Notification	10132527		*Notification type*	CR
Description	SW-P-D STARTED, NO DISCHARGE PRESSURE			Condition Report
Reported by	DJBROME	11:10:56	*NotifictnDate*	12/26/2001
Start date	12/26/2001		*End date*	01/02/2002
Start time	11:10:56		*End time*	09:10:56
Priority	CM			
FunctLocation	CNS-2-SW-P-D	SWP D		
SORT	SW-P-D			
Equipment				
Order	4216374			
Assembly				
MaintPlanGroup	CNS	Planning Dept	*Tel.*	
Malf. Start Date			*Malf. End date*	
Malf. Start time	00:00:00		*Malf. End time*	00:00:00

ORIGINAL

12/26/2001 11:20:00 David J. Bromen (DJBROME)

1) Description of Condition: Started D SWP, system pressure did not change and steady state pump amps were 18. Expected response would be an increase in the system pressure with pump running amps at 35-40. Pump discharge pressure was noted to be 1.5 psig prior to and after pump operation.

2) Requirement Not Met: SWP-D did not develope discharge pressure when started.

3) Method of Discovery: Starting SWP-D

4) Immediate Actions Taken: Notify CRS, secure D SWP.

5) Recommendations: Investigate cause.

6) Location of Evidence: SWP-D
12/26/2001 11:38:25 Steven P. Norris (SPNORRI)

1) Immediate Actions Taken: Secured SW pump D

2) Basis For Ops Review: Basis for review N/A for on-shift operations generated notifications.

3) Basis For Classification: RCR-apparent cause # III-C-1 # cause unknown for SW pump D being air bound.

4) Basis For Disp. Department: System engineer responsible for evaluating eauipment performance

5) Apparent Cause: unknown

6) Clarification Comment: Determine cause of SW pump D being air bound and correct as necessary. Perform OD on remaining SW pumps. Modify Standing order 2001-0011 as necessary.

44

R4-5A15

J-15

Notification: 10132527

Task REVIEW OPRV INOPERABLE, NARRATIVE LOGS 12-26-01/932
Partner
System Status TSCO

12/26/2001 13:34:28 Andrew R. Ohrablo (AROHRAB)
OPERATIONS REVIEW OF NOTIFICATION

Equipment Identification Section

Affected Equipment/System: SW-P-D

Equipment/System Classification (check all that apply):

[X] TS
[ ] TS SUPPORT
[X] SAFETY-RELATED
[ ] TRM
[ ] ODAM
[ ] PASS
[X] MRRS
[ ] FHA/APP. R
[ ] SBO
[ ] RG 1.97 CAT 1 or CAT 2
[ ] HELB
[ ] ATWS
[ ] FLDG
[ ] EMERGENCY FACILITY/EQUIPMENT

Operations Review Screening Section

Operations Review of Notification required if any question below is yes:

[X] YES; [ ] NO Any classification above marked and not PLANNED WORK?

[X] YES; [ ] NO Condition may apply to similar equipment, including non-SSC (generic concern/common cause failure)? If YES, document in Comments section below.

[X] YES; [ ] NO Present OPERABILITY concern - includes conditions with an indirect impact on OPERABILITY? Past OPERABILITY concerns should be addressed under the REPORTABILITY question below.

[ ] YES; [X] NO POTENTIALLY REPORTABLE per 10CFR20, 10CFR26.73, 10CFR50.72, 10CFR50.73, or 10CFR73.71? Reportability concerns for past events should be identified below for Licensing review.

[ ] YES; [X] NO Immediate personnel or equipment safety concern not yet adequately addressed. If YES, document in Comments section below.

[ ] YES; [X] NO Plant operational concern, including Reactivity event?

[ ] YES; [X] NO Fitness for Duty issue?

[ ] YES; [X] NO Site Security issue?

[X] YES; [ ] NO Operations Review of Notification required?

Immediate Actions Taken:
DISCUSSIONS WERE HELD WITH MANAGMENT ON ADDRESSING THIS ISSUE.

Comments:
PREVIOUS OD WRITTEN ON SW-P-A, ALL 4 SERVICE WATER PUPMS HAVE A STANDING ORDER THAT THE PUMP IS TO BE STARTED WHEN DISCHARGE PRESSURE OF THE SECURED PUMP REACHES 2 PSIG.

Operability Determination Screening Section

An OD is required if any question below is YES, unless declared INOPERABLE:

[ ] YES; [X] NO Degraded condition of SSCs where functionality is called into question?

[ ] YES; [X] NO Nonconforming conditions affecting SSCs where the qualification is called into question?

[ ] YES; [X] NO Existing but previously unanalyzed condition affecting SSCs?

[ ] YES; [X] NO OD required? If NO, provide BASIS below.

Basis for No OD:
DECLARED INOPERABLE NO OD PER 0.5OPS 3.1.11.5b.

Operability/Reportability Review Section

[ ] YES; [X] NO Risk assessment required? If YES, ensure assessment performed per Procedure 0.49, Schedule Risk Assessment. NOT REQUIRED TO BE OPERABLE IN PRESENT PLANT CONDITIONS.

[X] YES; [ ] NO Previous OD/OE/BCO written for an identical concern? If YES, identify previous OD/OE: 10131419 FOR SW-P-A

[X] YES; [ ] NO OPEN OD/OE File for aggregate effect?

[X] YES; [ ] NO System, Structure, or Component determined to be INOPERABLE?

[ ] YES; [X] NO Safety Function Determination required?

[ ] YES; [X] NO LCO, TLCO, or ODAM Action Statement entered?

Date/Time Entered: 11-26-01/ 09:32
TS/TRM/ODAM LCO Action Statement(s):
LCO Work Order Number:NARRATIVE LOGS

[ ] YES; [X] NO Condition Immediately Reportable per Procedure 2.0.5, Reports to NRC Operations Center?

Report Completed at Date/Time:
Report Number:

[X] YES; [ ] NO SS signature required?

Equipment/System Comments:

Safety Function Determination Comments:

Reportability Comments

Task REVIEW CAP RCR-R/C I.B.1 PED
Partner
System Status TSCO

12/28/2001 09:45:37 Ronnie Deatz (RCDEATZ)
RCR-R/C I.B.1 PED

Task REVIEW SCRN PRI 21 MODE R MWR M-SHOP, CM
Partner
System Status TSCO

Task REVIEW LIC INDETERMINATE
Partner
System Status TSCO

12/27/2001 14:46:21 Coy L. Blair (CLBLAIR)
12/27/01 BY CLBLAIR - REPORTABILITY FOR NOTIFICATION 10132527 IS INDETERMINATE. INFORMATION IN THE NOTIFICATION (AND OTHER REPORTS) RAISES A QUESTION ABOUT THE PAST OPERABILITY OF THE SERVICE WATER PUMPS, BECAUSE THE COUPLING FAILURE MAY REPRESENT A "SINGLE CAUSE THAT COULD HAVE PREVENTED FULFILLMENT OF THE SAFETY FUNCTION OF TRAINS OR CHANNELS IN DIFFERENT SYSTEMS". PER PROCEDURE 0.5.CLSS, THE ACTION OWNER FOR THIS NOTIFICATION, PED, SHALL PROVIDE THE LICENSING DEPARTMENT WITH INFORMATION ON WHICH TO BASE THE REPORTABILITY DETERMINATION WITHIN 14 DAYS OF DISCOVERY, I.E., BY 01/09/02.

Task REVIEW MRUL EXPORT
Partner
System Status TSCO TSSC

Task REVIEW OPRV PREPARE OD
Partner
System Status TSCO

12/29/2001 06:00:14 John R. Myers (JRMYERS) Phone 5624

Notification Number: 10132527

Revision Number: 0

1. Identify affected equipment/system(s): Service Water Pumps (A, B, C, and D).

2. Identify all Safety Functions of affected SSC(s): The system shall continuously provide a supply of cooling water directly to the diesel generator and to the secondary side of the REC heat exchangers and to the RHR service water booster pumps adequate for the requirements under both normal operations and under transient and accident conditions.

The system shall be capable of providing direct cooling to essential REC heat loads following a 7-day post accident time period or after a passive REC failure.

The service water pumps supply cooling water to the systems necessary to achieve and maintain a safe shutdown condition during and following Design Basis Events.

For transient and accident conditions, a SW pump degraded to the minimum allowable must be able to meet the minimum post LOCA flow and RHR SWBP suction head.

References:
USAR Volume IV, Section 8.0, Service Water and RHR Service Water Booster System.
DCD-3, Volume 1, Service Water (SW) and Residual Heat Removal Service Water Booster System.

3. Identify when the Safety Functions of affected SSC(s) are required:

[X] Mode 1
[X] Mode 2
[X] Mode 3
[X] Mode 4
[X] Mode 5 </= 21' above flange
[X] Mode 5 >/= 21' above flange
[X] Fuel movement in Sec Cont
[ ] Core Alterations
[ ] OPDRVs
[X] Other: When supported systems are required operable.

NOTE - Common cause failure analysis of the Emergency Diesel Generator (EDG) in the opposite division shall be performed within 24 hours of an EDG being declared inoperable per Technical Specification LCO 3.8.1. This is not required if Surveillance Testing per Technical Specification SR 3.8.1.2 is performed.

4. Identify potential failure mechanisms, including common mode failure/generic concerns of redundant or similar equipment as a result of the degraded and/or nonconforming condition. Identify commitments or requirements not met.

4.1 Potential failure mechanisms: The pump casing and shaft are manufactured from different materials. These materials expand and contract at different rates with temperature changes of the pumped fluid. As river temperature lowers, the clearance between the impeller and pump bowl lowers. The potential failure mechanism is that when the pump impeller comes in contact with the pump bowl liner, due to inadequate impeller lift (clearance), the pump may not perform its design function. A metallurgical flaw (see NRC Information Notice 93-68) in some couplings make it the weakest link in the pump shaft, which can lead to failures from the increased starting loads caused by the impeller being forced into the bowl.

4.2 Commitments: None.

5. [ ] YES; [X] NO Are any potential failure mechanisms time dependent? Does the condition have the potential to continue to degrade and/or will any potential consequences increase? If so, describe tracking mechanism including procedures and formal processes:

An impeller to bowl clearance change is caused by a temperature change due to the different coefficient of expansion between the pump column and pump shaft. This change is not directly related to time.

6. List potential cumulative effects, if any.

[X] None
[ ] Credit Taken For Alarms
[ ] Interfacing Systems
[ ] Fire Loadings
[ ] Gross ECCS Leakage
[ ] Electrical Load Calculations
[ ] Pipe Support/Hanger
[ ] Electrical Separation
[ ] Operator Actions
[ ] Other:

Comments: None.

7. [X] YES; [ ] NO Impact of this condition on Open OD/OEs reviewed?

Comments: The issue previously identified in Notification 10131419 (air binding) does not impact the condition of this OD (inadequate impeller lift)

8. Technical Basis for OPERABILITY:

On 12/26/01, during an attempted start of Service Water Pump SW-P-D, the motor started but pump parameters indicated the pump was not functioning. An inspection of the pump revealed a failed coupling. Investigation into the coupling determined that it did not conform to the required metallurgical properties. A review of the repair and parts issue records for the other service water pumps could not provide assurance that couplings manufactured in the same time frame were not installed in the other service water pumps. This OD provides a basis for operability of SW pumps A, B, and C with couplings which may contain manufacturing defects similar to the defect found on the D SWP shaft coupling. Couplings on SW-P-D have been replaced.

Additionally, the pump lift must be periodically adjusted to accommodate changes in river temperature. The lift setting procedure does not provide specific requirements related to river temperature. Therefore, the lift settings for all of the pumps are being checked and adjusted for the existing river temperatures to ensure that adequate clearance exists to prevent impeller-bowl interference while not impacting the ability of the pump to meet performance requirements. This OD will provide adequate controls for pump operability until the procedure has been appropriately modified to accommodate changes in river temperature.

Upon visual inspection of pump, SW-P-D, it was determined (as indicated by sharp edged indications on the bowl and impeller) that the impeller had contacted the bowl liner. Investigation indicated this was caused by a temperature decrease in the river temperature from the time the lift to set clearance was last adjusted (12/5) to the time of failure. Each one degree lowering of river temperature results in a clearance reduction of 0.0015 inches. Based on the temperature of the river at the time the lift was adjusted and present river temperature, and elongation of the shaft due to hydraulic loading of the impeller, an interference of up to ~0.016 inches could have existed, or a significant bending load could have been applied to the coupling. When attempting to start pump D, a higher than normal torque was created as a result of the inadequate impeller clearance. This increase in torque caused the weakest link (shaft coupling, see factor 2 below) to fail.

The failure of the coupling was the result of a combination of two circumstances:

Factor 1: Based on visual inspection, the impeller was impinging upon the bowl liner. The resulting friction between the bowl and impeller significantly increased the amount of torque needed to rotate the impeller.

Factor 2: The coupling had a metallurgical flaw as a result of manufacturing and heat treating. This caused the coupling to be the weakest link in the transmission of the higher than normal torque from the motor to the impeller. Consequently, when the pump experienced a higher torque requirement, the coupling failed first.

To ensure operability of the pumps until the couplings can be inspected and those which were improperly manufactured are replaced, it will be necessary to ensure the impeller lifts are properly set to prevent the impeller from contacting the bowl liner. Work orders have been initiated to accomplish this action. The lift for each of the SW pumps has been set per MP 7.2.45, with the lift set at near the minimum procedural limit of .040#, with the river at the lowest expected temperature (~32 degrees F). At this lift setting the impeller will not come in contact with the bowl liner, normal starting torque on the pump will not be exceeded, and therefore reasonable assurance exists that even an incorrectly manufactured coupling will not fail. A temperature of ~32 degrees F is appropriate as the pumps could see this temperature during a transient or accident when de-icing flow is lost.

