Schroeder, John-P

From: Lauzze, J Mike (WLS) [J_Mike_Lauzze@DRESSER-RAND.com]
Sent: Tuesday, December 04, 2001 2:02 PM
To: Schroeder, John-P
Subject: Terry Turbine

John

You should not have any major problem starting or stopping your turbine ever 15 minutes or so in an Emergency situation. You could end of with some condensation or control problems but this should not prevent the turbine from running.

Mike

A1135

STATE CHANGE HISTORY

Initiate
⇨
by WILLIAM ZIPP

AR Pre-Screen
10/29/2002 12:41:27 PM
Owner (None)

SECTION 1

Activity Request Id:	CAP029952		
Activity Type:	CAP	Submit Date:	10/29/2002 12:41:27 PM
One Line Description:	Possible Common Mode Failure of Aux Feed Recirculation Lines		
Detailed Description:	10/29/2002 12:41:27 PM - WILLIAM ZIPP: Partial plugging of the mini-recirc orifice (RO-4008) in the recirc line from aux feed pump P-38A occurred during testing on 10/24. This is documented in CAP 029908. Flow through the recirc line remained above operational limits during the event, and the remaining aux feed pumps were run to check for extent of condition with no reduction in recirc flows found. Review of this event has led to the conclusion that it is possible the mini-recirc orifices for all the aux feed pumps (3 per unit) could plug during an emergency when aux feed is needed. Plugging of the recic orifice could then render its associated pump inoperable, as this flowpath provides a safety related function to maintain a required amount of flow for pump protection. This considers use of our credited water supply (service water), but may also be an issue using the normal CST water supply. This is because of the small orifice opening sizes compared to the size of material that might credibly be introduced into the system from service water, such as rust nodules from the carbon steel supply piping, sand/silt, and lake grass. Material could also be introduced from the CST water supply, though this is thought to be a very pure supply of water.		
Initiator:	ZIPP, WILLIAM	Initiator Department:	EESB Engineering Equipment Systems BOP Mechanical PB
Date/Time of Discovery:	10/29/2002 11:21:55 AM	Date/Time of Occurrence:	10/29/2002 11:21:55 AM
Identified By:	Site-Identified	System:	(None)
Equipment # (1st):	(None)	Equipment Type (1st):	(None)
Equipment # (2nd):	(None)	Equipment Type (2nd) :	(None)
Equipment # (3rd):	(None)	Equipment Type (3rd) :	(None)
Site/Unit:	Point Beach - Common		
Why did this occur?:	10/29/2002 12:41:27 PM - WILLIAM ZIPP: My opinion: It is explained via considering the history for the aux feed recirc lines: 2-3 years ago, due to recirc line vibration, cavitation, and ensuing weld failures, the recirc orifices were redesigned and a modification was initiated to replace the existing orifices with anti-cavitation models. All four have been replaced, the last one being done last month during U1R27. The new orifices have smaller passages than the original model. At the time the mod was conceptualized, the recirc line's function was to LIMIT flow, ensuring adequate forward flow to the steam generators. Potential for blockage of the orifices was explored, and considered possible, but justified based on the short length of time the recirc line is needed at the beginning of an accident. The recirc line's function to limit flow bounds any postulated orifice blockage.		

Nov/Dec 2001: Issue of recirc line AOV failing closed on loss of instrument air; subsequent "red" finding. PBNP design philosophy evolves to needing recirc line flow to maintain aux feed pump operability. EOPs and AOPs revised to ensure minimum forward flow required to protect the pumps from overheating is maintained, and absent that, that recirc flow is present. The means of verifying recirc flow is that the recirc AOV indicates open, as there is no control room indication of recirc flow. Apparently, the impact of the new orifice mod was not considered. Unclear to me at this point.

Summer 2002: Recirc line AOV function to open becomes a safety related function. The internals of the check valve in the common return line to the CSTs was removed to eliminate a potential common mode failure. Again, the orifice appears to have not been considered.

