shall be performed within 24 hours after reaching 90% RTP.

*Note: The accuracy of the instruments used for monitoring RCS pressure, temperature and flow rate is discussed in this Bases section under LCO (Ref. 2).

REFERENCES

1. Watts Bar FSAR, Section 15.0, "Accident Analysis," Section 15.2, "Condition II - Faults of Moderate Frequency," and Section 15.3.4, "Complete Loss Of Forced Reactor Coolant Flow."

2. Watts Bar Drawing 1-47W605-243, "Electrical Tech Spec Compliance Tables."

3. WCAP-16067-P, Rev. 0, "RCS Flow Measurement Using Elbow Tap Methodology at Watts Bar Unit 1," April 2003.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.9 Pressurizer

BASES

BACKGROUND

The pressurizer provides a point in the RCS where liquid and vapor are maintained in equilibrium under saturated conditions for pressure control purposes to prevent bulk boiling in the remainder of the RCS. Key functions include maintaining required primary system pressure during steady state operation, and limiting the pressure changes caused by reactor coolant thermal expansion and contraction during normal load transients.

The pressure control components addressed by this LCO include the pressurizer water level, the required heaters, and their controls. Pressurizer safety valves and pressurizer power operated relief valves are addressed by LCO 3.4.10, "Pressurizer Safety Valves," and LCO 3.4.11, "Pressurizer Power Operated Relief Valves (PORVs)," respectively.

The intent of the LCO is to ensure that a steam bubble exists in the pressurizer prior to power operation to minimize the consequences of potential overpressure transients. The presence of a steam bubble is consistent with analytical assumptions. Relatively small amounts of noncondensible gases can inhibit the condensation heat transfer between the pressurizer spray and the steam, and diminish the spray effectiveness for pressure control.

Electrical immersion heaters, located in the lower section of the pressurizer vessel, keep the water in the pressurizer at saturation temperature and maintain a constant operating pressure. A minimum required available capacity of pressurizer heaters ensures that the RCS pressure can be maintained. The capability to maintain and control system pressure is important for maintaining subcooled conditions in the RCS and ensuring the capability to remove core decay heat by either forced or natural circulation of reactor coolant. Unless adequate heater capacity is available, the hot, high pressure condition cannot be maintained indefinitely and still provide the required subcooling margin in the primary system. Inability to control the system pressure and maintain subcooling under conditions of natural circulation flow in the primary system could lead to a loss of single phase natural circulation and decreased capability to remove core decay heat.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

In MODES 1, 2, and 3, the LCO requirement for a steam bubble is reflected implicitly in the accident analyses. Safety analyses performed for lower MODES are not limiting. All analyses performed from a critical reactor condition assume the existence of a steam bubble and saturated conditions in the pressurizer. In making this assumption, the analyses neglect the small fraction of noncondensible gases normally present.

Safety analyses presented in the FSAR (Ref. 1) do not take credit for pressurizer heater operation; however, an implicit initial condition assumption of the safety analyses is that the RCS is operating at normal pressure.

The maximum pressurizer water level limit satisfies Criterion 2 of the NRC Policy Statement. Although the heaters are not specifically used in accident analysis, the need to maintain subcooling in the long term during loss of offsite power, as indicated in NUREG-0737 (Ref. 2), is the reason for providing an LCO.

LCO

The LCO requirement for the pressurizer to be OPERABLE with a water volume ≤ 1656 cubic feet, which is equivalent to 92%, ensures that a steam bubble exists. Limiting the LCO maximum operating water level preserves the steam space for pressure control. The LCO has been established to ensure the capability to establish and maintain pressure control for steady state operation and to minimize the consequences of potential overpressure transients. Requiring the presence of a steam bubble is also consistent with analytical assumptions.

The LCO requires two groups of OPERABLE pressurizer heaters, each with a capacity ≥ 150 kW. The minimum heater capacity required is sufficient to maintain the RCS near normal operating pressure when accounting for heat losses through the pressurizer insulation. By maintaining the pressure near the operating conditions, a wide margin to subcooling can be obtained in the loops. The design value of 150 kW per group is exceeded by the use of fifteen heaters in a group rated at 23.1 kW each. The amount needed to maintain pressure is dependent on the heat losses.

(continued)

BASES (continued)

APPLICABILITY

The need for pressure control is most pertinent when core heat can cause the greatest effect on RCS temperature, resulting in the greatest effect on pressurizer level and RCS pressure control. Thus, applicability has been designated for MODES 1 and 2. The applicability is also provided for MODE 3. The purpose is to prevent solid water RCS operation during heatup and cooldown to avoid rapid pressure rises caused by normal operational perturbation, such as reactor coolant pump startup.

In MODES 1, 2, and 3, there is need to maintain the availability of pressurizer heaters. In the event of a loss of offsite power, the initial conditions of these MODES give the greatest demand for maintaining the RCS in a hot pressurized condition with loop subcooling for an extended period. For MODE 4, 5, or 6, it is not necessary to control pressure (by heaters) to ensure loop subcooling for heat transfer when the Residual Heat Removal (RHR) System is in service, and therefore, the LCO is not applicable.

ACTIONS

A.1 and A.2

Pressurizer water level control malfunctions or other plant evolutions may result in a pressurizer water level above the nominal upper limit, even with the plant at steady state conditions. Normally the plant will trip in this event since the upper limit of this LCO is the same as the Pressurizer Water Level - High Trip.

If the pressurizer water level is not within the limit, action must be taken to restore the plant to operation within the bounds of the safety analyses. To achieve this status, the plant must be brought to MODE 3, with the reactor trip breakers open, within 6 hours and to MODE 4 within 12 hours. This takes the plant out of the applicable MODES and restores the plant to operation within the bounds of the safety analyses.

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES

ACTIONS (continued)

B.1

If one required group of pressurizer heaters is inoperable, restoration is required within 72 hours. The Completion Time of 72 hours is reasonable considering the anticipation that a demand caused by loss of offsite power would be unlikely in this period.

C.1 and C.2

If one group of pressurizer heaters are inoperable and cannot be restored in the allowed Completion Time of Required Action B.1, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.4.9.1

This SR requires that during steady state operation, pressurizer level is maintained below the nominal upper level limit of ≤92% (value does not account for instrument error, Ref. 3) to provide a minimum space for a steam bubble. The Surveillance is performed by observing the indicated level. The Frequency of 12 hours corresponds to verifying the parameter each shift. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess level for any deviation and verify that operation is within safety analyses assumptions. Alarms are also available for early detection of abnormal level indications.