The pump impeller to bowl clearances can also adversely impact pump performance as the clearances widen (due to rising temperatures). At large clearances, pump efficiency will degrade and the IST performance requirements may not be met. Setting the impeller clearance in the range required by MP 7.2.45 (0.040 to 0.060 inches), will keep the clearances such that pump performance will remain within IST requirements as river temperatures rise. This conclusion is valid for temperatures up to 50 degrees F. It is conceivable that a transient could occur while the plant is in a condenser backwash lineup, and for some period the SW pumps could be required to operate at a temperature above river temperature.

With the above actions to adjust lift complete, and limitations on service water temperature in place, the service water pumps can be considered conditionally operable. An LCO Tracking Order will be initiated to ensure these requirements are observed and tracked.

References: Evaluation of Failure of Service Water Pump D, Rev 1
Maintenance Procedure 7.2.45
WO 4216375 (Pump D)
WO 4216873 (Pump B)
WO 4216874 (Pump C)
WO 4216875 (Pump A)

9. [ ] YES; [X] NO Are interim compensatory actions required? If so, describe actions and tracking mechanism and review Step 13:

N/A

NOTE - Manual operator action cannot be used in place of automatic action for protection of safety limits to justify OPERABILITY.

10. [ ] YES; [X] NO Is manual action being substituted for automatic actions? Is local action being substituted for remote action? If so, describe actions and tracking mechanism and review Step 13:

N/A

11. List or describe any operating modes, plant conditions, or seasonal variations not supported by this OD (i.e., OPERABILITY is CONDITIONAL):

Operability is conditional based on a service water temperature between 30 F and 50 F. (PMIS Points M138 and M137 are the preferred source of data)

The 30 degree F service water temperature will ensure the pump impeller will not come in contact with the bowl liner after the lifts are set.

The 50 degree F service water temperature will ensure that the pump satisfies IST flow requirements.

12. List the mechanism(s) in place to control the condition(s) necessary for CONDITIONAL OPERABILITY (i.e., LCO Tracker, Night Order, procedure change, etc.) and review Steps 13 and 14:

Potential LCO 1002002 has been initiated to track this limitation. 6.LOG.601 or 6.LOG.602 will be utilized to monitor service water (river) temperature.

13. [ ] YES; [X] NO; [ ] N/A Is a 10CFR50.59 Review required for action(s) identified above? Basis (if NO): A 50.59 review is not required due to the proposed interim compensatory actions being supported by current SORC approved procedures.

13.1 [ ] YES; [ ] NO; [X] N/A 10CFR50.59 Evaluation required for implementation?

14. [ ] YES; [X] NO; [ ] N/A Is a Safety Assessment required for the required action(s) identified above? Basis (if NO): A safety assessment is not required due to the proposed interim compensatory actions being supported by current SORC approved procedures.

15. [ ] YES; [ ] NO; [X] N/A OE Required.

OE due from Engineering - Date/Time:

[ ] YES; [X] N/A Engineering Notified.

16. OD Performed By/Date/Time:

Mike Matheson - John Myers / 12-29-01 / 0535

17. OD Accepted - SS/Date/Time:

Task REVIEW OPRV APPROVE OD
Partner
System Status TSCO

Task REVIEW OPRV STATUS OD
Partner
System Status TSCO

12/29/2001 07:29:20 Steve Wheeler (SCWHEEL)
OD/OE STATUS

Notification Number: 10132527

OD/OE Revision Number: 00

Basis for SS Approval for OD Extension Beyond 24 hrs: SW PP D WAS DECLARED INOPERABLE.

[] YES; [X] NO Cumulative Effects.©

[] YES; [X] NO Interim Compensatory Action Required.

[] YES; [X] NO Manual Action Substituted for Automatic Action.

[] YES; [X] NO Local Action Substituted for Remote Action.

[] YES; [X] NO Condition has Potential to Degrade Over Time.

[X] YES; [] NO Operability is Conditional.

[] YES; [X] NO OD Awaiting OE.

NOTE - If none of the above are checked YES, the OD/OE may be closed.

OD/OE [] CLOSED

OD/OE [X] OPEN

Actions Required to Allow Closure (if initially open):

IMPLEMENT PROCESS CHANGE TO ASSURE LIFT OF SW PUMPS ARE ADEQUATE TO COMPENSATE FOR RIVER TEMPERATURE CHANGES.

EXIT LCO 1002002.

REMOVE SUPPLEMENTAL RIVER TEMPERATURE MONITORING FROM TECH SPEC LOGS.

[X] YES; [] NO OD/OE Logged in OD/OE Database:

OD/OE Closed (if initially open) based on (provide short explanation):

[] YES; [] NO OD/OE Logged in OD/OE Database:

Task REVIEW OPRV PREPARE OD QUALITY CHECK
Partner
System Status TSCO

12/29/2001 13:07:08 Andrew R. Ohrablo (AROHRAB)
Notification Number: 10132527

Revision Number: 00

OD Quality Criteria:

G = Very Good

A = Adequate

I = Improvement Needed

N = Not Applicable

[N] The OD was completed within 24 hours of the Notification Supervisor review or a justification for exceeding 24 hours is provided.

[A] The OD is correctly characterized as open or closed and the appropriate criteria are referenced.

[A] The conditions required for closing the OD are objective, reasonable, and clearly stated.

[A] The affected equipment is accurately identified.

[A] The safety function of the affected equipment is accurate and complete, and refers to appropriate design and licensing basis requirements. Appropriate references are identified.

[A] When the safety functions are required is accurate and complete.

[A] Potential failure mechanisms are identified. Similar equipment is identified and generic concerns and common mode failures are evaluated.

[A] Cumulative effects (e.g., multiple operator actions, multiple degraded hangers, etc.) are addressed.

[A] The time and operational dependency of the potential failure mechanism and associated consequences is addressed.

[N] Interim compensatory actions, operational restrictions, and/or mode/configuration limits are identified and a tracking mechanism specified (e.g., additional surveillances being required, manual or local operations being necessary, system capability limitations).

[A] The evaluation is logical and can be followed without talking to the Originator.

[A] Assumptions or Engineering judgements made are clearly stated and adequately discussed. Where feasible, the basis for Engineering judgements is quantitative rather than qualitative.

[A] The bases for evaluation logic is clearly stated and references listed.

[A] If used, informal inputs (e.g., telecons, faxes) are identified.

[A] Applicable codes, standards, etc., are referenced where appropriate.

[N] Where actions are required as a basis for operability, the necessary 10CFR50.59 paperwork is attached.

[N] Where actions are required as a basis for operability, the necessary Safety Assessment paperwork is attached.

[N] A date and time are assigned for the OE, if required.

[A] The OD package is well organized, in accordance with procedural requirements, and in a manner that makes it easy for a reviewer to follow and understand.

[X] YES, [] NO OD is Acceptable (No I Areas).

I Areas (Notify Operations Supervisor):

Resolution of I Areas:

Item detail 0001

Text	BULMER,J -CHECKED CAL ON DISCHARGE PRESS
Object part	P PUMP
Damage	
Cause of damage	UNK UNKNOWN
Cause text	BULMER,J -INDICATOR IS INDICATING WITHIN
Assembly	
Error class	

12/26/2001 16:46:02 Jerry W. Bulmer (JWBULME)
BULMER,J -PI IS WITHIN REQUIRED TOLERANCE.

12/26/2001 16:42:42 Jerry W. Bulmer (JWBULME)
BULMER,J -CHECKED CAL ON DISCHARGE PRESSURE INDICATOR SW-DPI-360D PER IAC PROCEDURE 14.28.1. FOUND NO EVIDENCE OF STICKING OR DRAGGING ON INDICATOR. INDICATOR RESPONDED SMOOTHLY THROUGHOUT THE ENTIRE RANGE. THE LOW END (1 PSI) INDICATED LOW (0 PSI, BUT STILL IN TOLERANCE) AND NEAR THE HIGH END, (75 PSI) READ 74.5 PSI, OTHERWISE ALL OTHER TEST POINTS WERE EXACTLY AS EXPECTED. SAT

Notification: 10132527

Item detail 0002

Text
Object part M102 PLANT EVENT
Damage OTH Others not listed or unknown
Cause of damage A408 MAINTENANCE (REPAIR OR REPLACE EQUIPMENT
Cause text PUMP, RE20

Assembly
Error class

Item detail 0003

Text
Object part M000 DISC METH N/A
Damage
Cause of damage
Cause text

Assembly
Error class

Activity PUMPSYS CHK
CHECKED PI CALIBRATION. AS FOUNDS ARE SA

End of report

Order	4216374	*Order type*	**CAP Corrective Action Program**		
Description	RCR 2001-1667 #1				
Notification	10132527	*PM Act. Type*	EVL Evaluation		
Start date	12/27/2001	*End date*	12/27/2001		
Priority	4 Routine 4				
Malf. Start Date	00:00:00	*Malf. End Date*	00:00:00		
Status	REL GMCO NMAT PRC SETC INPR				
Funct Location	CNS-2-SW-P-D			*ABC Ind.*	E
SORT	SW-P-D				
Description	SWP D				
Maintenance Rule:					
	MRRS				
Programs:					
	IST		SSEL		
Tech Spec Components:					
	3.7.2 A				
Equipment Description					
Location	903	*Room*	SWP RM	*Plant Section*	IS
MaintPlanGroup	CAP CNS	CAP/NAIT			
MainWrkCenter	NEPM CNS	PLANT ENGINEERING MANAGER			
MaintenancePlan			*MaintPlanItem*		
Schedule Window	RE20	CNS REFUELING OUTAGE RE20			
Required in Mode:	1 RUN	*Repair in Mode:*	4 COLD SHUTDOWN		
	2 STARTUP		5 REFUEL		
	3 HOT SHUTDOWN				
Tech Spec Ref.:	3.7.1	*References:*			

RCR 2001-1667 #1
SW PUMP INOPERABLE, LCO 3.7.2 - DIV 1, REQURIED PRIOR TO MODE CHANGE
NO REACTIVITY IMPACT REQUIRED
DOES NOT IMPACT CONTAINMENT
FIRE IMPAIRMENT WILL BE REQUIRED.

ORDER TYPE: CAP Corrective Action Program

Operation	0005		RCR 2001-1667 #1 - PERFORM ROOT CAUSE EV	
Status	REL			
Work center	NEPM	CNS	PLANT ENGINEERING MANAGER	
CompConf No.	383002			
Activity type	PROF			
EarlStartDate	12/27/2001		*Start time*	08:46:00
LateEndDate	12/27/2001		*End time*	08:46:00

RCR 2001-1667 #1 - PERFORM ROOT CAUSE EVALUATION
NOTIF. #10132527

R/C COMMENTS:

N/C NOTES:

Operation	0010			
Status	REL			
Work center	NEPM	CNS	PLANT ENGINEERING MANAGER	
CompConf No.	380346			
Activity type	PROF			
EarlStartDate	12/27/2001		*Start time*	08:46:00
LateEndDate	12/27/2001		*End time*	08:46:00

ORDER TYPE: CAP Corrective Action Program

Order object list: 4216374 RCR 2001-1667 #1

Sort field		*Processing state*	
FunctLocation	CNS-2-SW-P-D	SWP D	
SORT	SW-P-D	*ABC Ind.:* E	
Maintenance Rule:			
	MRRS		
Programs:			
	IST		SSEL
Tech Spec Components:			
	3.7.2 A		
Equipment			
Assembly			
MaintNotifNo.	10132527	SW-P-D STARTED, NO DISCHARGE PRESSURE	

End of report

Notification: 10132527

Notification	10132527		*Notification type*	CR
Description	SW-P-D STARTED, NO DISCHARGE PRESSURE			Condition Report
Reported by	DJBROME	11:10:56	*NotifictnDate*	12/26/2001
Start date	12/26/2001		*End date*	01/02/2002
Start time	11:10:56		*End time*	09:10:56
Priority	CM			
FunctLocation	CNS-2-SW-P-D	SWP D		
SORT	SW-P-D			
Equipment				
Order	4216374			
Assembly				
MaintPlanGroup	MEC	Mechanical Shop	*Tel.*	
Malf. Start Date			*Malf. End date*	
Malf. Start time	00:00:00		*Malf. End time*	00:00:00

12/26/2001 11:20:00 David J. Bromen (DJBROME)

1) Description of Condition: Started D SWP, system pressure did not change and steady state pump amps were 18. Expected response would be an increase in the system pressure with pump running amps at 35-40. Pump discharge pressure was noted to be 1.5 psig prior to and after pump operation.

2) Requirement Not Met: SWP-D did not develope discharge pressure when started.

3) Method of Discovery: Starting SWP-D

OD

4) Immediate Actions Taken: Notify CRS, secure D SWP.

5) Recommendations: Investigate cause.

6) Location of Evidence: SWP-D
12/26/2001 11:38:25 Steven P. Norris (SPNORRI)

1) Immediate Actions Taken: Secured SW pump D

2) Basis For Ops Review: Basis for review N/A for on-shift operations generated notifications.

3) Basis For Classification: RCR-apparent cause # III-C-1 # cause unknown for SW pump D being air bound.

4) Basis For Disp. Department: System engineer responsible for evaluating eauipment performance

5) Apparent Cause: unknown

6) Clarification Comment: Determine cause of SW pump D being air bound and correct as necessary. Perform OD on remaining SW pumps. Modify Standing order 2001-0011 as necessary.

