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TASK CLOSE OUT DOCUMENT

Task Scope PARTICIPATE IN EP-32 CHANGES

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Task No. 40 Date Complete 5/3/79

Reason felt task is complete:

EP-32 ~~was~~ is being replaced with EP-34. The draft of EP-34 was reviewed and changes suggested.

Members of Committee

DAVE TOOKER

WOODY STRANG

Signed
Committee Leader

TASK 40

PARTICIPATE IN EP-32 (CHANGED TO EP-34) CHANGES

Rather than revise EP-32, "Loss of RCP's - Successful - Natural Circulation", a new Emergency Procedure, E-34 "Loss of Natural Circulation"was written. (attached) These comments are on this latter procedure.

The EP-34 plan of action upon loss of natural circulation is excellent. The following comments are given by paragraph number.

Paragraph 3.5 should be changed to read as follows (Changes underlined). "RCS pressure shall be kept at least 100 psi above .... until a maximum pressure of 1000 psia is reached. The procedure as currently written requires the pressure to be lowered to 100 psi above the hottest thermocouple which is currently reading 320°F. Saturation pressure at 320°F is 90 psia and therefore the required pressure is 190 psia. I do not believe this is the intent. In fact I suggest that a lower bound of 500 psi +50 be used in the procedure and then revise the procedure when decision is made to further reduce pressure. The maximum pressure of 100 psia in the current procedure is evidently a typographical error which should be corrected to read 1000 psi.

Paragraph 5.1.2. Correct the work "hiatus" to "heaters" in the second sentence.

Paragraph 5.1.3. I suggest that the words "or below" be deleted from the first sentence. The "or below" phrase allows the operator to close the bypass valve and stop the steaming of the operating OSTG(s). If a lower limit must be stated, I suggest that it be placed on the minimum allowable pressure, if any, of the steam generator. If there is no such limit the steam generator should be steamed to as close to the condenser temperature as time and other limits allow.

Paragraph 5.2.4. Operational Limits. The limits as now written are for operation at 900 psi. I suggest that a set of limits be provided for 900 psi and a set for 500 psi. In the transition from 900 to 500 psi use the 500 psi limits. I believe an appropriate set of 500 psi limits are:

5.2.4.1 T_H for the operating OTSG(s) $\leq 350^{\circ}F$

5.2.4.2 All in-core thermocouples $\leq 900^{\circ}F$

5.2.4.3 No more than three (3) thermocouples $\geq 700^{\circ}F$

5.2.4.4 At least six (6) incore thermocouples $\leq 450^{\circ}F$

When the "B" long term OTSG cooldown system is ready and set up for service this procedure should be revised starting at paragraph 5.2.5 to reflect initial operation of the "B" OTSG in the solid mode to the new system.

DRAFT

EP-34 5/1/79

LOSS OF NATURAL CIRCULATION

1.0 Purpose

To reestablish core cooling if natural circulation is lost.

2.0 References

2.1 EP-32, Rev. 2 4/23/79

2.2 EP-33, Latest Revision

2.3 GPU Service Memo TSC-109, April 28, 1979, to G. A. Kunder

3.0 Limitations and Precautions

3.1 Contact R. C. Arnold before changing the present method of maintaining natural circulation or if any of the following notification levels are exceeded. Exceeding these levels may indicate natural circulation is being lost.

a. Loop A ΔT greater than $20^{o}F$
b. Loop A T_H increasing for 8 hours
c. Hottest in core thermocouple exceeds $350^{o}F$
d. Any in-core thermocouple increases by more than $30^{o}F$
e. T_{sat} of the operating OTSG (s) goes below Loop A T_C by more than $5^{o}F$.

3.2 Operational limits of RCP with backup RCPs available:

a. frame vibration exceeds 5 mils
or
b. shaft vibration exceeds 30 mils
and
c. upper seal leakage and return flow increases to greater than 1.9 GPM.

3.3 Operational limits of RCP with no backup RCP available

a. Shaft vibration > 70 mils
or
b. Upper seal leakage > MU system capability to maintain RC system water level.

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3.4 The following limitations should be maintained while in natural circulation:

a. OTSG level maintained at 400 to 430" on the operating OTSG or OTSGs.

b. Balance leakage and letdown flows with makeup and seal injection in a continuous mode rather than using periodic makeup.

3.5 RCS pressure shall be kept at least 100 psi above saturation pressure for the hottest in core thermocouple at all times until ~~a maximum~~ pressure of 100 psia is reached.

3.6 Makeup tank temperature should be maintained as high as possible but below 150°F.

3.7 All makeup to the Makeup Tank shall be deareated (degassed). Makeup boron concentration shall be such as to maintain 3000 ppm boron in the RCS. (Letter TSC-109, April 28, 1979, to G. A. Kunder)

3.8 If the pressurizer is solid maintain pressurizer water temperature approximately 25°F below saturation pressure for RCS pressure.