SR 3.4.9.2

The SR is satisfied when the power supplies are demonstrated to be capable of producing the minimum power and the associated pressurizer heaters are verified to be at their design rating. This may be done by testing the power supply output and by performing an electrical check on heater element continuity and resistance. The Frequency of 92 days is considered adequate to detect heater degradation and has been shown by operating experience to be acceptable.

(continued)

BASES (continued)

REFERENCES

1. Watts Bar FSAR, Section 15.0, "Accident Analyses."

2. NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980.

3. Watts Bar Drawing 1-47W605-243, "Electrical Tech Spec Compliance Tables."

Date_______ **INITIALS**

5.4 Auto Operation of Pzr Heaters

NOTES

1) 1-PIC-68-340A, PZR PRESS MASTER CONTROL, also controls spray 1-FCV-68-340B and -340D when their controllers are in AUTO.

2) D bank heater operates at pressures up to 2250 psig. At 2220 psig heater is on 100% of the time; at 2250 psig heater is on 0% of the time. D bank heater must initially be placed in ON position to operate. There is no auto function in P AUTO. Backup heater groups energize at 2210 psig with A & B banks de-energizing at 2218 psig. C Bank must be turned off manually once energized. If Pzr level is less than 17%, all heaters de-energize.

[1] **ENSURE** the following for AUTO operation: _______

- 1-PIC-68-340A, PZR PRESS MASTER CONTROL [1-M-4], in AUTO _______
- 1-HS-68-341F, CONTROL HEATERS D [1-M-4], in P AUTO with red (breaker closed) indicating light ON _______
- [1-HS-68-341A, BACKUP HEATERS A-A [1-M-4], in A-P AUTO _______
- 1-HS-68-341D, BACKUP HEATERS B-B [1-M-4], in A-P AUTO _______
- 1-HS-68-341H, BACKUP HEATERS C [1-M-4], in P AUTO _______
- RCS Press less than 2260 psig [1-M-5] _______

[2] Section 5.4, Auto Operation of Pzr Heaters complete. _______

6.0 NORMAL OPERATION

Applicable Checklists will be performed at discretion of Operations Superintendent or designee. Checklists will normally be performed for System Alignment Verification in Mode 5 or whenever alignment verification is needed.

6.1 Normal Operation of Pzr Spray Valves

A. Pzr spray controllers 1-PIC-68-340B, LOOP 2 SPRAY CONTROL, and 1-PIC-68-340D, LOOP 1 SPRAY CONTROL, are in AUTO.

B. Spray bypass valves 1-BYV-68-552-S and 1-BYV-68-555-S are set to provide tempering flow to prevent thermal shock to spray lines and nozzle (approx. 1 gpm each). Low flow is indicated by PZR SPRAY TEMP LO alarm (89E) in MCR.

C. RCS press 2218-2260 psig and RCS in service with a Pzr bubble.

D. 1-PIC-68-340A, PZR PRESS MASTER CONTROL, in AUTO.

6.2 Auto Operation of the Pzr Spray Valves

If Pzr press rises above 2260 psig, spray 1-FCV-68-340B and -340D begin to open. If press continues to rise, the sprays will be full open at 2310 psig. If press rise continues, the PORVs open at 2335 psig.

I. PROGRAM

WATTS BAR OPERATOR TRAINING

II. COURSE

A. License Training
B. Licensed Requalification

III. TITLE

T/S 3.4, "Reactor Coolant System," Bases, and Technical Requirements Manual

IV. LENGTH OF LESSON

A. License Training 1 Hour

Licensed Requalification time will be determined after objectives are identified.

V. TRAINING OBJECTIVES

AUO	RO	SRO	STA	
	X	X	X	00. Demonstrate an understanding of NUREG 1122 knowledge's and abilities associated with the Reactor Vessel that are rated $\geq$2.5 during Initial License Training and $\geq$3.0 during License Operator Requalification Training for the appropriate license position as identified in Appendix A.
	X	X	X	1. Demonstrate the ability to extract specific information from the Technical Specifications and Technical Requirements, as they pertain to RCS.
		X	X	2. Determine the bases for each specification, as applicable, to the RCS.
		X	X	3. Given plant conditions/parameters correctly determine the OPERABILITY of components associated with RCS.
	X	X	X	4. Given plant conditions and parameters correctly determine the applicable Limiting Conditions for Operations or Technical Requirements for the various components of the RCS.

