NRC

REV 2 REV. [redacted]

4/15/79 DATE [redacted]

EMERGENCY PROCEDURE EP- 21

TITLE: Total Loss of Pressurizer Level Indication.

APPROVALS: PORC(Vice-Chairman) R P Warren DATE 4/15/79

UNIT SUPT.: [illegible] DATE 4/15/79

B&W [illegible] DATE 4/13/79 NRC [illegible] DATE 4/15/79

ALARA [illegible] DATE 4/13/79

Temp & Pressure Limitations

1) Use #1 for Temp. between 230° and 240° F

2) Insure sufficient pressure to give 2.4 gpm RCS Leakage.

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ASSUMPTIONS: ~~Conditions of Plant established when the second level instrument failed:~~

1.) 2 level detectors (PZR) already failed and the 3rd and last indicator fails.

2.) MUV-18 Shut

3.) RCV-1 Shut (Spray Valve) (MANUAL)

4.) RCV-150 Open (Spray line bypass)

5.) Bank 8 Pressurizer heaters ON - ALL other heater groups OFF.

6.) Pressurizer heater interlocks disabled to prevent level failure from causing loss of heaters.

7.) TEMPERATURE OF RCS BETWEEN 230° AND 280°F.

8.) RC-V2, RC-R2, AND RC-V137 SHUT

9.) The portion of the procedure for calculating/predicting pressurizer level (sections 2 → 3.2.1) should only be used for 30 hours. If no level indication is regained or installed within the allowed 30 hours, the RCS should be taken solid and maintained in a solid condition in ~~accordance with~~ section 3.2.2.

1.0 SYMPTOMS

1.1 Failed pressurizer level indication. Level instrument should fail to midscale, but may fail high or low.

1.2 Pressurizer level annunciator sounds

1.3 Pressurizer level steady with changing plant parameters

2.0 IMMEDIATE ACTIONS

2.1 Take the following readings to establish baseline data for operation and control. Record below and on Attachment (1)

a. Record date and time: _____

b. Record last known pressurizer level from strip chart: _____

c. Record, then monitor pressurizer temperature:

Console _____

Computer Point 1739 _____

d. Record, then monitor RCS pressure:

Console _____

Computer Point 399 _____

e. Record, then monitor RCS temperature:

Computer Point 394 _____

Computer Point 397 _____

f. Record, then monitor makeup tank parameters:

Level _____

Temperature _____

Pressure 155 ~~126~~

g. Record, then monitor OTSG levels and temperatures:

A Level

B Level

A Temperature

B Temperature

h. Record, then monitor pressurizer heater amps!

2.2 Check shut MU-V18

2.3 Check shut RC-V137

2.4 Check shut RC-V1

3.1 Maintain pressurizer level as follows:

3.1.1 Each hour, makeup for RCS leakage (~~2.4~~ gpm) by pumping from the makeup tank to the RCS to decrease makeup tank level by ~~3~~ 4.5 inches.

3.1.2 When makeup tank level increases 20 inches above the level recorded in section 2, lower makeup tank level to the original level by pumping from the makeup tank to the RCS

3.1.3 For every 10°F rise in RCS temperature, allow the makeup tank level to increase ~~8~~ 16 inches from normal letdown.

3.1.4 For every 10°F decrease in RCS temperature, lower the makeup tank level by ~~8~~ 16 inches, by pumping from the makeup tank to the

CAUTION

Monitor pressurizer temperature for evidence of uncovered pressurizer heaters. A superheated condition occurs rapidly if the heaters are uncovered. If pressurizer temperature increases by 10°F or more in one minute, secure all heaters and pump from the makeup tank to the RCS to decrease makeup tank level by 30 inches. If a marked decrease in pressurizer heater current occurs, secure all heaters and pump deaerated water to the RCS to decrease makeup

tank level by 30 inches

3.1.5 Based on section 2 reference data, RCS leak rate, makeup tank level, RCS temperature, time elapsed since loss of indication, and makeup added to the makeup tank, calculate pressurizer level and plot the calculated level each hour. Attachment 1 describes this calculational method.