Notification: 10132527

Task REVIEW OPRV INOPERABLE, NARRATIVE LOGS 12-26-01/932
Partner
System Status TSCO

12/26/2001 13:34:28 Andrew R. Ohrablo (AROHRAB)
OPERATIONS REVIEW OF NOTIFICATION

Equipment Identification Section

Affected Equipment/System: SW-P-D

Equipment/System Classification (check all that apply):

[X] TS
[ ] TS SUPPORT
[X] SAFETY-RELATED
[ ] TRM
[ ] ODAM
[ ] PASS
[X] MRRS
[ ] FHA/APP. R
[ ] SBO
[ ] RG 1.97 CAT 1 or CAT 2
[ ] HELB
[ ] ATWS
[ ] FLDG
[ ] EMERGENCY FACILITY/EQUIPMENT

Operations Review Screening Section

Operations Review of Notification required if any question below is yes:

[X] YES; [ ] NO Any classification above marked and not PLANNED WORK?

[X] YES; [ ] NO Condition may apply to similar equipment, including non-SSC (generic concern/common cause failure)? If YES, document in Comments section below.

[X] YES; [ ] NO Present OPERABILITY concern - includes conditions with an indirect impact on OPERABILITY? Past OPERABILITY concerns should be addressed under the REPORTABILITY question below.

[ ] YES; [X] NO POTENTIALLY REPORTABLE per 10CFR20, 10CFR26.73, 10CFR50.72, 10CFR50.73, or 10CFR73.71? Reportability concerns for past events should be identified below for Licensing review.

[ ] YES; [X] NO Immediate personnel or equipment safety concern not yet adequately addressed. If YES, document in Comments section below.

[ ] YES; [X] NO Plant operational concern, including Reactivity event?

[ ] YES; [X] NO Fitness for Duty issue?

[ ] YES; [X] NO Site Security issue?

[X] YES; [ ] NO Operations Review of Notification required?

Immediate Actions Taken:
DISCUSSIONS WERE HELD WITH MANAGMENT ON ADDRESSING THIS ISSUE.

Comments:
PREVIOUS OD WRITTEN ON SW-P-A, ALL 4 SERVICE WATER PUPMS HAVE A STANDING ORDER THAT THE PUMP IS TO BE STARTED WHEN DISCHARGE PRESSURE OF THE SECURED PUMP REACHES 2 PSIG.

Operability Determination Screening Section

An OD is required if any question below is YES, unless declared INOPERABLE:

[ ] YES; [X] NO Degraded condition of SSCs where functionality is called into question?

[ ] YES; [X] NO Nonconforming conditions affecting SSCs where the qualification is called into question?

[ ] YES; [X] NO Existing but previously unanalyzed condition affecting SSCs?

[ ] YES; [X] NO OD required? If NO, provide BASIS below.

Basis for No OD:
DECLARED INOPERABLE NO OD PER 0.5OPS 3.1.11.5b.

Operability/Reportability Review Section

[ ] YES; [X] NO Risk assessment required? If YES, ensure assessment performed per Procedure 0.49, Schedule Risk Assessment. NOT REQUIRED TO BE OPERABLE IN PRESENT PLANT CONDITIONS.

[X] YES; [ ] NO Previous OD/OE/BCO written for an identical concern? If YES, identify previous OD/OE: 10131419 FOR SW-P-A

[X] YES; [ ] NO OPEN OD/OE File for aggregate effect?

[X] YES; [ ] NO System, Structure, or Component determined to be INOPERABLE?

[ ] YES; [X] NO Safety Function Determination required?

[ ] YES; [X] NO LCO, TLCO, or ODAM Action Statement entered?

Date/Time Entered: 11-26-01/ 09:32
TS/TRM/ODAM LCO Action Statement(s):
LCO Work Order Number:NARRATIVE LOGS

[ ] YES; [X] NO Condition Immediately Reportable per Procedure 2.0.5, Reports to NRC Operations Center?

Report Completed at Date/Time:
Report Number:

[X] YES; [ ] NO SS signature required?

Notification: 10132527

Equipment/System Comments:

Safety Function Determination Comments:

Reportability Comments

Task REVIEW CAP RCR-R/C I.B.1 PED
Partner
System Status TSCO

12/28/2001 09:45:37 Ronnie Deatz (RCDEATZ)
RCR-R/C I.B.1 PED

Task REVIEW SCRN PRI 21 MODE R MWR M-SHOP, CM
Partner
System Status TSCO

Task REVIEW LIC INDETERMINATE
Partner
System Status TSCO

12/27/2001 14:46:21 Coy L. Blair (CLBLAIR)
12/27/01 BY CLBLAIR - REPORTABILITY FOR NOTIFICATION 10132527 IS INDETERMINATE. INFORMATION IN THE NOTIFICATION (AND OTHER REPORTS) RAISES A QUESTION ABOUT THE PAST OPERABILITY OF THE SERVICE WATER PUMPS, BECAUSE THE COUPLING FAILURE MAY REPRESENT A "SINGLE CAUSE THAT COULD HAVE PREVENTED FULFILLMENT OF THE SAFETY FUNCTION OF TRAINS OR CHANNELS IN DIFFERENT SYSTEMS". PER PROCEDURE 0.5.CLSS, THE ACTION OWNER FOR THIS NOTIFICATION, PED, SHALL PROVIDE THE LICENSING DEPARTMENT WITH INFORMATION ON WHICH TO BASE THE REPORTABILITY DETERMINATION WITHIN 14 DAYS OF DISCOVERY, I.E., BY 01/09/02.

Task REVIEW MRUL EXPORT
Partner
System Status TSCO TSSC

Task REVIEW OPRV PREPARE OD
Partner
System Status TSCO

12/29/2001 06:00:14 John R. Myers (JRMYERS) Phone 5624

Notification Number: 10132527

Revision Number: 0

1. Identify affected equipment/system(s): Service Water Pumps (A, B, C, and D).

2. Identify all Safety Functions of affected SSC(s): The system shall continuously provide a supply of cooling water directly to the diesel generator and to the secondary side of the REC heat exchangers and to the RHR service water booster pumps adequate for the requirements under both normal operations and under transient and accident conditions.

The system shall be capable of providing direct cooling to essential REC heat loads following a 7-day post accident time period or after a passive REC failure.

The service water pumps supply cooling water to the systems necessary to achieve and maintain a safe shutdown condition during and following Design Basis Events.

For transient and accident conditions, a SW pump degraded to the minimum allowable must be able to meet the minimum post LOCA flow and RHR SWBP suction head.

References:
USAR Volume IV, Section 8.0, Service Water and RHR Service Water Booster System.
DCD-3, Volume 1, Service Water (SW) and Residual Heat Removal Service Water Booster System.

3. Identify when the Safety Functions of affected SSC(s) are required:

[X] Mode 1
[X] Mode 2
[X] Mode 3
[X] Mode 4
[X] Mode 5 </= 21' above flange
[X] Mode 5 >/= 21' above flange
[X] Fuel movement in Sec Cont
[ ] Core Alterations
[ ] OPDRVs
[X] Other: When supported systems are required operable.

NOTE - Common cause failure analysis of the Emergency Diesel Generator (EDG) in the opposite division shall be performed within 24 hours of an EDG being declared inoperable per Technical Specification LCO 3.8.1. This is not required if Surveillance Testing per Technical Specification SR 3.8.1.2 is performed.

4. Identify potential failure mechanisms, including common mode failure/generic concerns of redundant or similar equipment as a result of the degraded and/or nonconforming condition. Identify commitments or requirements not met.

4.1 Potential failure mechanisms: The pump casing and shaft are manufactured from different materials. These materials expand and contract at different rates with temperature changes of the pumped fluid. As river temperature lowers, the clearance between the impeller and pump bowl lowers. The potential failure mechanism is that when the pump impeller comes in contact with the pump bowl liner, due to inadequate impeller lift (clearance), the pump may not perform its design function. A metallurgical flaw (see NRC Information Notice 93-68) in some couplings make it the weakest link in the pump shaft, which can lead to failures from the increased starting loads caused by the impeller being forced into the bowl.

4.2 Commitments: None.

5. [ ] YES; [X] NO Are any potential failure mechanisms time dependent? Does the condition have the potential to continue to degrade and/or will any potential consequences increase? If so, describe tracking mechanism including procedures and formal processes:

An impeller to bowl clearance change is caused by a temperature change due to the different coefficient of expansion between the pump column and pump shaft. This change is not directly related to time.

6. List potential cumulative effects, if any.

[X] None
[ ] Credit Taken For Alarms
[ ] Interfacing Systems
[ ] Fire Loadings
[ ] Gross ECCS Leakage
[ ] Electrical Load Calculations
[ ] Pipe Support/Hanger
[ ] Electrical Separation
[ ] Operator Actions
[ ] Other:

Comments: None.

7. [X] YES; [ ] NO Impact of this condition on Open OD/OEs reviewed?

Comments: The issue previously identified in Notification 10131419 (air binding) does not impact the condition of this OD (inadequate impeller lift)

8. Technical Basis for OPERABILITY:

On 12/26/01, during an attempted start of Service Water Pump SW-P-D, the motor started but pump parameters indicated the pump was not functioning. An inspection of the pump revealed a failed coupling. Investigation into the coupling determined that it did not conform to the required metallurgical properties. A review of the repair and parts issue records for the other service water pumps could not provide assurance that couplings manufactured in the same time frame were not installed in the other service water pumps. This OD provides a basis for operability of SW pumps A, B, and C with couplings which may contain manufacturing defects similar to the defect found on the D SWP shaft coupling. Couplings on SW-P-D have been replaced.

Additionally, the pump lift must be periodically adjusted to accommodate changes in river temperature. The lift setting procedure does not provide specific requirements related to river temperature. Therefore, the lift settings for all of the pumps are being checked and adjusted for the existing river temperatures to ensure that adequate clearance exists to prevent impeller-bowl interference while not impacting the ability of the pump to meet performance requirements. This OD will provide adequate controls for pump operability until the procedure has been appropriately modified to accommodate changes in river temperature.

Upon visual inspection of pump, SW-P-D, it was determined (as indicated by sharp edged indications on the bowl and impeller) that the impeller had contacted the bowl liner. Investigation indicated this was caused by a temperature decrease in the river temperature from the time the lift to set clearance was last adjusted (12/5) to the time of failure. Each one degree lowering of river temperature results in a clearance reduction of 0.0015 inches. Based on the temperature of the river at the time the lift was adjusted and present river temperature, and elongation of the shaft due to hydraulic loading of the impeller, an interference of up to ~0.016 inches could have existed, or a significant bending load could have been applied to the coupling. When attempting to start pump D, a higher than normal torque was created as a result of the inadequate impeller clearance. This increase in torque caused the weakest link (shaft coupling, see factor 2 below) to fail.

The failure of the coupling was the result of a combination of two circumstances:

Factor 1: Based on visual inspection, the impeller was impinging upon the bowl liner. The resulting friction between the bowl and impeller significantly increased the amount of torque needed to rotate the impeller.

Factor 2: The coupling had a metallurgical flaw as a result of manufacturing and heat treating. This caused the coupling to be the weakest link in the transmission of the higher than normal torque from the motor to the impeller. Consequently, when the pump experienced a higher torque requirement, the coupling failed first.

To ensure operability of the pumps until the couplings can be inspected and those which were improperly manufactured are replaced, it will be necessary to ensure the impeller lifts are properly set to prevent the impeller from contacting the bowl liner. Work orders have been initiated to accomplish this action. The lift for each of the SW pumps has been set per MP 7.2.45, with the lift set at near the minimum procedural limit of .040#, with the river at the lowest expected temperature (~32 degrees F). At this lift setting the impeller will not come in contact with the bowl liner, normal starting torque on the pump will not be exceeded, and therefore reasonable assurance exists that even an incorrectly manufactured coupling will not fail. A temperature of ~32 degrees F is appropriate as the pumps could see this temperature during a transient or accident when de-icing flow is lost.

The pump impeller to bowl clearances can also adversely impact pump performance as the clearances widen (due to rising temperatures). At large clearances, pump efficiency will degrade and the IST performance requirements may not be met. Setting the impeller clearance in the range required by MP 7.2.45 (0.040 to 0.060 inches), will keep the clearances such that pump performance will remain within IST requirements as river temperatures rise. This conclusion is valid for temperatures up to 50 degrees F. It is conceivable that a transient could occur while the plant is in a condenser backwash lineup, and for some period the SW pumps could be required to operate at a temperature above river temperature.

With the above actions to adjust lift complete, and limitations on service water temperature in place, the service water pumps can be considered conditionally operable. An LCO Tracking Order will be initiated to ensure these requirements are observed and tracked.

References: Evaluation of Failure of Service Water Pump D, Rev 1
Maintenance Procedure 7.2.45
WO 4216375 (Pump D)
WO 4216873 (Pump B)
WO 4216874 (Pump C)
WO 4216875 (Pump A)

9. [ ] YES; [X] NO Are interim compensatory actions required? If so, describe actions and tracking mechanism and review Step 13:

N/A

NOTE - Manual operator action cannot be used in place of automatic action for protection of safety limits to justify OPERABILITY.

10. [ ] YES; [X] NO Is manual action being substituted for automatic actions? Is local action being substituted for remote action? If so, describe actions and tracking mechanism and review Step 13:

N/A

11. List or describe any operating modes, plant conditions, or seasonal variations not supported by this OD (i.e., OPERABILITY is CONDITIONAL):

Operability is conditional based on a service water temperature between 30 F and 50 F. (PMIS Points M138 and M137 are the preferred source of data)

The 30 degree F service water temperature will ensure the pump impeller will not come in contact with the bowl liner after the lifts are set.

The 50 degree F service water temperature will ensure that the pump satisfies IST flow requirements.

12. List the mechanism(s) in place to control the condition(s) necessary for CONDITIONAL OPERABILITY (i.e., LCO Tracker, Night Order, procedure change, etc.) and review Steps 13 and 14:

Potential LCO 1002002 has been initiated to track this limitation. 6.LOG.601 or 6.LOG.602 will be utilized to monitor service water (river) temperature.