I. PROGRAM

Watts Bar Operator Training

II. COURSES

A. License Training

B. . Non-License Training

III. TITLE

PZR, PZR Pressure Control System/ PZR Level Control System, and PRT

IV. LENGTH OF LESSON

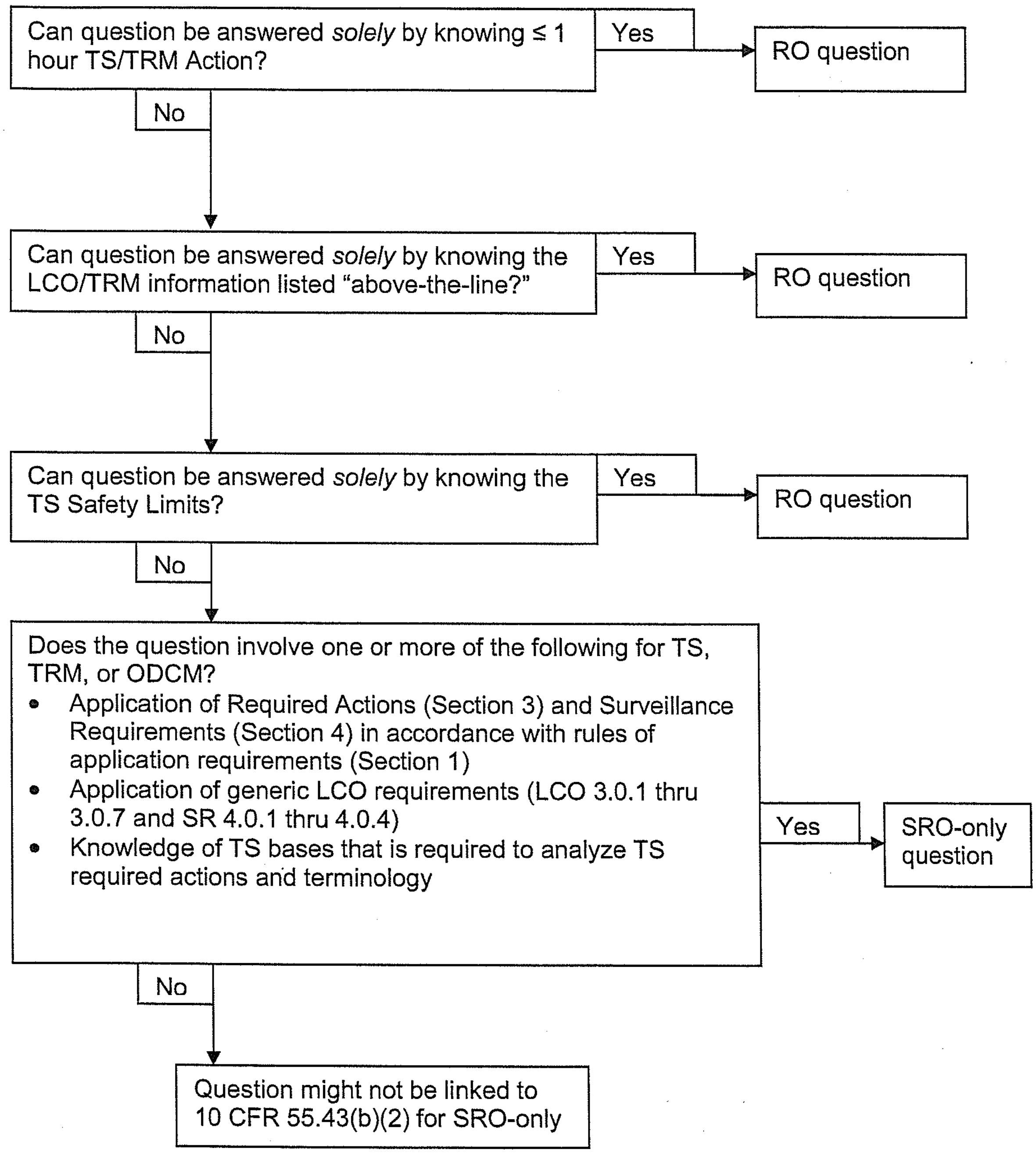
A. License Training 4 Hours
B. Non-License 6 Hours

V. TRAINING OBJECTIVES

AUO	RO	SRO	STA	
X	X	X	X	1. Identify the three (3) main purposes of the Pressurizer.
X	X	X	X	2. Describe the major components of the Pressurizer.
X	X	X	X	3. Describe the purposes of the Manual Bypass Pressurizer Spray Throttle Valves.
X	X	X	X	4. Identify the normal setpoint required to auto open the PZR Relief Valves (PORVs).
X	X	X	X	5. Identify each setpoint and resulting automatic action for the Pressurizer Pressure Program.
	X	X	X	6. State the basis for the low pressure reactor trip, as stated in Tech Specs Section 2.1.1.
	X	X	X	7. State the basis for the high pressure reactor trip, as stated in Tech Specs Section 2.1.1.
	X	X	X	8. Describe the operation of the master pressure controller.
	X	X	X	9. Describe what control room indication would alert the operator that the pressurizer spray valves were open.
	X	X	X	10. Describe the method of control for the power operated relief valves.
	X	X	X	11. Describe the indication an operator has that a PORV is open or leaking through.
X	X	X	X	12. Identify the program setpoints, and describe any automatic actions relative to the pressurizer level program.

AUO	RO	SRO	STA	
X	X	X	X	13. Describe the basis for the program setpoints of the pressurizer level program circuit.
X	X	X	X	14. Explain the basis for programming the level vs. maintaining the level constant in the pressurizer.
X	X	X	X	15. Describe the response to a deviation from pressurizer level program.
X	X	X	X	16. Explain the purpose of the PRT.
X	X	X	X	17. Identify the components which drain into the Pressurizer Relief Tank.
	X	X		18. Deleted.
	X	X		19. Deleted
X	X	X	X	20. Describe the in-plant location of major system components, instrumentation, controls, and piping/header arrangements.
X	X	X	X	21. Describe the flow path of sources of supply, discharges, vents, drains, leakoff, and connections/penetrations that intertie this system to other systems.
X	X	X	X	22. Explain the operation of major system components.
X	X	X	X	23. Deleted
	X	X	X	24. Deleted

Figure 1: Screening for SRO-only linked to 10 CFR 55.43(b)(2) (Tech Specs)



89. 025 G2.1.28 089

Given the following:

- Unit 1 is in Mode 3 preparing for a reactor startup when Tech Spec LCO 3.6.12, Ice Condenser Doors, is entered due to the following:

0600 - Annunciator window 144-A, ICE COND INLET DOOR OPEN, alarms.

0620 - An AUO reports one lower inlet door is cracked just off the closed position, is free to open, but will not close completely.

1010 - Maximum ice bed temperature verified to be 24.6°F.

1345 - Maximum ice bed temperature verified to be 24.8°F.

1850 - Maximum ice bed temperature verified to be 25.2°F.

2050 - Inlet door is repaired, closed, and testing completed.

Which ONE of the following identifies...

(1) the purpose of the Ice Condenser lower inlet doors flow proportioning springs

and

(2) the earliest of the listed times a Tech Spec violation had occurred?