Immediate Action Taken: 10/29/2002 12:41:27 PM - WILLIAM ZIPP:
Discussed with engineering management, Ops management including the on-shift DSS, Licensing. The shift manager declared all four aux feed pumps inoperable at approx. 1025 on 10/29/2002. Came to concensus on immediate actions needed.

Recommendations: 10/29/2002 12:41:27 PM - WILLIAM ZIPP:
1) Write and hang temp info tags on the pump handswitches, requiring that a minimum forward aux feed flow of greater than 50 gpm (P-38 A/B) or 75 gpm (1/2 - P29) be maintained, if not, stop affected pump.; brief the Ops crews on the issue. (Ops)
2) Make changes to affected AOPs, EOPs, and other critical procedures to ensure that minimum forward flow is maintained, or the affected pump is stopped. (Ops, Engr support 50.59)
3) Review for reportability; report the issue (Licensing)
4) Review from PSA significance determination process perspective. Evalute the present way the orifices are modeled (PSA).
5) Review for impact on aux feed pump unavailability for NEI cornerstone performance indicator (EESN).
6) Redesign the recirc line orifices to make use of an orifice design that has aperture size of >1/8" (basis: service water zurn strainer size is 1/8"). Consider providing Control Room with indication of recirc line flow. (design engr)

◆ Notify Me During Eval?:	N	◆ SRO Review Required?:	Y

SECTION 2

Operability Status:	(None)	◆ Compensatory Actions:	N
Basis for Operability:			
◆ Unplanned TSAC Entry:	N	◆ External Notification:	N

SECTION 3

Screened?:	N	◆ Significance Level:	(None)
INPO OE Reqd?:	N	Potential MRFF?:	N
◆ QA/Nuclear Oversight?:	N	◆ Licensing Review?:	N
Good Catch/Well Doc'd?:	NA		

SECTION 4

Inappropriate Action:			
Process:	(None)	Activity:	(None)
Human Error Type:	(None)	Human Perf Fail Mode:	(None)
Equip Failure Mode:	(None)	Process Fail Mode:	(None)
Org/Mgt Failure Mode:	(None)	Group Causing Prob:	(None)
Hot Buttons:	(None)		

SECTION 5

CAP Admin:	PBNP CAP Admin	Prescreener:	(None)
Project:	Corrective Action Program (CAP)		
State:	AR Pre-Screen	Active/Inactive:	Active
Submitter:	WILLIAM ZIPP	Owner:	(None)
AR Type:	Parent	Last Modified Date:	10/30/2002 9:56:58 AM
Last Modifier:	MARYBETH ARNOLD	Last State Change Date:	10/29/2002 12:41:27 PM
Last State Changer:	WILLIAM ZIPP	Close Date:	
NUTRK ID:			
# of Children:	0		
References:			
Update:	The Managers' Screen Team initially reviewed this CAP on 10/30/02 and determined a Root Cause Evaluation of this Level A CAP should occur, as well as issuing actions as those made in the Recommendations section. This CAP still remains in the screening queue awaiting OD completion.		
Prescreen Comments:			
Import Memo Field:			
OPR Completed?:	N		
OLD_ACTION_NUM:			
sub_tsId:	0	original_project_id:	0
original_issue_id:			
Site:	Point Beach		
Cartridge and Frame:			

ATTACHMENTS AND PARENT/CHILD LINKS

Principal to OPR000031: Possible Common Mode Failure of Aux Feed Recirculation Lines

CHANGE HISTORY

10/29/2002 6:23:38 PM by DAN WEBER

Last Modified Date Changed From 10/29/2002 12:41:27 PM To 10/29/2002 6:23:38 PM

Last Modifier Changed From WILLIAM ZIPP To DAN WEBER

10/29/2002 6:32:25 PM by DAN WEBER

Last Modified Date Changed From 10/29/2002 6.23:38 PM To 10/29/2002 6:32:25 PM

Attachment Added: Principal to OPR000031: Possible Common Mode Failure of Aux Feed Recirculation Lines

10/30/2002 9:56:58 AM by MARYBETH ARNOLD

Last Modified Date Changed From 10/29/2002 6.32:25 PM To 10/30/2002 9:56:58 AM

Last Modifier Changed From DAN WEBER To MARYBETH ARNOLD

Update Changed From '' To '[Appended:]The Managers' Screen Team initially reviewed this CAP on 10/30/02 and determined a Root Cause Evaluation of this Level A CAP should occur, as well as issuing actions as those made in the Recommendations section. This CAP still remains in [...]'