13. [ ] YES; [X] NO; [ ] N/A Is a 10CFR50.59 Review required for action(s) identified above? Basis (if NO): A 50.59 review is not required due to the proposed interim compensatory actions being supported by current SORC approved procedures.

13.1 [ ] YES; [ ] NO; [X] N/A 10CFR50.59 Evaluation required for implementation?

14. [ ] YES; [X] NO; [ ] N/A Is a Safety Assessment required for the required action(s) identified above? Basis (if NO): A safety assessment is not required due to the proposed interim compensatory actions being supported by current SORC approved procedures.

15. [ ] YES; [ ] NO; [X] N/A OE Required.

OE due from Engineering - Date/Time:

[ ] YES; [X] N/A Engineering Notified.

16. OD Performed By/Date/Time:

Mike Matheson - John Myers / 12-29-01 / 0535

17. OD Accepted - SS/Date/Time:

Task REVIEW OPRV APPROVE OD
Partner
System Status TSCO

Task REVIEW OPRV STATUS OD
Partner
System Status TSCO

12/29/2001 07:29:20 Steve Wheeler (SCWHEEL)
OD/OE STATUS

Notification Number: 10132527

OD/OE Revision Number: 00

Basis for SS Approval for OD Extension Beyond 24 hrs: SW PP D WAS DECLARED INOPERABLE.

[] YES; [X] NO Cumulative Effects.©

[] YES; [X] NO Interim Compensatory Action Required.

[] YES; [X] NO Manual Action Substituted for Automatic Action.

[] YES; [X] NO Local Action Substituted for Remote Action.

[] YES; [X] NO Condition has Potential to Degrade Over Time.

[X] YES; [] NO Operability is Conditional.

[] YES; [X] NO OD Awaiting OE.

NOTE - If none of the above are checked YES, the OD/OE may be closed.

OD/OE [] CLOSED

OD/OE [X] OPEN

Actions Required to Allow Closure (if initially open):

IMPLEMENT PROCESS CHANGE TO ASSURE LIFT OF SW PUMPS ARE ADEQUATE TO COMPENSATE FOR RIVER TEMPERATURE CHANGES.

EXIT LCO 1002002.

REMOVE SUPPLEMENTAL RIVER TEMPERATURE MONITORING FROM TECH SPEC LOGS.

[X] YES; [] NO OD/OE Logged in OD/OE Database:

OD/OE Closed (if initially open) based on (provide short explanation):

[] YES; [] NO OD/OE Logged in OD/OE Database:

Task REVIEW OPRV PREPARE OD QUALITY CHECK
Partner
System Status TSOS

Notification: 10132527

Item detail 0001

Text BULMER,J -CHECKED CAL ON DISCHARGE PRESS
Object part P PUMP
Damage
Cause of damage UNK UNKNOWN
Cause text BULMER,J -INDICATOR IS INDICATING WITHIN

Assembly
Error class

12/26/2001 16:46:02 Jerry W. Bulmer (JWBULME)
BULMER,J -PI IS WITHIN REQUIRED TOLERANCE.

12/26/2001 16:42:42 Jerry W. Bulmer (JWBULME)
BULMER,J -CHECKED CAL ON DISCHARGE PRESSURE INDICATOR SW-DPI-360D PER IAC PROCEDURE 14.28.1. FOUND NO EVIDENCE OF STICKING OR DRAGGING ON INDICATOR. INDICATOR RESPONDED SMOOTHLY THROUGHOUT THE ENTIRE RANGE. THE LOW END (1 PSI) INDICATED LOW (0 PSI, BUT STILL IN TOLERANCE) AND NEAR THE HIGH END, (75 PSI) READ 74.5 PSI, OTHERWISE ALL OTHER TEST POINTS WERE EXACTLY AS EXPECTED. SAT

Item detail 0002

Text
Object part M102 PLANT EVENT
Damage OTH Others not listed or unknown
Cause of damage A408 MAINTENANCE (REPAIR OR REPLACE EQUIPMENT
Cause text PUMP, RE20

Assembly
Error class

Item detail 0003

Text
Object part M000 DISC METH N/A
Damage
Cause of damage
Cause text

Assembly
Error class

Activity PUMPSYS CHK
CHECKED PI CALIBRATION. AS FOUNDS ARE SA

End of report

068442 .1371

ATTACHMENT 3 NAIT FEEDBACK FORM

ACTION ITEM TRACKING STATUS FEEDBACK FORM

CAP ID NUMBER: RCR 2001-1667

RECEIVED FEB 26 2002

CAP ACTION NUMBER: 1

SAP CAP ORDER NUMBER: 421637 4

SAP ORDER TYPE: CAP (CAP Order, Tech Support Order)

ASSIGNED DEPARTMENT: PED

ACTION REQUESTED:

RC PED

[x] Closure [ ] Extension [ ] Action Owner Transfer

[ ] Resp. Transfer [ ] Status Update [ ] Reopen PMActType: ____

(Present Over Due Date: / /) [ ] (New Over Due Date: / /)

RESPONSE/EXTENSION/TRANSFER JUSTIFICATION: see attached

SAFETY IMPACT/GENERIC IMPLICATIONS: See attached

SUBMITTED BY: DWIGHT VORPAHL [signature] **DATE:** 2/26/02

RESPONSIBLE MGR: A05 2/26/02 Todd E. [signature] **DATE:** 2/26/2002

OTHER REVIEW #1: N/A ASRO: [signature] 7/31/02 **DATE:** 8-26-02

OTHER REVIEW #2: N/A **DATE:**

OTHER REVIEW #3: N/A **DATE:**

ATTACHMENT 1 NAIT ACTION ASSIGNMENT

Document Number: RCR 2001-1667 ACTION #1 4216374 Page: 1 of 1

Action Assigned By: DWIGHT VORPAHL / [signature] Date: 2/28/02

INSTRUCTIONS: Clearly identify the action to be taken, the assigned department, and the completion date. List each action separately and note if an action is contingent on the completion of a previous action. If necessary, use additional sheets. Note that the actions (including the action item wording) and completion dates (if Firm) should be developed jointly by the "assigned by" and the "assigned to" department. Each action must be accepted by the "assigned to" department. In addition, if corrective actions are also Regulatory Commitments, the commitment number should be referenced and signature of the Assigned Work Center acknowledges acceptance. NOTE: Enhancement actions are not tracked as part of CAP Orders. Reference Procedure 0-NPG-4.12 for Priority.

PMActType: PRE; Action Statement: The Plant Engineering Department Manager will educate the Plant Manager, the Work Control Manager and the Maintenance Manager on the importance of performing SW pump lift adjustments when required. (This addresses the condition.)

Schedule Type: N; Priority: 3; Over Due Date: 3/31/02; Firm Due Date (Y/N): N

Licensing Concurrence (Y/N): N; Assigned Work Center: NEPM

Assigned Work Center Acceptance: [signature]

SAP CAP ORDER NUMBER: 4230095 OTHER REVIEW:

PMActType: ______; Action Statement: ______

Schedule Type: ______; Priority: ___; Over Due Date: ______; Firm Due Date (Y/N): ___

Licensing Concurrence (Y/N): ___; Assigned Work Center: ______

Assigned Work Center Acceptance: ______

SAP CAP ORDER NUMBER: OTHER REVIEW:

PMActType: ______; Action Statement: ______

Schedule Type: ______; Priority: ___; Over Due Date: ______; Firm Due Date (Y/N): ___

Licensing Concurrence (Y/N): ___; Assigned Work Center: ______

Assigned Work Center Acceptance: ______

SAP CAP ORDER NUMBER: OTHER REVIEW:

EVALUATION OF D SW PUMP FAILURE

ROOT CAUSE CONDITION REPORT

RCR 2001-1667 ACTION #1

ORDER #4216374

02/18/02

PROBLEM STATEMENT

The D service water pump failed to pump water when started on 12/26/01 at 9:32 am.

EVENT DESCRIPTION AND EVALUATION

EVENT DESCRIPTION

According to the log entries, on 12/26/01 at 0932, an attempt was made to place the D Service Water (SW) pump in service. When the pump was started, the pump only drew 18 amperes. The normal amount is 34 to 40 amperes. Also, no change in D SW pump discharge pressure was noted. Because of this, "D" service water pump was then secured.

The pump in question is a single stage, mixed flow vertical pump manufactured by the Byron Jackson Pump Company, type 28 KXL, 1180 rpm, rated nominally for 8000 gpm with a TDH of 245 feet. The impeller diameter is nominally 18-1/4 inches. The pump has been in regular service since the plant went on line in 1974.

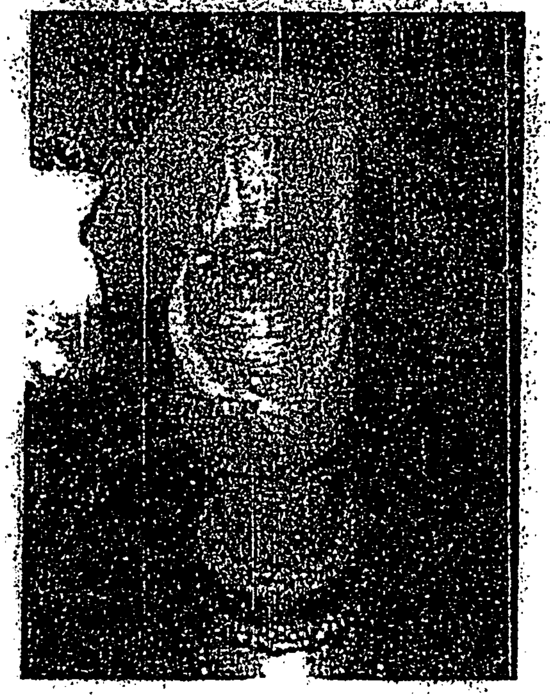
According to the log entries, on 12/26/01 at 0932, the D SW pump was declared inoperable "due to being air bound." It was subsequently declared operable on 12/29/01 at 1139. The D SW pump was inoperable for a period of approximately 76 hours.

At the time, "D" service water pump was noted to have a pressure of 1.5 psig on its discharge pressure gage (SW-PI-360D). The river level was approximately 877 feet in elevation. With the river at an elevation of 877 feet, to be air bound would require a pressure in the pump column of 7.4 psig. At this pressure, the column would be sufficiently full of air to expose the pump impeller and exit the bottom of the column at 860 feet elevation.

When pressure was released through the discharge pressure gage connection, a small amount of air was observed to vent from the column commensurate with a pressure of 1.5 psig. The pressure then dropped to zero.

After the pressure was vented, a subsequent re-start was attempted. The pump shaft was noted to spin and the pump motor was observed to use 13 amperes of current. However, the pump did not pump water and the discharge pressure did not change from 0 psig. The pump was not air bound.

Disassembly of the pump found that one of the shaft couplings had failed, as shown in photograph 1. The pattern of the fracture was typical of failure by torsion, i.e., the classic "barber pole." The location of the failed coupling was approximately halfway down the pump shaft, which is about 46 feet in total length.



Photograph 1. View of coupling as it emerged during disassembly of the "D" service water pump.

SYSTEM/COMPONENT OPERATION

DESIGN AND OPERATION OF THE SW PUMPS

Figure 1 shows the layout of the SW pump and motor. Each service water pump has 5 couplings, 4 long shafts of 10' each, and one short shaft of about 4' in length that is connected to the impeller. The suction of the SW pump is approximately 46 feet below the bottom of the SW pump motor and the suction of the SW pump is approximately 22" above the bottom of the pump bay.

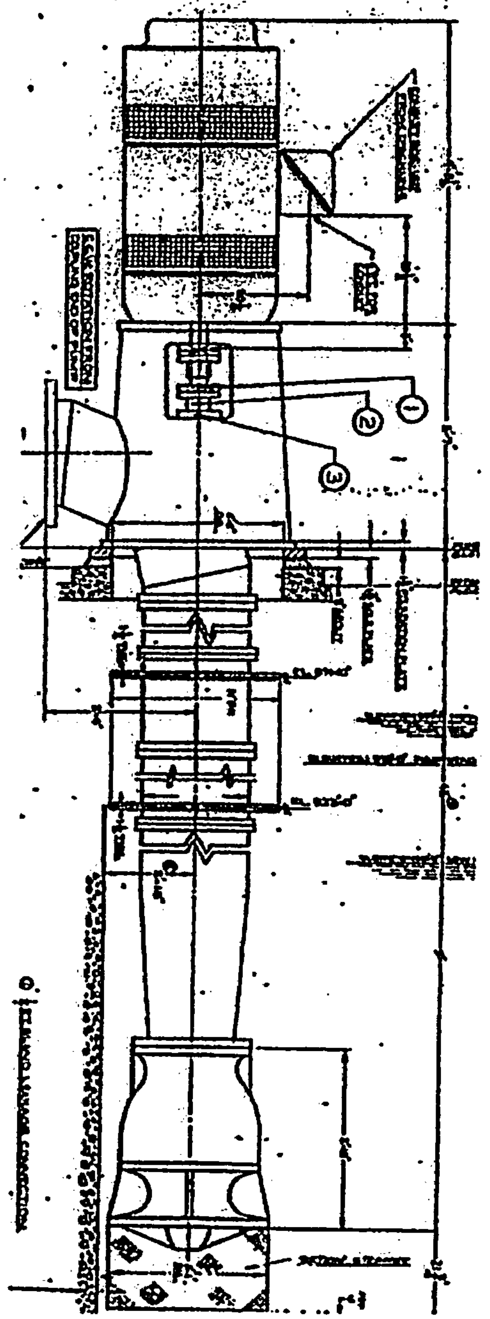


FIGURE 1

The SW pumps normally operate with an injection supply of gland water from the riverwell water system. This water source is injected in the stuffing box gland. Part of this water lubricates the packing and is discharged out of the pump packing to the environment, which then flows into the discharge elbow casing and through a hole back down into the pump bay. The rest of the injected water flows down the shaft in the enclosing tube (which encapsulates the pump shaft) lubricating the lineshaft bearings. This water then exits the top case bearing (top of the impeller see figure 2 item #12) and exits into the hollow chamber above the impeller. This water exits from the area between the top edge radius area of the impeller (figure 2 item #2) and the wear ring (figure 2 item 6), where it mixes with the pumped fluid, subsequently flushing any sand/silt and river water out of this area of the pump.