REFERENCE PROVIDED

A. (1) Controls flow of steam and air through Ice Condenser to ensure at least one hour of cooling from the Ice Bed.
(2) 1010

B. (1) Controls flow of steam and air through Ice Condenser to ensure at least one hour of cooling from the Ice Bed.
(2) 1850

C✓ (1) Allows door opening to be initiated when subjected to a loading of one pound per square foot.
(2) 1010

D. (1) Allows door opening to be initiated when subjected to a loading of one pound per square foot.
(2) 1850

DISTRACTOR ANALYSIS:

A. *Incorrect, Plausible because the springs cause proportional opening of the doors relative to the differential pressure across the doors and they do provide balanced flow across the ice beds but they are not designed to maintain at least an hour of cooling by the ice beds. Also because 1010 is correct for the earliest listed time when tech spec had been violated.*

B. *Incorrect, Plausible because the springs cause proportional opening of the doors relative to the differential pressure across the doors and they do provide balanced flow across the ice beds but they are not designed to maintain at least an hour of cooling by the ice beds. Also because a Tech Spec violation did occur between 1345 and 1850.*

C. *Correct, The purpose of the flow proportioning springs is to assure the doors close in the event they are inadvertently opened and they are adjusted such that only one pound per square foot will cause door opening to be initiated. Also, the Tech Spec LCO action time was not met for the first 4 hrs. Since the doors were declared inoperable at 0600, the first verification of ice bed temp should have happened by 1000. The 25% grace period for surveillances does not apply to the first surveillance.*

D. *Incorrect, Plausible since the first part is correct, and the Tech Spec requirements were not met at 1850. However, 1850 was not the first time a violation occurred. The Tech Spec LCO times were not met for the first surveillance.*

Question Number: 89

Tier: 2 **Group** 1

K/A: 025 G2.1.28
Ice Condenser System
Knowledge of the purpose and function of major system components and controls

Importance Rating: 4.1 / 4.1

10 CFR Part 55: 41.7 /

10CFR55.43.b: 2

K/A Match: This question matches the K/A by having the candidate recall the purpose of a major component of the Ice Condenser System (Ice Condenser lower inlet doors) and SRO by having candidate determine if the Tech Spec required action for inoperable equipment was performed within the required time frames. (Application of

K/A Match: This question matches the K/A by having the candidate recall the purpose of a major component of the Ice Condenser System (Ice Condenser lower inlet doors) and SRO by having candidate determine if the Tech Spec required action for inoperable equipment was performed within the required time frames. (Application of generic LCO requirements (SR 4.0.1 thru 4.0.4)).

Technical Reference: Tech Spec 3.6.12, Ice Condenser Doors, Amendment 3 and 3.6.12 Bases
N3-61-4001, Ice Condenser System, Revision 0018

Proposed references to be provided: Tech Spec 3.6.12 (5 pages)

Learning Objective: 3-OT-SYS061A

6. Describe the ice condenser doors and state at what pressures they open.
24. Regarding Technical Specifications and Technical Requirements for this system:
    a. Identify the conditions and required actions with completion time of one hour or less.
    b. Explain the Limiting Conditions for Operation, Applicability, and Bases.
    c. Given a status/set of plant conditions, apply the appropriate Technical Specifications and Technical Requirements.

Cognitive Level:

Higher X
Lower ___

Question Source:

New ___
Modified Bank X
Bank ___

Question History: WBN bank question T/S3612 001 modified for use on the WBN 10/2010 exam.

Comments:

3.2.19 Structural Components (continued)

2. Lower Support Structure

   Ice basket bottoms are designed to be supported by and held down by attachments to the lower support structure. The basket supports are designed for structural adequacy under accident and safe shutdown earthquake loads and permit weighing of selected baskets.

3. Basket Alignment

   The ice condenser crane aligns with baskets to facilitate basket weighing and/or removal. The baskets are capable of accepting basket lifting and handling tools.

4. Basket Loading

   The ice baskets are capable of being loaded by a pneumatic Ice Distribution System. The baskets are designed to contain a minimum of 2,404,500 lbs of ice (Refs. 7.4.23 and 7.4.26). Note that this ice weight value (per Tech Spec) has an 6.34% safety margin above the minimum ice weight value used in the ICS analysis (Ref. 7.4.17).

5. External Basket Design

   The baskets are designed to minimize external protrusions which would interfere with lifting, weighing, removal or insertion.

6. Basket Couplings and Stiffening Rings

   Coupling or rings are located at 6' intervals along the basket and shall have internal inserts, except at the top of the 48' column, to support the ice from falling down to the bottom of the ice column during and after a DBA and/or SSE. When using the two basket option, a coupling with an internal cruciform insert is located at 6' intervals along the 48' basket column, except at the top where the insert is not required. For all other two foot intervals, a coupling without an internal cruciform insert is used.

D. Lower Inlet Doors

The lower inlet doors form the barrier to air flow through the inlet ports of the ice condenser for normal unit operation. They also provide continuation of thermal insulation around the lower crane wall to minimize heat input that would promote sublimation and mass transfer of the ice.

In the event of a LOCA or HELB, causing a pressure increase in the lower compartment, the doors open, venting air and steam relatively evenly into all sections of the ice condenser. The doors are of a simple mechanical design to minimize the possibility of malfunction. Maximum radiation at the inlet door is 5 rad/hr gamma during normal operations. There is no secondary radiation due to neutron exposure.

3.2.19 Structural Components (continued)

Twenty-four pairs of inlet doors are located on the ice condenser side of ports in the crane wall immediately above the ice condenser floor. Each door panel is 92.5" high, 42" wide and 7.5" thick. Each pair is hinged vertically on a common frame (Refs. 7.4.19 and 7.5.3).

Each door consists of a 0.5" thick fiber reinforced polyester (FRP) plate stiffened by six steel ribs, bolted to the plate. The FRP plate is designed to take vertical bending moments resulting from pressure generated from a LOCA and from subsequent stopping forces on the door. The ribs are designed to take horizontal bending moments and reactions, as well as tensile loads resulting from the door angular velocity, and transmit them to the crane wall via the hinges and door frame.

Thermal insulation is provided by 7" of urethane foam bonded to the back of the FRP plate. Front and read door surfaces are protected with 26 gauge stainless steel covers which provide a complete vapor barrier around the insulation. The urethane foam and stainless steel covers do not carry overall door moments and shearing forces.

Three hinge assemblies are provided for each panel; each assembly is connected to two of the panel ribs. Loads from each of the two ribs are transmitted to a single 1.572" diameter hinge shaft through brass bushings. These bushings have a spherical outer surface which prevents binding which might otherwise be caused by door rib and hinge bar flexure during accident loading condition. The hinge shaft is supported by two self-aligning, spherical roller bearings in a cast steel housing. Vertical positioning of the door panel and shaft with respect to the bearing housing are provided by steel caps bolted to the ends of the shaft and brass spacer rings between the door ribs and bearings.

Shims are provided between the shaft and caps to obtain final alignment.
Each bearing housing is bolted to the door frame by bolts, threaded into tapped holes in the housing. Again, shims are provided between the housings and door frame to maintain hinge alignment. Hinges are designed and fabricated to prevent galling and self welding.

