

NC	REV 00	Date 06-03-83	AP-530
NATURAL CIRCULATION			
<u>ENTRY</u>			
SYMPTOMS		CONDITIONS	
1. No operating RCPs.		<ul style="list-style-type: none"> • Loss of offsite power • Manual trip of RCPs due to ES actuation. 	
2. Annunciator alarms associated with trip of all RCPs.			
Reviewed By PRC <u><i>[Signature]</i></u>		Date <u>06-03-83</u>	Mtg.# <u>83-22</u>
Approved By NPM <u><i>[Signature]</i></u>		Date <u>7-6-83</u>	
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<u>ACTIONS</u>											
IMMEDIATE		REMEDIAL									
<p>1. Verify adequate subcooling margin:</p> <table border="1"> <tr> <th>RC PRESSURE</th> <th>SUBCOOLING MARGIN</th> </tr> <tr> <td>PSIG</td> <td>°F</td> </tr> <tr> <td>> 1500</td> <td>20</td> </tr> <tr> <td>≤ 1500</td> <td>50</td> </tr> </table>		RC PRESSURE	SUBCOOLING MARGIN	PSIG	°F	> 1500	20	≤ 1500	50	<p>1. Establish full HPI.</p> <p>2. Start raising OTSGs to 95% on operating range using emergency feedwater.</p> <p>3. Refer to AP-380, Engineered Safeguards Actuation.</p>	
RC PRESSURE	SUBCOOLING MARGIN										
PSIG	°F										
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<p>2. Start raising OTSG levels to level:</p> <table border="1"> <tr> <th>CONDITION</th> <th>LEVEL</th> </tr> <tr> <td> <ul style="list-style-type: none"> • <u>NO</u> RCPs • Adequate subcooling margin </td> <td>50%</td> </tr> <tr> <td> <ul style="list-style-type: none"> • Less than adequate subcooling margin </td> <td>95%</td> </tr> <tr> <td> <ul style="list-style-type: none"> • < 2 HPI pumps available </td> <td>95%</td> </tr> </table>		CONDITION	LEVEL	<ul style="list-style-type: none"> • <u>NO</u> RCPs • Adequate subcooling margin 	50%	<ul style="list-style-type: none"> • Less than adequate subcooling margin 	95%	<ul style="list-style-type: none"> • < 2 HPI pumps available 	95%	<p>Establish full HPI.</p>	
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<u>FOLLOW-UP</u>											
ACTIONS		DETAILS									
1. Start VP-580 <u>AND</u> notify SOTA.		Start Plant Safety Verification Procedure.									
CAUTION Cooldown of RC shall not exceed the following rates:											
<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th>Tc (°F)</th> <th>RATE (°F/HR)</th> </tr> <tr> <td>550 - 280°</td> <td>10.0</td> </tr> <tr> <td>280 - 150</td> <td>5.0</td> </tr> <tr> <td>< 150</td> <td>2.5</td> </tr> </table>				Tc (°F)	RATE (°F/HR)	550 - 280°	10.0	280 - 150	5.0	< 150	2.5
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2. Establish required OTSG levels <u>AND</u> maintain PZR level > 50".		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th>CONDITION</th> <th>LEVEL</th> </tr> <tr> <td>• Adequate subcooling margin</td> <td>50%</td> </tr> <tr> <td>• Less than adequate subcooling margin</td> <td>95%</td> </tr> <tr> <td>• < 2 HPI pumps available</td> <td>95%</td> </tr> </table>		CONDITION	LEVEL	• Adequate subcooling margin	50%	• Less than adequate subcooling margin	95%	• < 2 HPI pumps available	95%
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
<u>NOTE</u>			
AP-450, Emergency Feedwater Actuation, contains EFW throttling rules.			
3. <u>IF</u> emergency feedwater is used, <u>THEN</u> refer to AP-450, Emergency Feedwater Actuation.			
<u>NOTE</u>			
Rapid and possibly erratic increase in PZR level without change in RC make up, RC letdown, OTSG feed rate or OTSG steaming rate is indication of <u>RC void</u> .			