The stainless steel open style impeller of this pump matches the contour of the impeller liner (figure 2 item #9). The impeller is designed to be able to be raised above the impeller liner to allow for shaft stretch and for increasing or decreasing performance. As the impeller is raised, the impeller lift increases, which increases the dimension between the impeller and impeller liner. Increasing the lift decreases the pumps performance due to increased recirculation of the pumped fluid. This lift setting can be adjusted from 0.000" to approximately 0.500". At 0.000", the impeller is touching the liner, and in actuality would bind upon pump startup due to downthrust causing the shaft to stretch, forcing it to rub against the liner (explained in detail in following paragraphs). At 0.500", the top of the impeller comes in contact with the bowl of the pump.

The original lift setting specified by the pump manufacturer, Byron Jackson, was 0.021". The lift is set under a static condition (pumps off and water in column only up to river elevation). This recommended lift setting was changed by Byron Jackson in 1993 to be greater than 0.056". The reason for this change was due to shaft elongation resulting from the hydraulic forces action on the impeller produce a downward thrust which will stretch the shaft. This stretch was determined to be 0.030" at 6000 gpm and 0.039" at shutoff head.

The SW pumps are also exposed to another phenomena that will cause the lift to change on these style of pumps. This is caused by different coefficients of thermal expansion of the impeller shaft and the pump outer column based on changes in the river water temperature. As the river warms up, the pump lift increases due to the shaft expanding at a lower rate than the column and as the river cools down the opposite occurs and pump lift decreases.

The gland water supply to the lineshaft bearings also plays a role. The temperature of the gland water in the inner column around the pump shaft causes additional thermal expansion and contraction effects because this water may be a different temperature than the pumped water. If the gland water is at a significantly different temperature than the pumped fluid, the thermal expansion and contraction effects can be large.

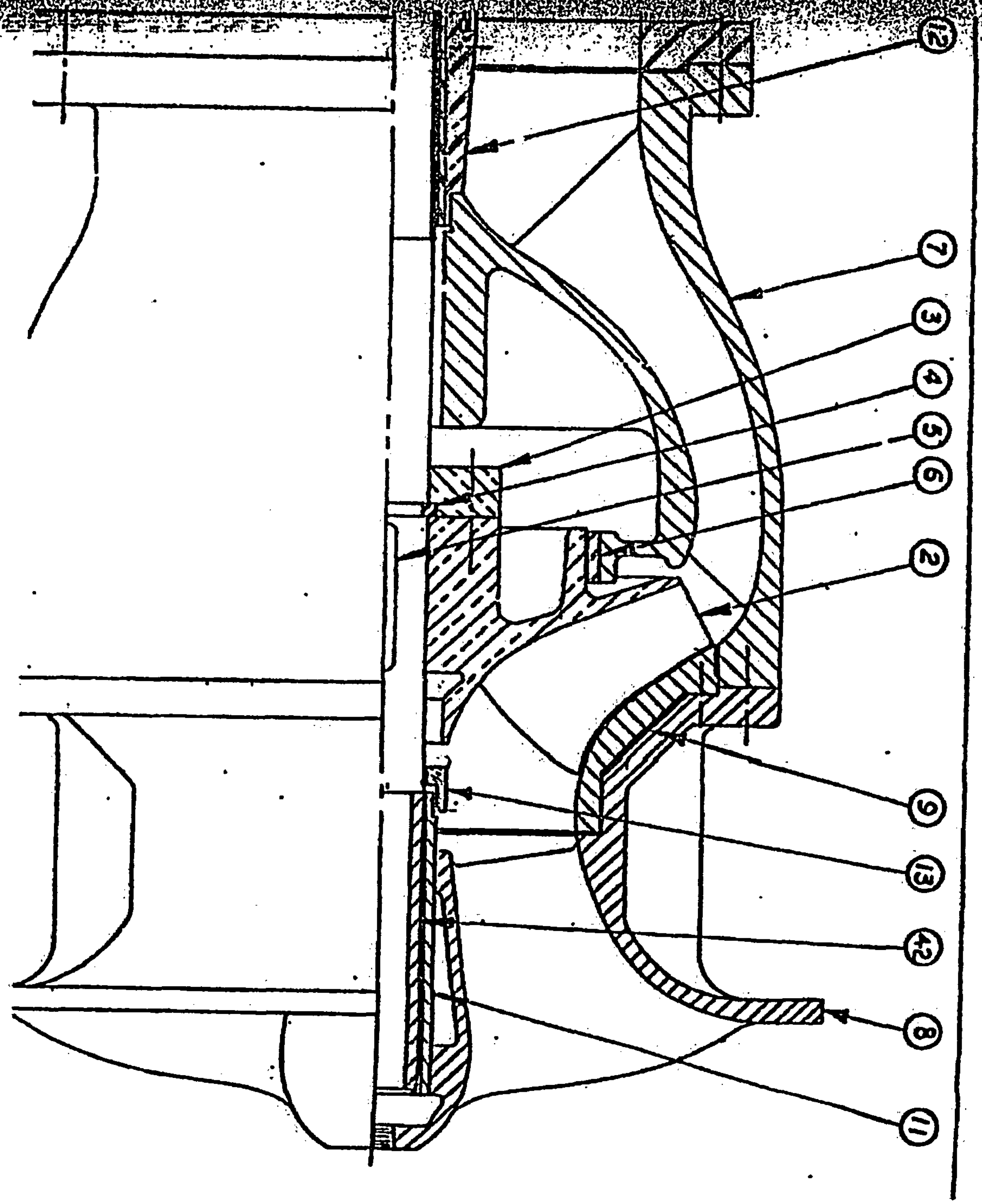


FIGURE 2

Other factors than can affect the clearance or lift setting of the pump include the following:

- Static stretch of the shaft. The weight of the shaft and impeller will stretch the shaft.
- Stretch of the pump column due to hydraulic forces. During operation, the discharge pressure and weight of the water will be transferred to the column, causing the column to lengthen.
- Thermal expansion of the motor shaft and frame. The stator and rotor will be at different temperatures and the resulting differential expansion will affect the axial position of the pump shaft.
- Looseness in coupling and impeller fits to the shaft.

Taking these factors into account using design river water temperatures of 32 °F to 90 °F, the lift can vary up to 0.087" due to thermal expansion, and can stretch a minimum of 0.030" from hydraulic forces.

It may be helpful to consider the basic steps in establishing the running clearance for the SW pumps. The following example is intended to clarify the relationship between the various factors that affect the pump clearance and the process of establishing the lift setting and operating the pump. The example is for illustrative purposes only. The actual sequence of activities followed by station personnel is slightly different.

The conditions in effect when the pump is removed from service and when the lift is adjusted can affect the lift setting. For example, if the lift is adjusted while well water is still being injected into the shaft enclosing tube or if there is a substantial height of water in the column, the conditions will be different than if all water has been drained from the pump and it is at ambient temperature. For simplicity, the following steps assume the pump is completely out of service and is being reassembled at ambient temperature.

Prior to re-establishing the lift, there is no flow through the shaft enclosing tube or the column and the shaft and column are at the same temperature (ambient). Since there is no water in the column, there are no hydraulic forces acting on the impeller or on the column. The shaft and impeller are sitting on the lower bowl liner surface and the shaft is in compression due to its own weight. The column is elongated due to its own weight and because it is carrying the weight of the shaft and impeller.

Before the shaft is lifted, the desired lift setting is established at the coupling. When the bolts are tightened and the shaft is lifted, the shaft comes out of compression and goes into tension. The shaft is elongated due to its own weight plus that of the impeller. The lifting of the impeller and shaft reduces the load on the column slightly, but it remains in tension due to its own weight.

After reassembly of the coupling is completed, water from the gland water system is supplied to the shaft enclosing tube. Since the source of gland water is the well water system, the temperature of the (enclosed) shaft will approach the temperature of the well water. Since the well water temperature will, most likely, be different than the ambient temperature, the shaft will expand or contract. The column, however, will remain at ambient temperature.

Before the pump is started, water enters the column and, depending on river level, reaches some height above the impeller. Once the pump is started, river water flows up through the column. The hydraulic forces acting on the impeller produce an additional stretch of the shaft. The hydraulic forces acting on the column produce an additional stretch of the column.

Since the source of the water is the Missouri River, the temperature of the column will approach the temperature of the river. Since the river temperature may be different than the ambient temperature, the column may expand or contract. However, whether or not the ambient and river temperatures differ, the well water and river temperatures almost certainly will. There will be some heat transfer across the shaft enclosing tube and so the exact temperature of the shaft is difficult to predict. In general, however, the expansion or contraction of the column will differ from the expansion or contraction of the shaft and, as a result, the clearance between the impeller and bowl will undergo a further change.

Each time the lift is adjusted, the static and hydraulic effects should be approximately the same. However, depending on the ambient, well water, and river temperatures, the thermal effects can be very different. Thus, if the net effect is to increase the clearance between the impeller and the bowl, the pump performance will be degraded. If, on the other hand, the net effect is to decrease the clearance, the pump performance could actually improve. If the decrease in the clearance is excessive, the impeller and bowl surfaces will come into contact and will begin to wear. This, in turn, will cause the pump performance to be degraded and will cause the motor to draw excessive amps. [Note: Although impeller wear will decrease the impeller's flow area and, thereby, cause some decrease in the performance of the pump, contact between the impeller and bowl liner might wear away only a relatively small amount of material. This could, effectively, establish very tight clearances and, perhaps, better match the contours of the impeller and liner—which would tend to improve the performance of the pump. In some cases, the net effect would be that pump performance would appear to improve temporarily.]

Effective monitoring and trending of these items can be used to ensure frequent SW pump lift adjustments are performed to keep the SW pumps operating in a desired band. These items are being monitored and trended by the System Engineer which is used as a basis to recommend adjusting SW pump lifts when required.

The original vendor specified pump lift setting for the SW pumps was 0.021". In fact this is still stamped on the pump nameplate. If the pumps were set at a lift of 0.021" and the shaft stretch is at least 0.030" from downthrust alone when the pump is started, it can easily be seen that the impeller will contact the liner. This is not even taking into account the effects the river temperature changes have on the impeller and liner clearance. Both of these materials (impeller and liner) are stainless steel and rubbing of these two materials together under high speeds (1180 rpm) will produce galling of the surfaces. This could lead to pump binding and/or shaft breakage.

Due to the shaft stretch from downthrust, the SW pump vendor manual was revised in 1993 to increase the recommended lift settings on the SW pumps from 0.021" to a range of 0.040" to 0.060".

Figure 3 is from a recent SW pump bowl assembly after being replaced. The galling in the liner and at the impeller vane tips from rubbing can be easily seen and is typical of all of the SW pump bowl assemblies that are replaced.

FIGURE 3

These problems with this type of pump are common in the industry and have come to light in the early 90's. Many utilities are still struggling to deal with these seasonal changes in pump lift.

DESIGN AND OPERATION OF THE E BAY (SW PUMP BAY)

A guide wall, known as the weir wall, has been constructed in front of the Intake Structure to reduce sediment buildup in the Intake Structure. The primary purpose of the weir wall is to reduce the sediment input to the Intake Structure by forcing bed load and other material contained at lower elevations in the river to flow past the intake to a point where inflow to the intake will not influence river behavior. The upper elevations of the river containing relatively finer sediment flow over the submerged weir. A model study[2] indicated a potential reduction of as much as 75% in the amount of sediment to be carried into the Intake Structure with the weir wall installed.

A reinforced concrete intake structure is constructed at the riverbank. The operating floor of the structure, on which the Service Water pumps are mounted is at Elevation 903.5 feet. The bottom elevation of the SW pump bay is 857.5 feet. (see figure 4)

The shape of the SW pump bay can be described as follows; Where the water enters the bay it necks down to nine feet, eight inches wide at the area where the trash racks and travelling screens are. The bay then widens out approximately 16' upstream of the SW pumps. (see figure 5)

Silt accumulation in the entrance and interior of the intake is controlled by the following: A water jet sparging system is installed near the bottom of the Intake Structure to agitate the silt and keep it in suspension, thus preventing its settling out. The sparging system consists of five rows of high-pressure water spray nozzles in the SW bay. Each set is approximately 1 foot off the floor of the pump bay with one set (J-4C) installed approximately 3 to 6 inches upstream of the SW pumps. These spargers are adequately located in the SW pump bay and in sufficient number to prevent the silt from settling out. Sounding of the bay in front of the SW pumps continues to show little, if any silt/sand build up on the floor of the bay directly upstream of the SW pumps.

The E bay travelling screen is located upstream of the SW pumps and functions to remove debris greater than 3/8" in size from the water entering the SW pump bay (E bay). The screenwash system functions to backwash the debris that accumulates in the screen and flushes the debris back out to the river.

The spray wash assembly and/or the traveling screens may be turned off for short periods of time (seven days) to perform maintenance. Silting has been evaluated and determined not to be a problem for these short periods of time. In addition to the above, flow, pressure and temperature data from the critical heat exchangers is periodically analyzed to detect any trends that could occur as a result of silt accumulation per Generic Letter 89-13.