Point Beach Nuclear Plant

OPERABILITY DETERMINATION
PART I

OPR 000031

CAP 029952

REV 0

ENGINEERING TO COMPLETE THIS BOX WHEN OD ACCEPTED BY DSS

SYNOPSIS FOR NIM INFORMATION ONLY

Unit(s) 0, 1, 2 System AF CHAMPS Equipment ID Various

- ☐ Inoperable - does not meet the minimum level of performance.
- ☐ Operable - fully meets performance requirements. No further action required.
- ☒ Operable But Degraded - or Operable But Nonconforming - meets the minimum required level of performances, compensatory measures ARE required.
- ☐ Operable But Degraded - or Operable But Nonconforming - meets the minimum required level of performances, compensatory measures are NOT required.

Potential for simultaneous failure of all AFW pumps due to insufficient minimum pump flow

TITLE (EQUIPMENT NUMBER AND DESCRIPTION OF ISSUE)

1. Describe the condition.

During a plant transient, a combination of the existing plant design and operating procedures may result in a failure mode of one or more AFW pumps.

When steam generator (SG) levels have been restored to desired levels following a transient, manual action is required to maintain those levels. This manual action could be accomplished by securing the associated pump(s), or by reducing flow to match the steaming rate. It could also be accomplished by completely closing off flow to one or both SGs if desired; this is likely to be the case if the desired level has been exceeded due to overfill, swell, etc. Isolating discharge flow to the SGs, could result in no flow through a running AFW pump since the recirculation line orifice passages are susceptible to blockage particularly when the safety related SW is aligned as the suction source. This would cause very rapid failure of these multi-stage high pressure pumps.

2. Identify the Current Licensing Basis (CLB) functions and performance requirements including:

Tech Spec Reference 3.7.5

FSAR Reference 10.2, 7.3.3.4

NRC Commitment Reference

Other 50.59 EVAL 2002-005, FCR 02-027, FCR 02-019

If no CLB function, requirement or commitment is affected, no further action is required. N/A Steps 3, 4 and 5 and proceed with Step 6.

TS 3.7.5

The AFW System shall be OPERABLE with one turbine driven AFW pump system <per Unit> and two motor driven AFW pump systems when in modes 1, 2, and 3. The bases for this Technical Specification states that "The AFW System automatically supplies feedwater to the steam generators to remove decay heat from the Reactor Coolant System upon the loss of normal feedwater supply".

FSAR Chapter 10.2.1

The AFW system shall automatically start and deliver adequate AF system flow to maintain adequate generator levels during accidents which may result in main steam safety valve opening including: Loss of Normal Feedwater (LONF) and Loss of All AC Power to the Station Auxiliaries (LOAC). These accidents are evaluated in detail in sections 14.1.10 and 14.1.11 respectively.

The AF system is credited with automatically starting and delivering sufficient AF flow to maintain adequate steam generator levels during accidents which require rapid reactor coolant system cooldown to achieve cold shutdown condition within the limits of the analysis, including Steam Generator Tube Rupture (SGTR; FSAR Chapter 14.2.4), and Main Steam Line Break (MSLB; FSAR Chapter 14.2.5).

The AF system shall be capable of isolating the AF steam and feedwater supply lines from the ruptured generator following a SGTR event.

The AF system also is capable of automatically supplying sufficient feedwater to remove decay heat from both units without any reliance on AC power for one hour (station blackout).

In the event of plant fires, including those that require evacuation of the control room, the AF system shall be capable of manual initiation to provide feedwater to a minimum of one steam generator per unit at sufficient flow and pressure to remove decay and sensible heat from the reactor coolant system over the range from hot shutdown to cold shutdown conditions.

FSAR 10.2.2

This section states that each pump has an AOV controlled recirculation line back to the condensate storage tanks to ensure minimum flow to prevent hydraulic instabilities and dissipate pump heat.