4. <u>WHEN</u> RC voids are indicated, <u>THEN:</u> a. Reduce RC void volume b. Maintain RC TEMP and PRESS <u>until</u> void indication does <u>NOT</u> exist.		Reduce RC void volume: a. Stop depressurization b. Stabilize RC temperature c. Raise RC PRESS d. Observe PZR level for decrease and stability.	
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
5. <u>IF</u> subcooling margin ≤ 0 <u>THEN</u> go to EP-290, Inadequate Core Cooling.		<ul style="list-style-type: none"> ● Observe subcooling margin meter selected to incore thermocouples. <u>OR</u> <ul style="list-style-type: none"> ● Determine: <ul style="list-style-type: none"> - AVG of 5 highest incore thermocouples. - RC PRESS - Steam tables. 	
6. <u>IF</u> adequate subcooling margin <u>does not</u> exist, <u>THEN</u> : <ul style="list-style-type: none"> a. Establish HPI-PORV cooling b. Ensure required OTSG levels c. Refer to AP-380, Engineered Safeguards Actuation. 		Establish HPI-PORV cooling: <ul style="list-style-type: none"> a. Open: <ul style="list-style-type: none"> ● MUV-73 ● MUV-58 b. Start 2 HPI pumps c. Open: <ul style="list-style-type: none"> ● MUV-23 ● MUV-25 ● MUV-24 ● MUV-26 d. When RC PRESS > 2300 PSIG, <u>THEN</u> open PORV. 	
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
<p>7. <u>IF</u> natural circulation is verified,</p> <p><u>THEN</u> go to Follow-up step 20.</p>		<p>Verify natural circulation by observing:</p> <ul style="list-style-type: none"> • $T_c \approx T_{SAT}$ of OTSG. • ΔT develops and stabilizes • The average of the 5 highest incores follows T_H within 10°F. • T_H, T_c, and Incores lower when OTSG pressure is lowered. 	
<p>8. Establish HPI cooling.</p>		<ol style="list-style-type: none"> Open: <ul style="list-style-type: none"> • MUV-58 • MUV-73 Start 2 HPI pumps Open: <ul style="list-style-type: none"> • MUV-23 • MUV-25 • MUV-24 • MUV-26 Cycle PORV to maintain subcooling margin < 100°F. Refer to AP-380, Engineered Safeguards Actuation, Follow-up step 7. 	
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<u>FOLLOW-UP (Cont'd)</u>											
ACTIONS		DETAILS									
9. Establish required OTSG level.		<table border="1"> <tr> <th>CONDITION</th> <th>LEVEL</th> </tr> <tr> <td> <ul style="list-style-type: none"> • <u>NO</u> RCPs • Adequate subcooling margin </td> <td>50%</td> </tr> <tr> <td> <ul style="list-style-type: none"> • Less than adequate subcooling margin </td> <td>95%</td> </tr> <tr> <td> <ul style="list-style-type: none"> • < 2 HPI pumps available </td> <td>95%</td> </tr> </table>		CONDITION	LEVEL	<ul style="list-style-type: none"> • <u>NO</u> RCPs • Adequate subcooling margin 	50%	<ul style="list-style-type: none"> • Less than adequate subcooling margin 	95%	<ul style="list-style-type: none"> • < 2 HPI pumps available 	95%
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10. <u>IF</u> natural circulation is verified, <u>THEN</u> go to Follow-up step 20.		Verify natural circulation by observing: <ul style="list-style-type: none"> • $T_c \approx T_{SAT}$ of OTSG. • ΔT develops and stabilizes • The average of the 5 highest incores follows T_H within 10°F. • T_H, T_c, and Incores lower when OTSG pressure is lowered. 									
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
11. Lower OTSG pressure until OTSG T _{SAT} is 40 - 60° below AVG of 5 lowest incore thermocouples.			
12. <u>IF</u> natural circulation is verified, <u>THEN</u> go to Follow-up step 20.		Verify natural circulation by observing: <ul style="list-style-type: none">• $T_C \approx T_{SAT}$ of OTSG.• ΔT develops and stabilizes• The average of the 5 highest incores follows T_H within 10°F.• T_H, T_C, and Incores lower when OTSG pressure is lowered.	
<u>NOTE</u> RCPs are available when the following conditions are met: <ul style="list-style-type: none">• Pump start permissives• Power available.			