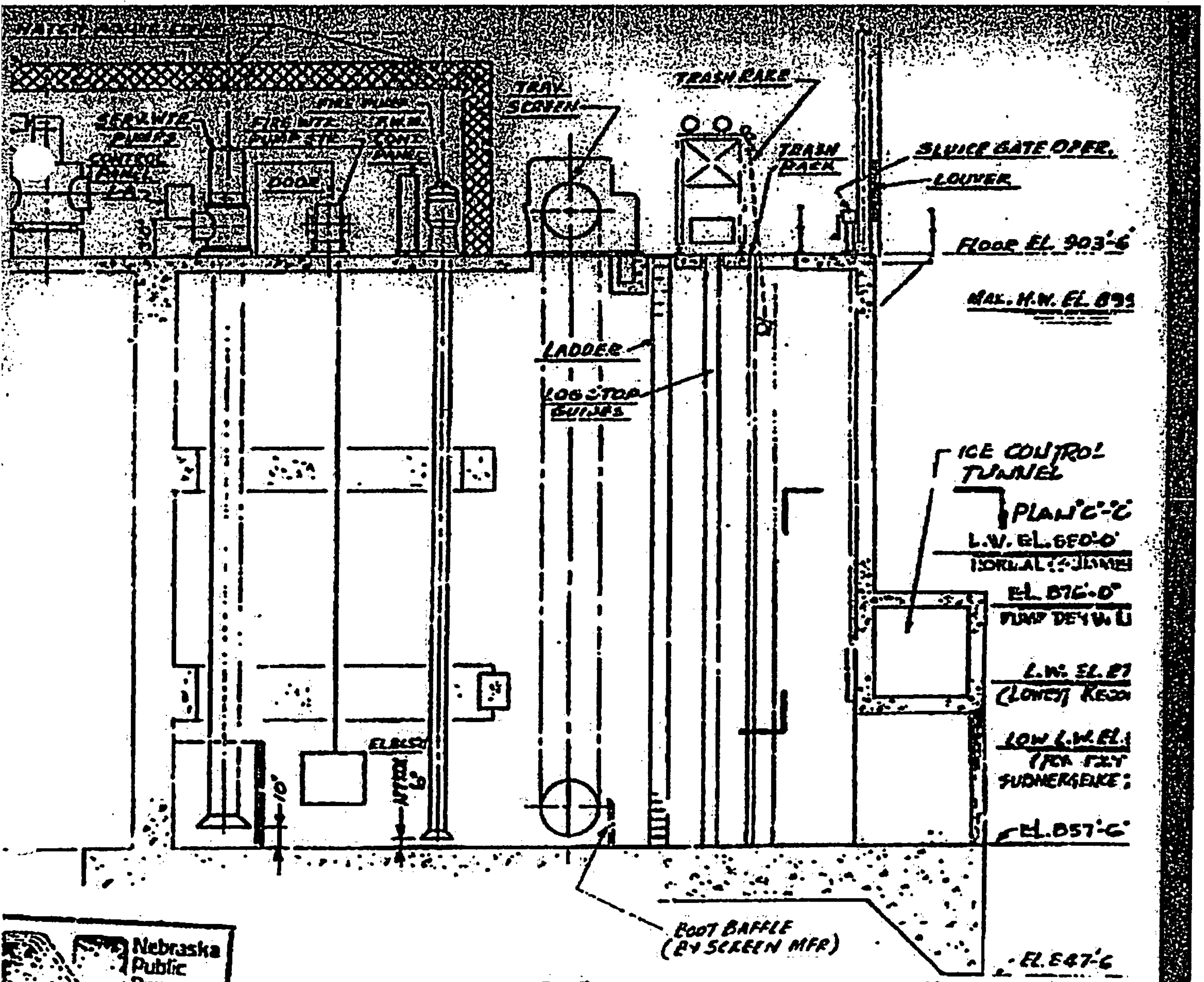
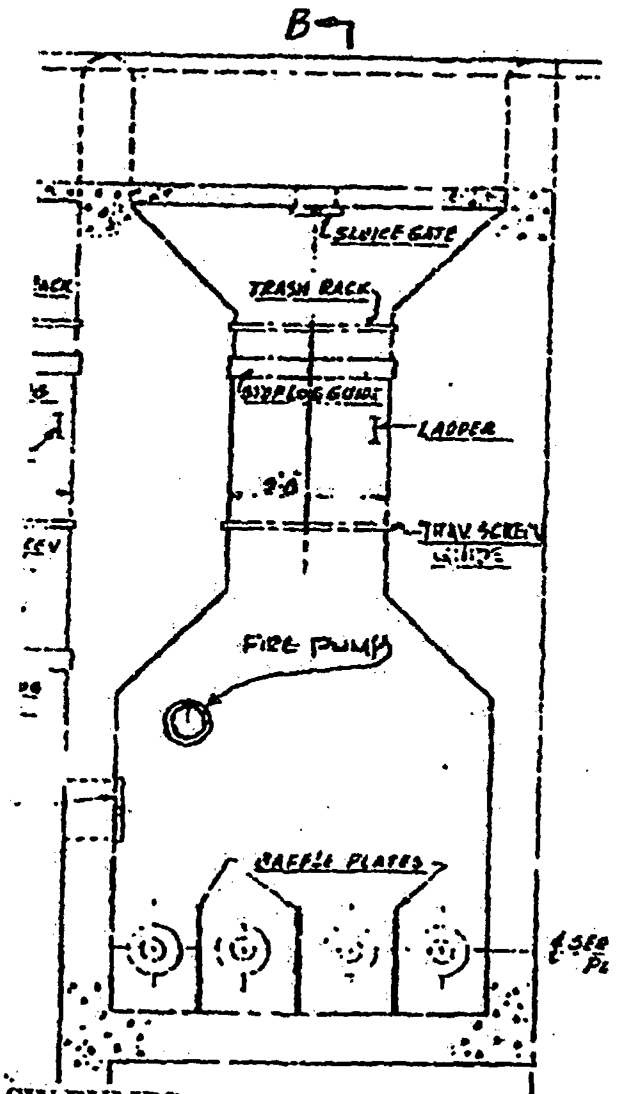


FIGURE 4

RIVER



SW PUMPS

FIGURE 5

CHRONOLOGY

The D SW pump inspection on 12/27/02 revealed the following information:

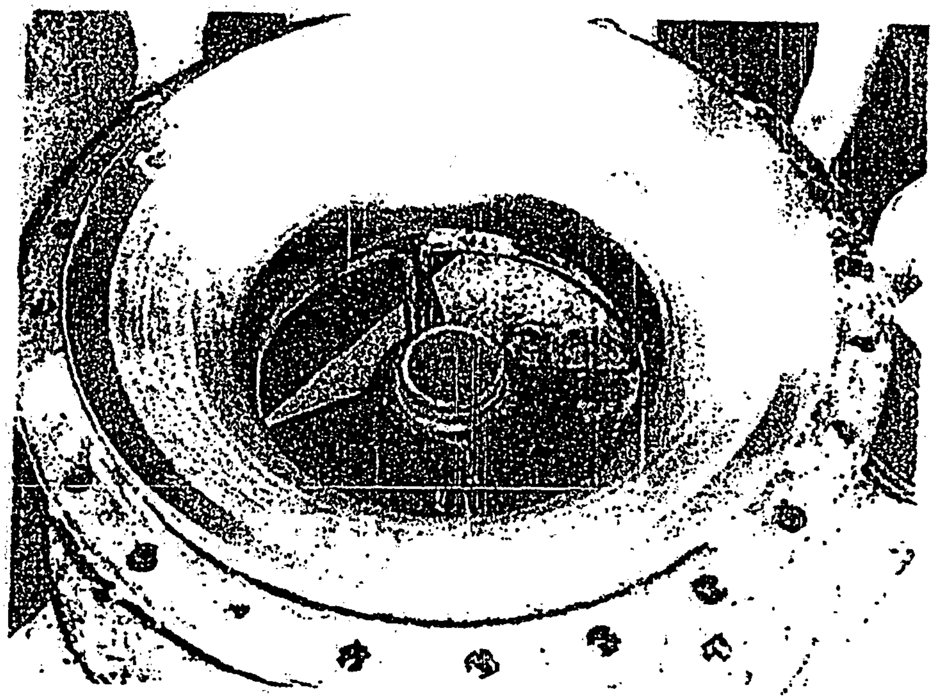
Examination of all the rubber Cutlass bearings in the pump found no evidence of unusual wear or "dry" contact. They all appeared in good condition. No damage or unusual wear was noted in the pump shaft sections. The area under the pump (floor of the SW intake bay) was sounded to ensure there was no unusual build up of silt or sediment. This was performed under work order 4216375 on 12/27/01 where a weight was used to sound the bay could be felt hitting concrete and the depths indicate no silt buildup. Close examination of the fracture found no evidence of fatigue. The appearance of the fracture appeared consistent with over-load by torsion with some bending moment, possibly due to secondary moments caused by deflection (Photograph 2 and 3 below).

Photograph 2. General view of the fracture in the coupling.

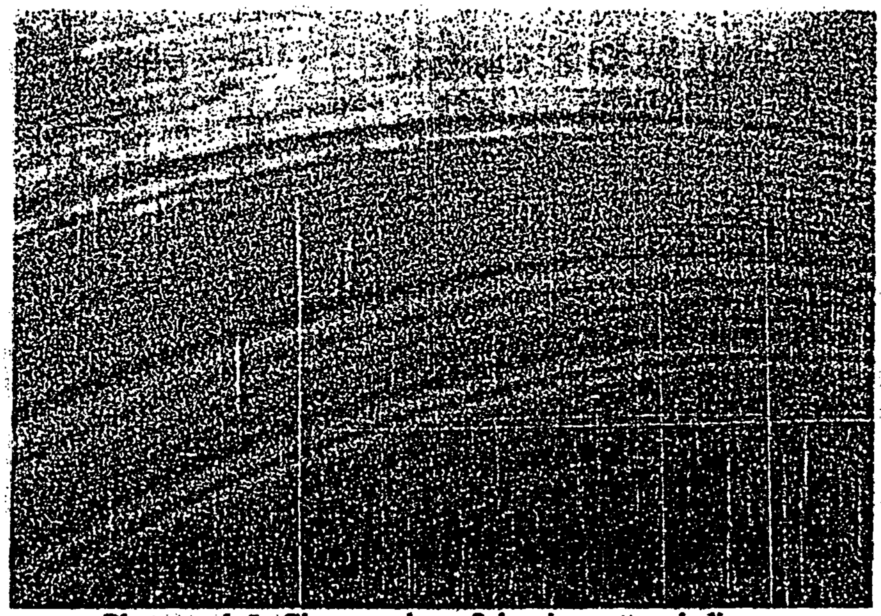
Photograph 3. Close up view fracture surface.

A check of the Byron Jackson pump material specifications for this coupling found that it is specified to be heat-treated 410 stainless steel. Heat treatment was to be in accordance with ASTM 479 HT2 specifications, which indicates that the material should have a final hardness of 269 BHN or Rc27. This hardness is consistent with a tensile strength of 126,000 psi.

The impeller and liner were disassembled, removed and examined. The liner and impeller were badly abraded, as shown in photographs 4 and 5. The liner had an especially deep phonograph type wear pattern caused by impingement of the impeller into the liner. This was caused by insufficient lift adjustment. Some of the marks on the liner appeared fresh. Roll over material abrad :d from the edges of the impeller blades was also razor sharp, which is an indication of having been recently made. Abrasions that have been present for some time in the liner or impeller tend to be "softened" and blunted by erosion of the suspended solids in the water..



Photograph 4. Phonograph abrasion pattern in liner.



Photograph 5. Close up view of abrasion pattern in liner.

At the time this event occurred, the river temperature had dropped to approximately 32 °F (PMIS point M138). The D SW pump had previously had a lift adjustment performed on December 5, 2001. At that time, the river temperature was approximately 43 °F (PMIS point M138). The "as-left" lift setting on December 5, 2001, was 0.048 inches. Since pump down thrust causes the shaft to extend more than 0.030 inches when operating, this left a net clearance of about 0.018 inches when the pump was operating. Based on the difference in rates of thermal expansion caused by a drop in river temperature of 11 °F this would have caused the pump impeller to impinge upon the liner at the time that this failure occurred. This would have significantly increased the required starting torque.

It is known from past experience at CNS that the shaft and couplings have been sufficiently strong with respect to torque. Experience shows that when the shaft is held immobile, the motor will trip off or burn out prior to failure of the shaft or coupling. This was demonstrated on March 2, 1987, with service water pump "D". As was reported in NCR 87-0827: *Upon start up of pump, blue smoke came out of the motor. Received ground alarm on breaker 1BG. Investigate and repair as necessary. Pump was very difficult to rotate at first but was rotating freely before the attempt to start it.* Other examples are listed in the CNS experience section.

The failed coupling was sent to Rail Sciences, Inc. for analysis. The analysis was performed by Hans Iwand, P.E., who reached six conclusions:

a. The coupler contained an intergranular crack that existed from the time of installation.

b. The presence of bronze on the fracture surface indicates the crack existed during operation (of the pump), and when bronze particles from nearby bearings became present it was trapped in the crack.
c. The hardness of the coupler exceeds the allowable standard.
d. The coupler failed due to bending of the shaft transverse to its major axis.
e. The coupler failed as a consequence of the pump impeller becoming jammed.
f. No fatigue or other progressive fracture morphology was noted on the fracture surfaces.

The intergranular crack found in the coupling did not cause it to fail, rather it caused the coupling to become the weak link in the drive train (i.e. motor overloads, motor shaft, shaft key). The weak link failed due to the increased starting torque caused by the impeller and liner impingement.