FSAR 10.2.3

Based on the operating characteristics of the minimum recirculation flow control scheme, a portion a AF pumps discharge will be automatically recirculated back to the CSTs for approximately 45 seconds after the pump starts. The 45 second time delay in closing the recirculation line control valves is incorporated in the design to provide for pump stability and cooling during coastdown.

FSAR 7.3.3.4

If a loss of instrument air occurs or an Auxiliary Feedwater Pump minimum flow recirculation valve fails closed, manual operator action is required to prevent the potential failure of the pump(s). By procedure, the operator will either secure the running pump(s) or maintain forward flow through the still running pump(s) to prevent pump damage that could be caused by overheating.

Backup pneumatic supplies are provided to all AF pump minimum recirculation valves. These backup supplies are sized to provide adequate time for operators to either maintain minimum flow through the running pump(s) to secure the unneeded pump(s) if necessary to restore instrument air, or to use the manual gag on each valve to provide minimum recirculation flow.

3. Aggregate Review: Identify related issues by review of active ODs for the same system including as applicable their compensatory measures. Historical ODs can also be included in this review at the discretion of the Engineer. The review of the active ODs and their compensatory measures is to ensure there is no conflict between the related conditions, i.e., conflicting assumptions or compensatory measures

☐ No related issues exist.

Related AR Number CR 01-3648
Impact:

Review of the condition described in section 1 of this OD indicates a potential for the loss of a flowpath for the MDAFWPs mirroring that described in OD CR 01-3648. OD CR 01-3648 describes a condition where an Appendix R fire in Fire Areas A01-B, A02, A23N and A23S, could result in the loss of MDAFP flowpath due to a fire initiated auto-start of an MDAFP with a coincident loss of off-site power and instrument air. In each of the fire areas listed above, a MDAFP is relied upon as the means of delivering Aux Feedwater to at least one Steam Generator for at least one or both Units to support decay heat removal from the RCS. This condition occurs due to a fire initiated trip of the Main Feedwater Pumps or start signal to the credited MDAFP. This auto-start signal generated by this condition opens the associated recirculation valve and motor operated discharge valve(s) for the steam generator to be supplied AF. Due to fire damage, the motor driven discharge valve may fail to open and the mini-recirc valve may fail closed due to a loss of instrument air supply.

The difference in the conditions described in OD CR 01-3648 and this OD is the failure mechanism of the MDAFP recirculation line, however the failure mechanism for the MDAFPs is the same. The condition described in this OD, as it pertains to Appendix R, is bounded by that described in OD CR 01-3648 because the initiating event is essentially the same for both conditions, i.e., auto-start of the MDAFP and loss of control of the motor operated discharge valve(s) for the steam generator due to fire damage. The loss of instrument air described in OD CR 01-3648 is equivalent to the recirculation line failure mechanism described in this OD because loss of instrument air is assumed for all Appendix R fires and the failure mechanism described in this OD could appy to all fire initiated starts of the MDAFPs. Therefore, failure of the MDAFPs as described in OD CR 01-3648 is the same for this condition and Appendix R operability conclusion of Operable But Nonconforming also remains the same.

Related AR Number CR 01-3595
Impact:
Closed. Concerns postulated failure of the recirculation line AOV. This is a related issue but it does not impact this OPR.

Related AR Number _____
Impact:

Review additionally, as applicable, these items to help clarify current plant conditions.
These items may have impact on the SSC performance.

Active Temporary Operating Procedure Changes None Applicable

Active Temporary Modifications None Applicable

Modifications currently being installed None Applicable

Recent Work Orders None Applicable

Approved DCNs None Applicable

Recently Performed Inservice Testing IT-10

4. Evaluate the CLB functions and performance requirements identified in Step 2 against the as-found condition and the related issues identified in Step 3. The evaluation must identify the extent to which the SSC is capable of performing its identified CLB function. Document the evaluation:

After the automatic initiation of AF in response to an analyzed event, operators are required to manually control AF flow based on SG levels (FSAR 7.3.3.4). Manual control may include shutting pump discharge valves resulting in pump operation strictly on recirculation flow. Due to the potential debris blockage of the recirculation line restriction orifices (1/2RO-4003, RO-4008, RO-4015), sufficient flow to prevent pump damage may not be achieved.