The door frame is fabricated mainly from steel angle sections; 6" x 6" on the sides and 6" x 4" on the top and bottom. A 4" central I beam divides the frame into sections for each door. At each hinge bracket, extensions and gusset plates, fabricated from steel plate, are welded to the frame to carry loads to the crane wall.

The door panel is sealed to the frame by a compliant rubber seal which attaches to channels welded to the door frame. During normal unit operations these seals are compressed by the cold air head of the ice bed acting on the door panels. As the seals operate at a much warmer temperature than the ice bed, frosting of the seal region is unlikely.

3.2.19 Structural Components (continued)

Each door is provided with four flow proportioning springs. One end of each spring is attached to the door panel and the other to a spring housing mounted on the door frame. These springs provide a door return torque proportional to the door opening angle and thus satisfy the requirement for flow proportioning. In addition, they assure that the doors close in the event they are inadvertently opened during normal unit operations. The springs are adjusted during assembly such that, with no load on the doors, the doors are slightly open. For small door openings, the required 3/8" door opening is controlled by a 3/8" gap between panels and is, thus, independent of the door position as measured in degrees.

In order to dissipate the large kinetic energies resulting from pressures acting on the doors during an event, each door is provided with a shock absorber assembly. The shock absorber element is sheet metal air box 93" high, 42" wide, and 29" thick at its thickest section. The air box is attached to a back plate assembly which is bolted to the lower support structure.

Two edges of the sheet metal box are fastened to the ends of back plate by clamping bars and bolts, making them air tight joints. The sheet met is bent such that it has an impact face and a pre-folded side.

When the lower inlet doors open due to sudden pressure rise, they impact on the face of the air box. The impact face moves with the door. Because of a restraining rod within the box, the pre-folded side of the air box collapses inwards. The volume of the air trapped in the air box decreases as the impact face moves towards the back plate, thereby increasing air pressure. Part of the kinetic energy of the door is used up in compressing air. To prevent excessive pressure rise, the air is allowed to escape through the clearance gap between the sheet metal and end plates. A portion of the energy of the doors is also used up in buckling of stiffners.

All exposed surfaces are made of stainless steel or coated with paint suitable for use inside the containment. All insulation material is compatible with containment chemistry requirements for normal and accident conditions.

E. Lower Support Structure

The lower support structure is designed to support and hold down the ice baskets in the required array, to provide an adequate flow area into the ice bed for the air and steam mixture in the event of a DBA, to direct and distribute the flow of air and steam through the ice bed, and to protect the containment structure opposite the ice condenser inlet doors from direct jet impingement forces.

The last two functions are accomplished by turning vanes that are designed to turn the flow of the air and steam mixture up through the ice bed in event of a DBA. For such an event, the vanes would serve to reduce the drag forces on the lower support structural members, reduce the impingement forces on the containment across from the lower inlet doors and to distribute the flow more uniformly through the ice bed (Ref. 7.4.1).

3.6 CONTAINMENT SYSTEMS

3.6.12 Ice Condenser Doors

LCO 3.6.12 The ice condenser inlet doors, intermediate deck doors, and top deck doors shall be OPERABLE and closed.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

-----------------------------------NOTE-----------------------------------
Separate Condition entry is allowed for each ice condenser door.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more ice condenser inlet doors inoperable due to being physically restrained from opening.	A.1 Restore inlet door to OPERABLE status.	1 hour
B. One or more ice condenser doors inoperable for reasons other than Condition A or not closed.	B.1 Verify maximum ice bed temperature is $\leq 27°F$.	Once per 4 hours
	<u>AND</u>	
	B.2 Restore ice condenser door to OPERABLE status and closed positions.	14 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition B not met.	C.1 Restore ice condenser door to OPERABLE status and closed positions.	48 hours
D. Required Action and associated Completion Time of Condition A or C not met.	D.1 Be in MODE 3. AND D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.12.1	Verify all inlet doors indicate closed by the Inlet Door Position Monitoring System.	12 hours
SR 3.6.12.2	Verify, by visual inspection, each intermediate deck door is closed and not impaired by ice, frost, or debris.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.12.3	Verify, by visual inspection, each inlet door is not impaired by ice, frost, or debris.	-----NOTE------ The 3 month performance due September 9, 1996 (per SR 3.0.2) may be extended until October 21, 1996. --------------- 3 months during first year after receipt of license AND 18 months
SR 3.6.12.4	Verify torque required to cause each inlet door to begin to open is $\leq$ 675 in-lb.	-----NOTE------ The 3 month performance due September 9, 1996 (per SR 3.0.2) may be extended until October 21, 1996. -------------- 3 months during first year after receipt of license AND 18 months

(continued)

SURVEILLANCE REQUIREMENTS (Continued)

SURVEILLANCE		FREQUENCY
SR 3.6.12.5	Perform a torque test on a sampling of $\geq$ 50% of the inlet doors.	-----NOTE------ The 3 month performance due September 9, 1996 (per SR 3.0.2) may be extended until October 21, 1996. -------------- 3 months during first year after receipt of license AND 18 months
SR 3.6.12.6	Verify for each intermediate deck door: a. No visual evidence of structural deterioration; b. Free movement of the vent assemblies; and c. Free movement of the door.	3 months during first year after receipt of license AND 18 months

(continued)

SURVEILLANCE REQUIREMENTS (Continued)

SURVEILLANCE		FREQUENCY
SR 3.6.12.7	Verify, by visual inspection, each top deck door: a. Is in place; b. Free movement of top deck vent assembly; and c. Has no condensation, frost, or ice formed on the door that would restrict its opening.	92 days

B 3.6 CONTAINMENT SYSTEMS

B 3.6.12 Ice Condenser Doors

BASES

BACKGROUND

The ice condenser doors consist of the inlet doors, the intermediate deck doors, and the top deck doors. The functions of the doors are to:

a. Seal the ice condenser from air leakage during the lifetime of the plant; and

b. Open in the event of a Design Basis Accident (DBA) to direct the hot steam air mixture from the DBA into the ice bed, where the ice would absorb energy and limit containment peak pressure and temperature during the accident transient.

Limiting the pressure and temperature following a DBA reduces the release of fission product radioactivity from containment to the environment.