The SW pump lifts since plant startup until 1993 were specified to be in the 0.021" range and review of past work packages confirm the lifts were set at this value. It should also be noted that the pre-1993 events occurred even after performing frequent rotations of the pumps. In 1993, the required lift setting was increased to 0.056" nominally with a recommended range of 0.040" to 0.060" to account for shaft stretch. No failures resulting from impeller/liner contact occurred after adjusting the lift setting on the SW pumps in this range until this event.

The lack of understanding of the real issue has caused many operational changes to the rotation of the SW pumps, as evidenced by the changes to Procedure 2.2.71.

The timeline of these changes to Procedure 2.2.71, "Service Water System" and justification for each change is identified below and in the references.

- 1974, based on suspected SW pump binding problems and input from Byron Jackson, pump rotation by hand using a wrench was initiated every 4 hours.

- Procedure 2.2.71, Rev 2, added a requirement to manually rotate the SW pumps once per 8-hour shift (circa 1975).

- Procedure 2.2.71, Rev 15, per standing order 78-5, shift running and standby SW pumps each 8-hour shift (4/83).

- Procedure 2.2.71, Rev 20, per nonconformance report 87-004 (smoked SW motor due to bound pump caused by heavy silting) added a requirement to manually rotate each SW pump before each non-automatic start (7/87).

- Procedure 2.2.71, Rev 25, standardized method of rotating idle pumps daily (7/89)

- Procedure 2.2.71, Rev 34, instituted 12-hour pump rotation to be consistent with procedure 2.1.11, "Station Operations Tour" and management direction (8/94).

- Procedure 2.2.71, Rev 36, deleted manual rotation requirements (2/95).
- Procedure 2.2.71, Rev 45, added a specific section providing guidance for performing the pump rotations (1999).

Testing of siltation in the SW pump bays with and without the sparger systems in 1973 was also reviewed (reference 76). This testing was conducted to determine siltation levels in the E bay and was performed operating only the A and C SW pumps between October 5 and 12, 1973. During this period of time the travelling screens and spargers were secured, the sluice gate between bays D and E was open and the spargers and screens in bay D were off. During the test, river levels and condition were recorded. During this period of time the river level varied between 881.5' to 890.5' (emergency flood procedure entered at elevation 895') and river condition was described as muddy to very muddy at the higher river level. The muddy condition described at the higher river level is as expected due to the known increase in suspended solids with increased river level and velocity, which also results in conservative test results.

The following conclusions were reached from these events:

- With the two SW pumps running, the area around the SW pumps and fire pumps remained almost entirely free of sediment, except for small lumps near the sidewalls.
- The sediment deposition in other areas gradually increased during the test period of a week as follows:

  From 2' 6" to 9' 6" at the trash racks
  From 2' 6" to 7' 0" in front of the travelling screen
  From 2' 6" to 5' 0" behind the travelling screens

- After this test the bay was easily cleared of silt by putting the spargers J1, J2 and J3 on with low pressure water (30 psig). However, high dps were experienced across the SW pump discharge strainers due to the spargers lifting sediment into the waterway to be carried into the pumps and strainers.

These conclusions indicate that silt has less affect on pump operation than originally believed.

Silt accumulating in the area between the top side of the impeller and wear ring to the extent that the pump could not start is just not feasible considering the amount of force applied to the shaft when the motor starts. Silt would have to be completely packed into the whole pump and would have to be dry with no lubrication. The motor shaft would not physically contort from the forces exerted by sand in the wear ring, the sand would give as opposed to metal/metal contact

If the pump was completely packed and encased in silt, the pump would still operate and pump silt. The relatively high amount of porosity in samples taken from the river, which is typical of sand, indicates that when fully saturated, the sand still remains "flowable." In other words, unless a binding agent is added which creates additional cohesion between the individual sand particles (sand is naturally non-cohesive), or unusual compressive forces "squeeze" out the normal amount of porosity, the water which fills the interstices acts as an internal lubricant and keeps the material "fluidized." Such water saturated sand will simply flow in accordance with the usual characteristics of a liquid with a high specific gravity. At saturated conditions, sediment that would be found in the intake bays has a density of about 2.02 and a porosity of about 37%. (reference # 77)

Previous inspections of the pump impellers and the area above the impeller during overhauls have not shown any signs of significant amounts of silt or sand in the wear ring areas. Normal wear is also seen on these surfaces.

Previous inspections of the SW pumps' stainless steel impellers and liners during overhauls show signs of galling and rubbing between these surfaces. This can be seen by the deep grooves and rolling over of stainless steel material (up to ¼" depth) along the liner and grooving and rolling over of the stainless steel material of the vane tips. (figure # 3)

The issue of thermal expansion differences between the pump shafts and columns causing the impeller lift to change in combination with the downthrust experienced during pump runs is now well understood at Cooper and throughout the industry. This is being addressed separately and will ultimately improve the performance of the SW pumps and allow less frequent maintenance to be performed.

Based on the information obtained and studies performed, the cause of the failure of the D SW pump was not due to the coupling flaw nor siltation in the pump or pump bay, but the result of the impeller impinging into the liner from differential thermal expansion. This differential thermal expansion was introduced by an inadequate glandwater system design and also differences in the respective coefficients of thermal expansion of the pump shaft compared to the bowl and columns.

Based on this the lifts were reset on the A, B and C SW pumps on12/28/01 (Work orders 4216875, 4216873 and 4216874).

Actions have been established by the SW system engineers for monitoring and setting lift adjustments to preclude binding from impeller/liner contact in the future. This monitoring will also preclude the lift from opening up to far which could result in the performance of a SW pump degrading significantly. This is monitored by the SW system trend plan.

ANALYTICAL TECHNIQUES

Barrier Analysis and Kepner-Tregoe analytical techniques were used in this root cause evaluation.

Some of the key points that came out of these analysis techniques were evidence of the impeller rubbing against the liner, the coupling flaw was present at the time of manufacture and the river temperature decreased rapidly. Together these items were used to determine the root cause of this event.

CNS EXPERIENCE AND INDUSTRY EVENTS

CNS EXPERIENCE

A review of the unidata database was performed on this subject and many operations personnel were interviewed including individuals with many years of Cooper Nuclear Station experience. The referenced documents that were identified as being related to this issue via the unidata search were reviewed and referenced.

These documents center around significant issues of silt entrainment in the SW and CW pump bays and in the systems themselves from the Missouri River. Most of these documents were from the early 1970's timeframe.

This review did not show any documented cases of significant amounts of silt directly in front of the SW pumps. This review did identify 4 previous instances of SW pump binding but the details of these events are lacking. These events all incorrectly classified the failure of the pumps as being silt related as opposed to galling from contact with the impeller and liner. Although, it was noted several times, just as passing thoughts, that impeller, wear ring contact could have been the cause of some of these failures.

These four events are:

- At approximately 0210 hours on 3-7-74, SW pump D failed to start during routine pump switching operations. The pump motor breaker tripped on overload, and the pump shaft was not observed to rotate. Subsequently, while performing surveillance procedure 6.3.18.1 as required by Technical Specifications, section 4.11.C.2, SW pump "A" failed to start. With observations identical to those on SW pump D, neither pump could be rotated by hand. An orderly reactor shutdown was commenced as required by section 3.11.C.3 of the technical specifications. All control rods were inserted and the reactor mode switch was placed in "shutdown" at 1134 hours on 3-7-74.

  The apparent cause was determined to be higher than normal silt concentrations being experienced adjacent to the intake structure due to weir wall construction upstream, and because of this, sand had infiltrated into the wear rings of these pumps. The spargers were operational at this time. SW pump D had been shut down for a period of approximately 52 hours and SW pump A for approximately 34 hours. SW pump A was freed and placed into service at approximately 1130 hours on 3-7-74 and SW pump D was freed and placed into service at approximately 1600 hours on 3-7-74. The pumps were freed by simply uncoupling the motor from the shaft, which essentially raised the impeller lift setting, and recoupling the motor.

Corrective actions were to change operational procedures (approved by the Byron Jackson service representative) which was to alleviate this particular problem until the weir wall was completed. At the time it was believed that the buildup of sand in the pump wear rings was a function of river silt concentration and the length of time that the pump remains idle. Corrective actions were to run two SW pumps in one loop and one pump in the remaining loop continuously with routine manual rotation of the idle pump to assure that the impeller was free to rotate. This procedure change was to ensure maximum availability of all SW pumps.

- The third event occurred on 3/2/87 (reference 48). Upon startup of SW pump D, blue smoke came out of the motor. Prior to the pump start, it was rotated with a pipe wrench and was difficult to rotate at first but was rotating freely before attempting to start it. When it was started the shaft was observed to rotate and a ground alarm on breaker 1BG was received and the motor tripped. NCR 87-016 was written and documented the cause of this failure to be silt in the wear rings.

- The fourth event was the failure of the A SW pump motor in December 1988. The inspection report by GE (reference 52-56) indicated several problems with the motor. The rotor was removed and inspected. It was found that the motor shaft was twisted and bent, most noticeably near the lower end. The upper and lower shaft keyways were out of line by approximately five degrees. Also, a fault occurred in a motor coil midway through the stator. The top coil in the slot had burned completely through, and the bottom coil was also damaged. Damage to the stator iron next to the fault also occurred.

The conclusion as to the cause of the failure is that age-related insulation breakdown contributed to the fault, which occurred at the weakest insulation point in the windings. Loading problems on the motor are also considered to have been present because of the mechanical condition of the rotor high vibration readings for the motor immediately prior to the failure. It was determined that these two items were probably unrelated. A recommendation was also made to inspect the A SW pump and motor for possible impeller or shaft damage.

Once again it was thought that silting in the wear ring clearance areas was the cause of this failure.

INDUSTRY EXPERIENCE

Information Notice 93-68 published by the Nuclear Regulatory Commission, dated September 1, 1993, details how a pump shaft coupling made of 410 stainless steel failed in service on June 20, 1991, due to temper embrittlement during manufacture. The failure occurred at Beaver Valley Nuclear Station. The pump and coupling were manufactured by Byron Jackson.

The failure involved an internally threaded coupling similar to the one used at CNS. Two additional couplings from the same lot of couplings purchased in 1977 were found to have cracks and were part of a lot of 13. All of the deficient couplings came from the same heat treatment batch, HT821336, of type 410 stainless steel.

The notice concludes that "pump shafts containing temper embrittled couplings could fail during operation if the pump has worn bearings, the pump shaft is misaligned, or shaft motion is impeded by silt or debris ingestion."

A more complete report concerning this event is available at the following web address: http://192.168.100.22/fulltext/nrcnotes/in93068.txt.

FORT CALHOUN

The SW pumps at Fort Calhoun Nuclear Plant are the same style Byron Jackson pumps that are at Cooper Nuclear Station with the exception that they are two stage pumps and smaller with a shorter shaft length. The water supply for their SW system is also the Missouri River and they do have significant amounts of siltation in the pump bays. The silt is kept in suspension in the bays via a sparger system. Four SW pumps take suction 7" off the bottom of a concrete platform in the bay.

Discussions with the SW system engineer indicate that they have historically swapped their SW pumps once per shift due to potential perceived binding and have overhauled their SW pumps on a 2 year frequency due to perceived wear due to sand erosion. However approximately 3 years ago, they changed the operation of their SW system due to gained knowledge on proper lift settings on the SW pump and the notion that silt in the clearance area between the wear ring and impeller would not cause a SW pump to bind. They now run one to two SW pumps all the time and twice a week start and run their idle SW pumps for a couple of minutes. They do not swap pumps and basically run one pump to failure, prolonging the life on nonoperational pumps.

Since Fort Calhoun has changed its operating philosophy, there has been no degradation in performance of the sacrificial pump in 3 years. Nor have any operational problems occurred on the idle SW pumps when started bi-weekly.

BEAVER VALLEY

The SW pumps at Beaver Valley Nuclear are the same style Byron Jackson pumps that are at Cooper Nuclear Station with the exception that they are larger capacity pumps and have a longer shaft length. The water supply for their SW system is the Ohio River, which is high in suspended solids also. They do have significant amounts of siltation in the pump bays but do not operate with a sparging system. They have three SW pumps that take suction 7" off the bottom of their pump bay.

Discussions with the SW system engineer and pump component engineer indicate that they have historically had problems in the past with the lift settings of their pumps affecting performance from river temps, gland water temps and downthrust. They typically run one pump all the time and do not routinely rotate or swap their SW pumps. They do infrequently swap them to equal the run time.

On February 8, 2000 (OE 334-000208-1) 2 of their 3 SW pumps were made inoperable due to an overcurrent trip during start attempts from the control room. The cause of both of these overcurrent trip conditions was due to physical contact between the rotating element (impeller) and the lower casing of the pumps. The cause of this condition was due to differential thermal expansion between the pump shaft and the pump casing. This was caused by injecting an alternate lube water supply, which was approximately 30 degrees higher than the normal supply. This in combination with the downthrust upon pump start caused the impeller to contact the liner and bind. This event was not attributed to silt binding.

SURRY

On 11/06/87, a SW pump was discovered to be binding and difficult to turn. This was also attributed to binding between the impeller and liner from thermal expansion and downthrust, not silt binding.

ROOT CAUSE

The root cause of the coupling failure is an inadequate SW pump design and gland water system design. The D SW pump impeller was impinging upon the bowl liner. The resulting friction between the liner and impeller significantly increased the amount of torque needed to start the pump.

Some of the key points that came out of the analysis techniques were evidence of the impeller rubbing against the liner, the coupling flaw was present at the time of manufacture and the river temperature decreased rapidly. Together these items were used to determine the root cause of this event.

CORRECTIVE ACTION

IMMEDIATE ACTIONS

1) The coupling was replaced on the D SW pump by work order 4216375. The lift was reset and the pump was tested and declared operable. (This addresses the condition.)