Measures taken include heightened Operator awareness of the potential for pump damage (briefings with on-coming shift personnel), temporary information tags posted on the AFW pump flow controls. Revisions to operating procedures that will alert the Operator to the limitations of the AFW system with respect to minimum AFW pump flow are in progress. The revisions will ensure that AFW Minimum Flow Requirements are maintained or the affected AFW pump is secured.

NEMA guidelines states that motor driven pumps may be started twice from an initial standby condition with no restrictions. After the initial starts, NEMA MG-1 recommends subsequent starts after "all conditions affecting operation have been thoroughly investigated and the apparatus has been examined for evidence of excessive heating." This guidance encompasses situations where the load or prime mover may have experienced a fault which causes a failure to start or run; excessive temperatures are not expected with the equipment functioning normally. Additional starts therefore are allowed and not expected to cause machine failure. It should be recognized minimum of 3 starts of a motor driven AF pump are allowed in the first 15 minutes of operation. An additional one or two starts is allowed provided the run time is at least 15 minutes between these later starts. Motor starting nameplate information directs that after initial starts the motor may be restarted if run time has exceeded 15 minutes or it has been secured for 60 minutes. Excessive consecutive starting will decrease overall motor life. Starting duty limitations are provided by the manufacturer to provide the longest possible motor life.

The AOP SG control band is 29% to 65%. This represents an approximate volume of 5000 gallons. At a steaming rate of 50 gpm, a motor driven pump start would be required every 50 minutes to control level within half of the control band. At maximum pump flow rate of 200 gpm, the pump would be operated for 16 minutes to recover the level lost while the pump was secured. Since the operation of the pumps will meet the NEMA criteria established, the pump motor will not fail as a result of repetitive starts. The pump motors are supplied from Westinghouse DB-50 Air Circuit Breakers. Vendor

information indicates an in-rush, non-fault duty cycle of 750 breaker operations. The recommended operating conditions are a frequency of operation not to exceed 20 per 10 minutes or 30 per hour. Since the MDAFPs are only used during startup, shutdown (including SG chemical additions) and required system testing, the number of breaker operations are well below these operating limits. If an operator is required to secure and restart pumps during a transient, the actions would be performed at a frequency of operation much less than the recommended value for the entire transient.

There are no starting cycle limitations on the turbine driven AFW pumps. The turbine vendor was contacted and verified that no duty cycle concerns exist for this pump assembly. The steam supply MOVs are rated for 5 minutes of operation every hour which corresponds to five open/shut cycles. With a maximum steaming rate of 75 gpm, it would take approximately 33 minutes to steam off half of the control band (2500 gallons). The nameplate guidance for motors and valves is based on manufacturers' recommendations for long life and are considered conservative. Therefore, operation of the valve will not be degraded.

The recommendations of this Operability Determination is to consider the AF system OPERABLE but NON-CONFORMING. The potential Non-Conformance pertains to the FSAR statement of the minimum recirculation flow path ensuring minimum flow is available

Note: If the SSC is determined to be inoperable based on this evaluation, mark Step 5 N/A and continue with Step 6.

5. Evaluate the need for compensatory measures. Complete with input from DSS.

☐ Degraded or nonconforming, however, no compensatory measures are required.

☒ Degraded or nonconforming. The following compensatory measures are REQUIRED in order to maintain operability.

If Compensatory Measures are not required go to Step 6.