3.2 Loss of pressurizer level control:

3.2.1 Low pressurizer level: Indicated by increasing pressurizer temperature and/or marked decrease in pressurizer heater amps.

a. Secure all pressurizer heaters

b. Place mu-V17 in manual control and ~~set for zero~~ lift level close mu-V5, open ~~the valve~~.

c. Open mu-V18, ^ and pump 30 inches of makeup tank level to the RCS.

d. Energize the Bank 1 heaters and observe pressurizer temperature.

e. If pressurizer temperature ~~stabilizes~~ establish, ~~start~~ ~~mu-V17~~ pressurizer level using mu-V5 and mu-V17. ~~and mu-V18~~

f If pressurizer temperature continues to increas above T_{sat}, secure the b. Bank d. 1 heaters and perform steps ~~c.~~ ~~and d~~ again. 155 129

g. If desired, restore pressurizer level to mid-scale (≈ 200 inches) by making several (5-6) ~~30 inches~~ additions (≈ 30 inches of makeup tank

level) from the makeup tank to the RCS.

3.2.2 High pressurizer level: Indicated by increasing RCS pressure (greater than 2250 psi for existing PZR temperature). This indication only occurs if the pressurizer is near solid.

a. Take manual control of MU-V17 (if being used) and maintain the existing makeup flow rate. Use MU-V5 for pressure control.

b. Shut/check shut RC-V1, RC-V2 and RC-V137.

c. Secure all pressurizer heaters, ~~and~~ record the RCS pressure and mark the pressure recorder chart.

d. Slowly increase the makeup flow rate to raise pressure to 50 psi above the value recorded in step c. Maintain the RCS pressure at this value to completely collapse the bubble and take the pressurizer to a solid water condition. PRESSURE SHOULD ALWAYS BE KEPT ABOVE 500PSI.

NOTE

The indication that the pressurizer is solid is a sudden increase in RCS pressure when making up at a constant rate.

CAUTION 155 130

When operating in a solid condition, RCS temperature changes and/or net addition or removal of RCS water cause large changes

in RCS pressure. A net addition or removal of 10 gallons results in a pressure change of approximately 50 psig. A RCS temperature change of 1°F results in a pressure change of approximately 130 psig.

e. Attempt to maximize letdown flow to improve controllability of pressure.

f. Maintain pressure by varying makeup and/or letdown flow rate using MU-V5 and MU-V17.

g. Energize/deenergize pressurizer heaters intermittently to maintain pressurizer temperature 25-35°F below Tsat for the existing pressure.

h. If RCS pressure continues to increase with mu-v17 and mu-v18 shut, MU-V5 closed, jog open RC MU-V137 to decrease pressure back to the (PRESSURE IN SECTION 2 + 50 PSI) original control points. When pressure returns to the value being maintained previously, shut RC MU-V137 and revert to varying makeup/letdown flow rate for pressure control. If continuous venting through RC MU-V137 is necessary, minimize the flow rate through the vent valve by keeping the makeup addition rate as low as possible.

Babcock & Wilcox

ATTACHMENT 1 TO EP-21 (REV 02)

Data Sheet For Pressurizer Level Calculation

	Values at time of Failure (t_0)	Present Values (t_1)	Change
Date/Time			hours ΔT
L_{PZR} / T_{PZR}			ΔT_{PZR}
L_{MUT} / T_{MUT}			ΔL_{MUT}
T_c / Press			ΔT_c

Total additions since t_0 A = _____ gal

Estimated RCS Leak Rate L = _____ GPM

Calculation:

$$L_{PZR_{t_1}} = L_{PZR_{t_0}} - 3.23(L)(\Delta T) + 2.07(\Delta T_c) - 1.66(\Delta L_{MUT}) + 0.0539(A) + 0.287(\Delta T_{PZR})$$

$L_{PZR_{t_0}}$ = _____ $-$ _____ (L) (ΔT) $+$ 2.07 (ΔT_c) $-$ 1.66 (ΔL_{MUT}) $+$ 0.0539 (A) $+$ 0.287 (ΔT_{PZR})

$L_{PZR_{t_1}}$ = _____ INCHES

Assumptions: T_c 230 - 250 F

P_{RCS} 800 - 1000 PSIA

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