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
<p>13. <u>IF</u> RCP is available <u>THEN</u> "BUMP" 1 RCP for 10 SEC.</p> <p><u>IF NO</u> RCPs are available, <u>THEN</u> go to Follow-up step 18.</p>		<p>1. Ensure OTSG T_{SAT} is 40° - 60°F below average of 5 lowest incores.</p> <p>2. <u>IF</u> an RCP is available, <u>THEN</u> Bump 1 RCP for 10 seconds in loop with highest OTSG level.</p> <p>3. <u>WHEN</u> RC pressure has stabilized after pump bump (within 20 PSIG), <u>THEN</u> determine if natural circulation is established.</p>	
<p>14. <u>IF</u> natural circulation is verified, <u>THEN</u> go to Follow-up step 20.</p>		<p>Verify natural circulation by observing:</p> <ul style="list-style-type: none"> • $T_c \approx T_{SAT}$ of OTSG. • ΔT develops and stabilizes • The average of the 5 highest incores follows T_H within 10°F. • T_H, T_c, and Incores lower when OTSG pressure is lowered. 	
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
<u>NOTE</u> An RCP "Bump" is of 10 second duration.			
15. "Bump" remaining RCPs at 15 MIN intervals until all RCPs have been bumped.			
16. <u>IF</u> natural circulation is verified, <u>THEN</u> go to Follow-up step 20.		Verify natural circulation by observing: <ul style="list-style-type: none">• $T_C \approx T_{SAT}$ of OTSG.• ΔT develops and stabilizes• The average of the 5 highest incores follows T_H within 10°F.• T_H, T_C, and Incores lower when OTSG pressure is lowered.	
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
<p>17. <u>WHEN</u> 1 hour or more has elapsed since reactor trip</p> <p><u>THEN:</u></p> <p>a. Lower OTSG T_{SAT} to 90-100°F below incore temperature and maintain.</p> <p>b. Start 1 RCP and run continuously as long as at least one OTSG is available for heat removal.</p>		<p>a. Open TBVs or ADVs and lower OTSG pressure until OTSG T_{SAT} is 90-100°F below average of 5 highest incore temperatures.</p> <p>b. <u>IF</u> RCP permissives are met, <u>THEN</u> start 1 RCP and run continuously as long as one OTSG is available for heat removal.</p>	
<p>18. <u>IF</u> natural circulation is verified,</p> <p><u>THEN</u> go to Follow-up step 20.</p>		<p>Verify natural circulation by observing:</p> <ul style="list-style-type: none"> • $T_c \approx T_{SAT}$ of OTSG. • ΔT develops and stabilizes ($\sim 20^\circ - 50^\circ$). • The average of the 5 highest incores follows T_H within 10°F. • T_H, T_c, and Incores lower when OTSG pressure is lowered. 	
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<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
19. Maintain HPI cooling <u>AND</u> go to Follow-up step 24.		Refer to AP-380, Engineered Safeguards Actuation, Follow-up step 7.	
<u>NOTE</u> RCPs are available when the following conditions are met: <ul style="list-style-type: none">● Pump start permissives● Power available.			
20. <u>IF</u> RCPs are available <u>AND</u> adequate subcooling margin exists, <u>THEN</u> start: <ul style="list-style-type: none">a. 1 RCP in each loop<u>OR</u>b. 2 RCPs in one loop.			
21. <u>IF</u> cooldown is required, <u>THEN</u> refer to AP-380, Engineered Safeguards Actuation, Follow-up step 7.			
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NC	REV 00	Date 06-03-83	AP-530
<u>FOLLOW-UP (Cont'd)</u>			
ACTIONS		DETAILS	
22. <u>IF</u> HPI established <u>AND</u> HPI stop conditions exist, <u>THEN</u> : a. Stop HPI b. Ensure PORV and PORV BLK VLV closed.		<u>WHEN</u> the following condition exist: • High pressure - Adequate subcooling margin - PZR level \geq 50" - OTSG heat removal <u>OR</u> • Low pressure - LPI flow \geq 1000 GPM in each train - Stable for \geq 20 MIN. <u>THEN</u> stop HPI.	
23. Maintain plant conditions.			
24. <u>WHEN</u> VP-580 <u>AND</u> SAT, <u>THEN</u> notify SSOD.			
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