The ice condenser is an annular compartment enclosing approximately 300°of the perimeter of the upper containment compartment, but penetrating the operating deck so that a portion extends into the lower containment compartment. The inlet doors separate the atmosphere of the lower compartment from the ice bed inside the ice condenser. The top deck doors are above the ice bed and exposed to the atmosphere of the upper compartment. The intermediate deck doors, located below the top deck doors, form the floor of a plenum at the upper part of the ice condenser. This plenum area is used to facilitate surveillance and maintenance of the ice bed.

The ice baskets held in the ice bed within the ice condenser are arranged to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a DBA.

In the event of a DBA, the ice condenser inlet doors (located below the operating deck) open due to the pressure rise in the lower compartment. This allows air and steam to flow from the lower compartment into the ice condenser. The resulting pressure increase within the ice condenser causes the intermediate deck doors and the top deck doors to open,

(continued)

BASES

BACKGROUND (continued)

which allows the air to flow out of the ice condenser into the upper compartment. Steam condensation within the ice condensers limits the pressure and temperature buildup in containment. A divider barrier separates the upper and lower compartments and ensures that the steam is directed into the ice condenser.

The ice, together with the containment spray, serves as a containment heat removal system and is adequate to absorb the initial blowdown of steam and water from a DBA as well as the additional heat loads that would enter containment during the several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators. During the post blowdown period, the Air Return System (ARS) returns upper compartment air through the divider barrier to the lower compartment. This serves to equalize pressures in containment and to continue circulating heated air and steam from the lower compartment through the ice condenser, where the heat is removed by the remaining ice.

The water from the melted ice drains into the lower compartment where it serves as a source of borated water (via the containment sump) for the Emergency Core Cooling System (ECCS) and the Containment Spray System heat removal functions in the recirculation mode. The ice (via the Containment Spray System) and the recirculated ice melt also serve to clean up the containment atmosphere.

The ice condenser doors ensure that the ice stored in the ice bed is preserved during normal operation (doors closed) and that the ice condenser functions as designed if called upon to act as a passive heat sink following a DBA.

APPLICABLE SAFETY ANALYSES

The limiting DBAs considered relative to containment pressure and temperature are the loss of coolant accident (LOCA) and the steam line break (SLB). The LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are assumed not to occur simultaneously or consecutively.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

Although the ice condenser is a passive system that requires no electrical power to perform its function, the Containment Spray System and ARS also function to assist the ice bed in limiting pressures and temperatures. Therefore, the postulated DBAs are analyzed with respect to Engineered Safety Feature (ESF) systems, assuming the loss of one ESF bus, which is the worst case single active failure and results in one train each of the Containment Spray System and the ARS being rendered inoperable.

The limiting DBA analyses (Ref. 1) show that the maximum peak containment pressure results from the LOCA analysis and is calculated to be less than the containment design pressure. For certain aspects of transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the cooling effectiveness of the ECCS during the core reflood phase of a LOCA analysis increases with increasing containment backpressure. For these calculations, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the calculated transient containment pressures, in accordance with 10 CFR 50, Appendix K (Ref. 2).

The maximum peak containment atmosphere temperature results from the SLB analysis and is discussed in the Bases for LCO 3.6.5, "Containment Air Temperature."

An additional design requirement was imposed on the ice condenser door design for a small break accident in which the flow of heated air and steam is not sufficient to fully open the doors.

For this situation, the doors are designed so that all of the doors would partially open by approximately the same amount. Thus, the partially opened doors would modulate the flow so that each ice bay would receive an approximately equal fraction of the total flow.

This design feature ensures that the heated air and steam will not flow preferentially to some ice bays and deplete the ice there without utilizing the ice in the other bays.

In addition to calculating the overall peak containment pressures, the DBA analyses include the calculation of the transient differential pressures that would occur across

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

subcompartment walls during the initial blowdown phase of the accident transient. The internal containment walls and structures are designed to withstand the local transient pressure differentials for the limiting DBAs.

The ice condenser doors satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO establishes the minimum equipment requirements to assure that the ice condenser doors perform their safety function. The ice condenser inlet doors, intermediate deck doors, and top deck doors must be closed to minimize air leakage into and out of the ice condenser, with its attendant leakage of heat into the ice condenser and loss of ice through melting and sublimation. The doors must be OPERABLE to ensure the proper opening of the ice condenser in the event of a DBA. OPERABILITY includes being free of any obstructions that would limit their opening, and for the inlet doors, being adjusted such that the opening and closing torques are within limits. The ice condenser doors function with the ice condenser to limit the pressure and temperature that could be expected following a DBA.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause an increase in containment pressure and temperature requiring the operation of the ice condenser doors. Therefore, the LCO is applicable in MODES 1, 2, 3, and 4.

The probability and consequences of these events in MODES 5 and 6 are reduced due to the pressure and temperature limitations of these MODES. Therefore, the ice condenser doors are not required to be OPERABLE in these MODES.

ACTIONS

A Note provides clarification that, for this LCO, separate Condition entry is allowed for each ice condenser door.

(continued)

BASES

ACTIONS (continued)

A.1

If one or more ice condenser inlet doors are inoperable due to being physically restrained from opening, the door(s) must be restored to OPERABLE status within 1 hour. The Required Action is necessary to return operation to within the bounds of the containment analysis. The 1 hour Completion Time is consistent with the ACTIONS of LCO 3.6.1, "Containment," which requires containment to be restored to OPERABLE status within 1 hour.

B.1 and B.2

If one or more ice condenser doors are determined to be partially open or otherwise inoperable for reasons other than Condition A or if a door is found that is not closed, it is acceptable to continue plant operation for up to 14 days, provided the ice bed temperature instrumentation is monitored once per 4 hours to ensure that the open or inoperable door is not allowing enough air leakage to cause the maximum ice bed temperature to approach the melting point. The Frequency of 4 hours is based on the fact that temperature changes cannot occur rapidly in the ice bed because of the large mass of ice involved. The 14 day Completion Time is based on long term ice storage tests that indicate that if the temperature is maintained below 27°F, there would not be a significant loss of ice from sublimation. If the maximum ice bed temperature is > 27°F at any time, or ice bed temperature is not verified to be within the specified Frequency as augmented by the provisions of SR 3.0.2 the situation reverts to Condition C and a Completion Time of 48 hours is allowed to restore the inoperable door to OPERABLE status or enter into Required Actions D.1 and D.2. [NOTE: entry into Condition B is not required due to personnel standing on or opening an intermediate deck or upper deck door for short durations to perform required surveillances, minor maintenance such as ice removal, or routine tasks such as system walkdowns.]