Compensatory measures must be in place prior to OD final approval by the DSS

Affected Unit (1 OR 2 OR 0) 0

Describe the Compensatory Measure (what needs to be performed):

As an immediate compensatory measure, a briefing of all responsible on-shift Reactor Operations staff should be conducted describing the concern and appropriate responses:

1. *If discharge flow cannot be maintained per the applicable operating procedure(s) without exceeding desired SG level, secure the associated pump(s) and re-start again later when (if) needed.*
2. *Install tags, placards, or otherwise post the pertinent information at the controls (in the Control Room and locally) for the associated AFW pumps.*

3. *Emphasize verifying a minimum of 50 (75) gpm flow through a motor (turbine) driven pump when reducing flow as stated in operating procedures.*

Basis which indicates the Compensatory Measure maintains operability:

By verifying minimum pump flow requirements, the continued availability of the AFW pumps is ensured. Minimum pump flow maintains hydraulic stability, removes pump heat and increase the life of the pump. If the minimum flow requirement cannot be maintained, then the pump will be secured to prevent damage. Repetitive operation of a motor driven or turbine driven AF pump for SG level control has been determined to be acceptable.

As an additional action, revise operating procedures as appropriate to prevent reducing flow of operating AFW pumps below the minimum flow requirements.

Implementation Mechanism (Procedure number, Temp Mod number, etc):

As determined appropriate by Operations.

Plant condition(s) or mode(s) of operation which require the Compensatory Measure:

Modes 1, 2, and 3 (modes in which decay heat removal from the SGs is necessary and required capability per ITS.

Under what conditions may the Compensatory Measure be terminated?

Engineering evaluation or modification to restore the function of the recirculation lines.

6. Prepared By:
Eric A. Schmidt
John P. Schroeder / [signature] Date/Time: 10/30/02 1843
Name (Print) / Signature

Engineering Manager Approval of Evaluation and Proposed Compensatory Measure (if applicable)
T J Carter / [signature] Date/Time: 10/30/02 1845
Name (Print) / Signature

7. SRO Review of Operability Documentation:

- ☐ Inoperable - does not meet the minimum level of performance.
- ☐ Operable - fully meets performance requirements. No further action required.
- ☒ Operable But Degraded - or Operable But Nonconforming - meets the minimum required level of performances, compensatory measures ARE required.
- ☐ Operable But Degraded - or Operable But Nonconforming - meets the minimum required level of performances, compensatory measures are NOT required.

☒ Evaluation Accepted

☒ Evaluation and Compensatory Measures Accepted.

☒ Compensatory Measures Verified in Place.

☐ NP 10.1.1, LCO Tracking Log updated to include new items.

DSS: M Schug / M Schug Date/Time: 10/30/02 1850
Name (Print) / Signature

Route OD package to in-box in WCC for processing. Package includes original Part I, all attachments, and related condition report.

OPERABILITY DETERMINATION

OPR	_____	Unit(s)	_____
CAP	_____	System	_____
REV	_____	CHAMPS ID	_____

☐ OBD condition which requires compensatory measures.
☐ OBD condition which does NOT require compensatory measures.

_____
Title (Equipment ID and Description of Issue

PART II CORRECTIVE ACTION PLAN, SCHEDULE AND JUSTIFICATION
(30 days to complete)

1. For those Operable But Degraded or Nonconforming items, what action(s) need to be done to restore the condition to its "fully operable" or "fully qualified" status?

   - Also consider any compensatory measures in place and what needs to be done for their removal.

2. Provide a schedule for completion of the action(s) listed in question 1. This schedule represents the earliest available opportunity to perform the corrective actions, allowing reasonable time for planning, scheduling, design, procurement, etc.

3. List the date of the next refueling outage for the affected Unit(s). PB1: _____ PB2: _____

4. ☐ All actions required to bring this degraded or non-conforming issue back to fully operable will be completed prior or concurrent with the next refueling outage as indicated in Step 3. N/A Step 5 and obtain approval.
   ☐ All actions required to bring this degraded or non-conforming issue back to fully operable will NOT be completed prior or concurrent with the next refueling outage as indicated in Step 3. COMPLETE Step 5 and obtain approval.

5. Please provide justification for this schedule based on:

   - the amount of time required for design, review, and approval of the corrective action,
   - procurement for replacement or repair,
   - availability of specialized equipment to perform the repair,
   - the need to be in hot or cold shutdown to implement the corrective action,
   - or other factors that constrain the corrective action schedule.

Prepared by: _____ Date/Time: _____
Name (Print) / Signature

Engineering Manager Approval: _____ Date/Time: _____
Name (Print) / Signature