4.0 Loss of Natural Circulation Symptoms:

4.1 Loss of natural circulation could be caused by or be indicated by the following which should be monitored at all times:

a. Loss of condenser vacuum

b. Change in the operating OTSG T_H to T_C temperature differential by $\pm$ 5°F after being in an equilibrium condition.

c. T_{steam} of the operating OTSG becomes greater than operating T_H.

d. If the averaged in-core thermcouples begin to increase by 20°F/hr. over a 2-hour period.

e. Notification levels of Section 3.1.

5.0 Recovery of Natural Circulation

NOTE: It is assumed that prior to loss of natural circulation the following conditions existed. The RCS was in natural circulation with heat being removed by feeding and steaming of "A" OTSG with "B" OTSG isolated. The "A" OTSG level is 400" to 430". The "B" OTSG level is 380". The pressurizer level is 250" or greater by best estimate. The Loop A ΔT is between 10°F and 20°F. The RCS pressure is greater than 200 psia and less than 1000 psia.

5.1 Immediate Actions

5.1.1 Maintain RCS pressure at least 100 psi above the saturation pressure of the hottest in-core thermocouple. Do not exceed 1000 psia.

5.1.2 If the pressurizer is not solid, increase and maintain pressurizer level to 350" ± 25" by best estimate. This will protect against uncovering pressurizer ~~hiatus~~ during RCP jogs or operation.

5.1.3 Maintain ~~feeding~~ delete and steaming of the operating OTSG(s) at ~~or below~~ the rates in use prior to loss of natural circulation. Establish and maintain T_{sat} of the operating OTSG(s) above the Loop A T_c existing before loss of natural circulation.

5.1.4 Notify the Shift Supervisor of the loss of natural circulation. He will in turn notify R. C. Arnold and J. Herbein.

NOTE: No further immediate actions are required. The RCS heatup rate will be very slow and natural circulation should restart with no further actions required. Guidance on further action (outlined in succeeding sections) will be provided by the Natural Circulation Task Force.

5.2 NOTE 1: When equilibrium natural circulation conditions are established, RCS temperature T_H should stabilize at about 160 to 180°F.

NOTE 2: Natural circulation will result by a RCS ΔT for the operating OTSG (s) of approximately 10°F to 35°F when equilibrium conditions of flow have been achieved. Initially, however, ΔT may increase to greater values which could be as high as 100°F, followed by a decrease to the equilibrium ΔT. The ΔT values in this paragraph are provided for information only. It may take several hours to several days to reestablish natural circulation.

NOTE 3: The system responds slowly to changes while in the natural circulation mode. The loop transport time is a half hour or longer, therefore, changes in steam demand and feed rate should be made slowly and the system should be given time to equilibrate before additional changes are made.

5.2.1 Record and plot T_H and T_C for both loops as well as T_{SAT} for both OTSGs every twenty (20) minutes.

5.2.2 Read and record all operable in-core thermocouples every ten (10) minutes. Plot the six (6) lowest and six (6) highest thermocouples.

5.2.3 Natural circulation should be reestablished without resorting to RCPs or solid operation. The following criteria are provided as indicators that further operational changes are required.

5.2.4 Operational Limits

5.2.4.1 T_H for the operating OTSG(s) $\leq 420^{o}F$

5.2.4.2 All in-core thermocouples $\leq 1000^{o}F$

5.2.4.3 No more than three (3) in-core thermocouples $\geq 800^{o}F$

5.2.4.4 At least six (6) in-core thermocouples $\leq 500^{o}F$

Depen on pressu refer to ~~Action~~ Para 3

5.2.5 The following steps are listed in expected order of performance if they become necessary. Steps 5.2.6 thru 5.2.15 should be executed only on direction from R. C. Arnold (J. Herbein).

5.2.6 Start steaming "B" OTSG to the condenser thru the bypass valve. Maintain steaming of "A" OTSG. When natural circulation is established reduce steaming to maintain T_{SAT} at or above the T_C for the respective generator.

5.2.7 Initiate feedwater flow thru the auxiliary feed nozzles at _____ gpm for _____minutes.

5.2.8 Jog RCP 1A or 2A for approximately 5 seconds.

5.2.9 Secure steaming of "A" OTSG and go solid in "A" (Z-87) while continuing to steam on "B" OTSG.

5.2.10 Jog RCP 1B or 2B for approximately 5 seconds.

5.2.11 Run RCP 1A or 2A for approximately 30 seconds.

5.2.12 Go solid in "B" (Z-110). Run RCP 1A or 2A as necessary to remain within the limits of 5.2.4. Do not overcool the RCS and uncover the pressurizer heater.

5.2.13 Run RCP 1B or 2B for approximately 30 seconds.

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5.2.14 Go to long term "B" OTSG cooling.

5.2.15 If natural circulation cannot be re-established and sufficient cooling of the core is not achieved, proceed to EP-33 or to DHR (ADHR) as directed by R. C. Arnold (J. Herbein).

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