C.1

If Required Actions or Completion Times of B.1 or B.2 are not met, the doors must be restored to OPERABLE status and closed positions within 48 hours. The 48 hour Completion Time is based on the fact that, with the very large mass of ice involved, it would not be possible for the temperature to decrease to the melting point and a significant amount of ice to melt in a 48 hour period.

(continued)

Objective 3

Objective 5

Objective 6

2.6 Lower Inlet Doors

Twenty-four pairs of inlet doors are located on the ice condenser side ports in the crane wall at an elevation just above the ice condenser floor (elev. 745.69). They form the barrier to air flow through the inlet ports of the ice condenser for normal plant operations. They also provide the continuation of thermal insulation around the lower section of the crane wall to minimize heat input that would promote sublimation and mass transfer of ice in the ice condenser compartment.

Each door consists of a 0.5 in. thick fiber reinforced polyester (FRP) plate stiffened by six steel ribs, bolted to the plate. The FRP plate is designed to take vertical bending moments resulting from pressures generated from a LOCA and from subsequent stopping forces on the door. The ribs are designed to take horizontal bending moments and reactions, as well as tensile loads resulting from the door angular velocity, and transmit them to the crane wall via the hinges and door frame.

Each door is provided with four flow proportioning springs. One end of each spring is attached to the door panel and the other to a spring housing mounted on the door frame. They assure that the doors close in the event they are inadvertently opened during normal unit operations. The springs are adjusted during assembly such that, with no load on the doors, the doors are slightly open 3/8-inch. Doors are adjusted to allow one pound per square foot to initiate opening.

In order to dissipate the large kinetic energies resulting from pressures acting on the doors during a LOCA, each door is provided with a shock absorber assembly.

I. PROGRAM

Watts Bar Operator Training

II. COURSES

CERTIFICATION
NOTP
LICENSED OPERATOR REQUAL
AUO REQUAL

III. TITLE

Ice Condenser System

IV. LENGTH OF LESSON

Certification	1.5 hours
Non-Licensed Training	2 hours
NOTP	2.0 HOURS

LICENSED OPERATOR AND AUO REQUAL TIMES WILL BE DETERMINED WHEN OBJECTIVES ARE IDENTIFIED

V. TRAINING OBJECTIVES

AUO	RO	SRO	STA	
X	X	X	X	1. State the design basis of the Ice Condenser System in accordance with FSAR section 6.7.
X	X	X	X	2. State the function of the Ice Condenser System in accordance with the system description.
X	X	X	X	3. Describe the 11 components of the ice condenser structure and give a brief description of each.
X	X	X	X	4. Discuss the ice condenser drains, include how they are sealed and where they drain.
X	X	X	X	5. Sketch a profile of the ice condenser and indicate how steam flow will be directed from lower containment to upper containment.
X	X	X	X	6. Describe the ice condenser doors and state at what pressures they open.
X	X	X	X	7. Discuss which doors in the ice condenser have position indication.

AUO	RO	SRO	STA	
X	X	X	X	8. Describe the ice condenser instrumentation, as outlined in this lesson plan, and give two locations where ice condenser temperatures can be read.
X	X	X	X	9. Describe how the ice condenser is cooled; include the temperature range and areas that have cooling coils.
X	X	X	X	10. Describe the glycol chiller; include power supply, logic and capacity.
X	X	X	X	11. State the glycol chiller outlet temperature.
X	X	X	X	12. State the purpose of the glycol circulation system.
X	X	X	X	13. List and describe all the major components in the glycol system.
X	X	X	X	14. Discuss the normal arrangement of the 6 glycol pumps and chillers.
X	X	X	X	15. Describe the glycol pumps; include power supply, logic and capacity.
X	X	X	X	16. Describe the logic for the glycol containment isolation valves.
X	X	X	X	17. Given a loss of instrument air/control power, determine the effect on the following valve: a. FCV-61-194
X	X	X	X	18. Discuss what provisions have been made for glycol expansion after the glycol system is isolated from the containment.
X	X	X	X	19. Explain how glycol is added to the glycol system.
X	X	X	X	20. Describe how the glycol system and the ice system interface.
X	X	X	X	21. Explain how to place a glycol pump in service.
X	X	X	X	22. Discuss how to place a glycol chiller in service.
X	X	X	X	23. List the checks to be made on a glycol chiller that is in service.

AUO	RO	SRO	STA	
	X	X	X	24. Regarding Technical Specifications and Technical Requirements for this system: a. Identify the conditions and required actions with completion time of one hour or less. b. Explain the Limiting Conditions for Operation, Applicability, and Bases. c. Given a status/set of plant conditions, apply the appropriate Technical Specifications and Technical Requirements.
	X	X	X	25. Correctly locate control room controls and indications associated with the Ice Condenser System, including: a. Ice Condenser Lower Inlet Door Monitor b. Ice Bed Temperature Monitor

WBN Bank Question

1. T/S3612 001

The Unit is in Mode 3 preparing for a reactor startup when the following occurs:

0900 -	Annunciator window 144-A, ICE COND INLET DOOR OPEN, alarms.
0930 -	An operator sent to investigate reports one lower inlet door is cracked just off the closed position, is free to open, but will not close completely.
1320 -	Maximum ice bed temperature verified to be to 23.2°F.
1710 -	Maximum ice bed temperature verified to be to 23.4°F.
2100 -	Maximum ice bed temperature verified to be to 23.6°F.
2350 -	Inlet door repaired, closed, and testing completed.

Which of the following identifies:

the earliest time Tech Spec LCO 3.6.12, Ice Condenser Doors, was required to be entered,
and,
if the Required Actions of Condition B were met during the time the inlet door was inoperable?

REFERENCE PROVIDED

	LCO Entry Time	Required Actions
a.	0900	Met
b.✓	0900	NOT met
c.	0930	Met
d.	0930	NOT met

DISTRACTOR ANALYSIS:

A. *Incorrect, Plausible because the required entry time is 0900 when the alarm came in is correct and because T/S does allow for the 25% allowance but not on the first performance of the required surveillance.*

B. *Correct, the required entry time is 0900 when the alarm came in (knowledgeable individuals first became aware of the conditions as they were later verified) and the conditions of the LCO were not met during the inoperability because the first interval cannot exceed 4 hours (0900 till 1320). The required action to verify ice bed temperature every 4 hours is not met because Tech Specs provide for the 25% allowance on all actions after the first performance when the completion time statement is written as "Once per..." (See T/S section 3.0)*

C. *Incorrect, Plausible because 0930 is the time the condition was confirmed to exist and because T/S does allow for the 25% allowance but not on the first performance of the required surveillance.*

D. *Incorrect, Plausible because 0930 is the time the condition was confirmed to exist and because T/S does allow for the 25% allowance and the required actions not being met is correct.*

Question Number: 86

Tier: 2 **Group** 1

K/A: 025 G2.2.40
Ice Condenser System
Equipment Control
Ability to apply Technical Specifications for a system.

Importance Rating: 3.4 / 4.7

10 CFR Part 55: 41.10 / 43.2 / 43.5 / 45.3

10CFR55.43.b: 2

K/A Match:

Technical Reference:

Proposed references to be provided: Tech Spec 3.6.12 Ice Condenser Doors , 5 pages

Learning Objective:

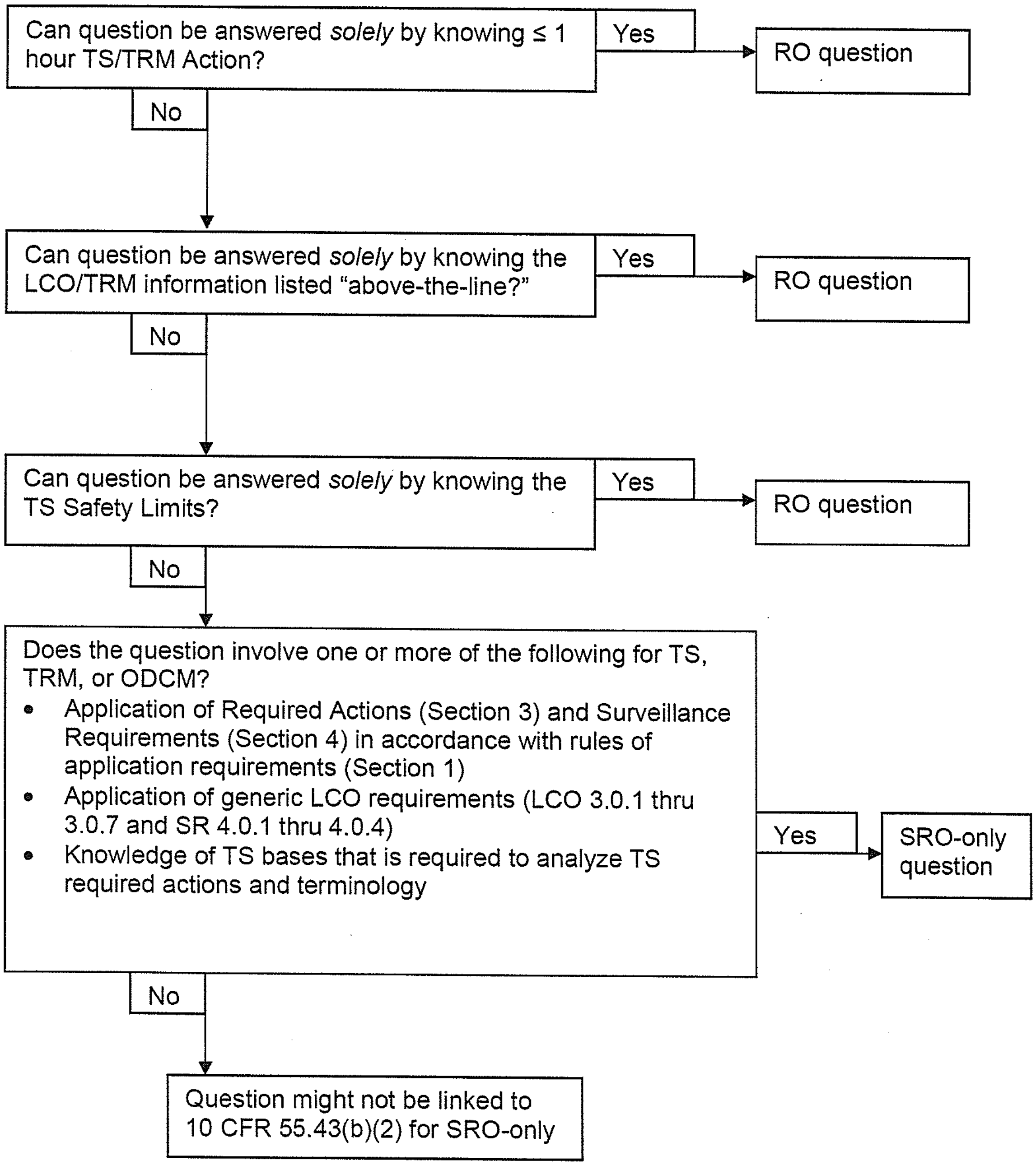
Cognitive Level:
- **Higher** ____
- **Lower** ____

Question Source:
- **New** ____
- **Modified Bank** ____
- **Bank** ____

Question History:

Comments:

Figure 1: Screening for SRO-only linked to 10 CFR 55.43(b)(2) (Tech Specs)



90. 026 G2.2.37 090

Given the following:

- Unit 1 RCS temperature is 325°F with a heatup in progress following a refueling outage.
- During a board walkdown both indicating lights on 1-HS-72-40, RHR SPRAY HDR A, are discovered to be DARK.
- The AUO sent to investigate reports back:
  - the valve is closed
  - the 480v breaker for the valve is tripped and cannot be reset.

Which ONE of the following identifies...

(1) if any Tech Spec LCO entry is currently required

and

(2) how the valve failure will affect the next MODE change as RCS heatup continues?

A.✓ (1) No
(2) Mode change can be made using the provisions of LCO 3.0.4.

B. (1) No
(2) The provisions of LCO 3.0.4 can **NOT** be used to make the Mode change.

C. (1) Yes
(2) Mode change can be made using the provisions of LCO 3.0.4.

D. (1) Yes
(2) The provisions of LCO 3.0.4 can **NOT** be used to make the Mode change.