2) The A, B, and C SW pump lifts were reset by work order numbers 4216875, 4216873 and 4216874. They were tested and declared operable. (This addressed the extent of condition.)

3) Engineering is continuing to monitor river temperatures and other SW parameters to predict when the lift setting needs to be adjusted on the SW pumps. This is part of the SW system trend plan. (This addresses the cause and condition)

INTERIM ACTIONS

1) The Plant Engineering Department Manager will educate the Plant Manager, the Work Control Manager and the Maintenance Manager on the importance of performing SW pump lift adjustments when required. (This addresses the condition.)

LONG TERM ACTIONS

1) None. Additional long term actions are being tracked by RCR 98-0152. (This will address both the condition and cause for the long term).

ENHANCEMENTS

1) None

REFERENCES

1) CNS Vendor Manual 0180 for Service Water Pumps, Materials of Construction

2) *Working Data – Carpenter Stainless Steels,* Carpenter Steel Division, 1973, page 26.

3) *Metal Progress Data Book*, Second Edition, American Society of Metals, page 4, Typical Mechanical Properties of Selected Carbon and Alloy Steels, table I.

4) ASTM A-479, Stainless and Heat-Resisting Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.

5) ASTM A-276, *Stainless and Heat Resisting Steel Bars and Shapes*

6) *Practical Data for Metallurgists,* The Timken Company, May 1977, pages 88-89, hardness conversion chart.

7) Drawing # 2009 – (J-4A)

8) Drawing # 2008 – (J-4B)

9) Drawing # 2007 – (J-4C)

10) Drawing # 2056

11) Drawing # 2C-4747

12) March 28, 1973 – Letter from I. Gabel to (obstructed view) concerning proposed sectionalizing walls in intake structure service bay.

13) April 18, 1973 – Memo from I. Gabel and M. Kushner to Distribution with attached letter listing areas of possible silt build-up.

14) June 13, 1973 – Letter from M. N. Kushner to E.R. Scott, Burns & Roe Inc. – Confirms engineering authorization to run pilot test program on two stage cyclone separators for CNS river water silt.

15) September 24, 1973 – Evaluation of Screen Wash and Sparging Pump Arrangement, prepared by Eric Haemer, Mechanical Engineer, Burns and Roe, Inc. – Discusses various problems noted in the screen wash and sparging systems.

16) September 26, 1973 – Factual data and calculations confirming that pump size CSK 1½ x1-6 successfully passed seismic qualification.

17) November 21, 1973 – Shipping Invoice from CNS to Byron Jackson for 28" KxH-1 stage VCT, S/N-681-11-0441/44, & parts.

18) December 6, 1973 – Letter from E. R. Scott, Director, Generation Projects to E. M. Kuchera, Burns & Roe, Inc. – Discusses diesel generator cooling water strainers.

19) March 12, 1974 – NCR 132 – SW-P-A & SW-P-D and MWR 74-3-102.

20) March 15, 1974 – Letter from L.C. Lessor, Station Superintendent, CNS, to E. Morris Howard, Director, US AEC – Discusses abnormal occurrence at CNS on 3/7/1974.

21) March 18, 1974 – Letter from S. M. Peterson, Site Mechanical Engineer, CNS, to R. P. Lovci – Abnormal occurrence involving service water pumps.

22) March 21, 1974 – Letter form R. P. Lovci, Project Manager, CNS, to Burns and Roe, Inc. – Service Water Pumps.

23) March 28, 1974 – Burns and Roe, Inc. – Record of J. Butz's telephone conversation with A. Acton of Byron Jackson – Discusses W.O. 2978-02 – NPPD/CNS, Service Water Pumps Failure to Rotate and Start.

24) April 11, 1974 – Letter from S. M. Peterson, Site Mechanical Engineer, CNS, to W. G. Conn – Discusses service water pump degradation.

25) April 11, 1974 – Letter from L.C. Lessor, Station Superintendent, CNS, to Irv Gabel – J. Butz's "Record of Telephone Conversation" with A. Acton of Byron Jackson.

26) April 25, 1974 – Letter from Paul B. Davis, Project Engineer, Burns & Roe, Inc. to A. Acton, Byron Jackson Pump Division – Confirms Byron Jackson is studying methods of redesigning service water pumps.

27) April or May, 1974 – Letter from C. P. Noyce to Leo concerning degradation curves.

28) May 9, 1974 – Letter from L. C. Lessor to R. P. Lovci concerning SW and CW pumping systems.

29) May 20, 1974 – Letter from L. C. Lessor to Bill Conn concerning SW pump degradation.

30) June 28, 1974 – Letter from H. A. Swarthout to Sam Peterson concerning Service Water Pumps and W.O. 2593.

31) July 9, 1974 – Letter from A. J. Acton, Sales Engineer, Byron Jackson Pump Division to Paul B. Davis, Burns & Roe, INC. – Discusses binding problem caused by silt build up in the balance wear ring of service water pumps.

32) July 10, 1974 – NCR 317 and Functional Test of Service Water Pumps – less than 6000 gpm at 125' TDH.

33) July 16, 1974 – Letter from Paul B. Davis to R. P. Lovci concerning W.O. 2978-02 – Service Water Pumps Modification.

34) August 8, 1974 – Letter from K. L. Meyer to W. G. Conn and C. R. Noyes about Service Water Pumps.

35) August 9, 1974 – Letter from M. N. Kushner for Paul B. Davis, Project Engineer, Burns and Roe, Inc. to A. J. Acton, Byron Jackson Pump Division – Requests Byron Jackson to investigate feasibility of specific modifications to service water pumps.

36) August 23, 1974 – Memo from M. L. Alexander to L. C. Lessor concerning Service Water Pump Testing.

37) September 5, 1974 – Letter from L. C. Lessor to C. R. Noyes – SW pumps.

38) October 4, 1974 – Letter from L. C. Lesso. to Meeting Attendees – SW booster pump meeting minutes.

39) November 12, 1974 – Operations Manual Procedure Change Notice – Adds "Manually Rotate each idle pump once per shift" to Procedure 2.2.71 Rev. No. 2.

40) December 4, 1974 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to A. J. Acton, Byron Jackson Pump Division – Confirms telecons and requests feedback on service water pump design proposals.

41) December 16, 1974 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to A. J. Acton, Byron Jackson Pump Division – Request for Byron Jackson to review potential effects of design modifications on seismic analysis of service water pumps.

42) February 4, 1975 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to R. P. Lovci, CNS – Discusses stainless steels used to manufacture impellers.

43) March 17, 1975 – Letter from L. C. Lessor to K. L. Meyer concerning SW pumps and SW booster pumps.

44) March 26, 1975 – Letter from L. C. Lessor to Meeting Attendees – SW and SWBP meeting – minutes.

45) March 27, 1975 – Letter from A. J. Acton, Sales Engineer, Byron Jackson Pump Division, to Paul B. Davis, Project Engineer, Burns & Roe, Inc. – Discussion of proposed service water pump modifications.

46) April 16, 1975 – Letter from L. C. Lessor, Station Superintendent, CNS, to John Butz, Burns and Roe, Inc. – Discusses service water pump binding.

47) May 8, 1975 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to R. P. Lovci, CNS – Summarizes and reports the Engineering status and recommendations for PAW list item 0-10 on the service water pump binding problem.

48) July 9, 1975 – Letter from L. C. Lessor to T. G. Hoeman – Service Water Pump Binding.

49) September 9, 1975 – NCR 603 – SW pump 1B was inop on 9-5.

50) December 30, 1975 – Letter from L. C. Lessor to C. R. Noyes – Indicates more than normal binding of SW pumps.

51) December 9, 1980 – MWR 08-0457 – SW-P-A vibrates excessively: overhaul.

52) March 23, 1983 – Operations Manual Procedure Change Notice – Incorporated Special Order 78-5, dealing with shifting the running and standby service water pumps on 0000-0800 shift, in Procedure 2.2.71, Rev 15.

53) December 12, 1986 – MWR 86-4320 – "Overhauled Service Water Pump as needed and replaced expansion boot."

54) April 8, 1987 – MWR 87-0827 – "Disconnect SW-MOT-SWPD electrically, Verified motor grounded at motor, Put motor on, Set lift, and Returned to service."

55) June 26, 1987 – Operations Manual Procedure Change Notice – Changes valve letter designations in Procedure 2.2.71, Rev 20.

56) March 2, 1988 – NCR 87-016 – SW pump motor 1D had a certificate of compliance, not a technical letter report provided with the repaired motor.

57) May 12, 1988 – NCR 88-130 – SW pump A failed to run during surveillance testing for post maintenance testing.

58) December 20, 1988 – NCR 88-230 – SW-P-A failed to start twice.

59) December 20, 1988 – MWR, WI.No 88-4941 – SW-P-A.

60) December 28, 1988 – Letter from R. A. Schultz to J. L. Peaslee – SW-P-A Reference Values and Acceptance Criteria.

61) January 23, 1989 – Record of phone conversation between J. D. Dykstra, CNS, and Jim Mokri, G.E. – SW-P-A motor vibration data.

62) January 25, 1989 – Letter from J. D. Dykstra, Electrical/I&C Engineer to J. R. Flaherty – Trip Report, January 16, 1988, for Service Water Pump Motor Failure.

63) May 19, 1989 – Procedure change notice – Changes mode selector from Pull-to-Lock to Manual in Procedure 2.2.71, Rev 25.

64) August 14, 1989 – Letter from J. M. Meacham, Sr. Manager, Operations, to D. J. Brager, Services Project Manager, GE – Authorization for a Task 156 Item for CE to review vibration data and operating history on SW pump motor A.

65) February 12, 1993 – Procedure Change Notice – Changes operating configuration of service water gland water systems and other service water changes in Procedure 2.2.71, Rev 34.

66) November 6, 1993 – DR 93-438 and evaluation / corrective action – Service Water Pump lift adjustment settings.

67) November 30, 1993 – VMCF 93-350 – Change to vendor manual 0180 replacing initial release and change record page 681-H-0441/4.

68) February 25, 1994 – Closure of DR 93-438 – Service water pump lift adjustment settings.

69) March 1, 1994 – VMCF 94-093 – Change to vendor manual 0180 with revised instruction manual pages affecting SW-P-A, B, C, D.

70) August 7, 1994 – Temporary Procedure Change Notice – Station Operators Tour – Procedure 0.4.2 – no longer necessary to rotate all SWBPs.

71) August 7, 1994 – Temporary Procedure change notice to 2.2.71 – shift SW pumps once per 12-hr. shift.

72) February 28, 1995 – Procedure Change Notice – changes procedure # 2.2.71 by changing reference for low river level effects.

73) June 29, 2000 – CNS Operations Manual System Operating Procedure 2.2.71 – Service Water System.

74) September 28, 2000 – CNS Operations Manual System Operating Procedure 2.1.11 – Station Operators Tour.

75) December 21, 2000 – CNS Operations Manual System Operating Procedure 2.1.12 – Control Room Data.

76) December 21, 2000 – CNS Operations Manual System Operating Procedure 2.2.3.1 – Traveling Screen, Screen Wash, and Sparger System.

77) February 1, 2001 – CNS Operations Manual System Operating Procedure 2.1.11 – Station Operators Tour.

78) February 13, 2001 – Failure Report with Unit Information – SURRY 2 – 2-SW-P-10B.

79) February 13, 2001 – Two of three safety-related river water pumps made inoperable by change to seal water supply – 334, Beaver Valley 1.

80) February 13, 2001 – Failure Report with Unit Information – SW-P-A.

81) February 13, 2001 – E-mail from Dwight J. Vorpahl, Jr. to Dwight J. Vorpahl, Jr. – OE 10760 – (Update to OE 10671) BVPS-1 B and C River Water Pumps Tripped on Overcurrent During Pump Starts.

82) *Cooper Intake Performance of Sparging System.*

83) February 7, 2001 – Laboratory Report, "Specific Gravity and Porosity Measurements of Sediment from Near the Plant Intake and Sediment in the Service Water Booster Pump Sub-System" – Randall Noon.

84) Work Order 4216375

CWIT search printouts producing the above references.

ATTACHMENTS

1) Report by Rail Sciences, Inc., dated December 27, 2001, by Hans Iwand, P.E., *Failure Analysis of Pump Shaft Coupling for NPPD*
2) February 20, 2001 – Report titled, "Evaluation of SW Pump Rotation Frequency" – Dwight Vorpahl
3) Work Order 4216374
4) Notification 10132527
5) SAP screen print of work order 4216875
6) SAP screen print of work order 4216873
7) SAP screen print of work order 4216874
8) SAP screen print of work order 4216375

EVALUATION OF SW PUMP ROTATION FREQUENCY

PED-BOP GROUP

Dwight Vorpahl – SW System Engineer
Bob Thacker – PED-BOP Supervisor

February 20, 2001

PROBLEM

The four SW pumps are currently rotated every twelve hours per System Operating Procedure 2.2.71, "Service Water System", rev 47 and System Operating Procedure 2.1.12, "Control Room Data", rev 10. The Service Water (SW) pumps are rotated every twelve hours to allegedly remove silt and sand from the suction area of the SW pumps. It has been historically been thought that this will ensure that large accumulations of silt and sand do not cause the pump to bind upon startup. These frequent starts/stops of the SW pumps causes additional stress on the pumps, additional operator burdens and additional/unnecessary administrative LCO's which are taken when rotating pumps. This LCO is taken due to the selector switch for the SW pumps being placed in manual vs auto to eliminate the potential for the SW pump in auto to either auto start on low pressure or trip on high pressure.

This evaluation is being written to determine the effects of silt and sand in the SW pump bay and its affect on the ability of the SW pumps to start when required. An evaluation will also be made as to the cause of the pump binding incidents that have occurred in the past. This evaluation will take into account historical information on the performance of the SW pumps, sparger system, design information on the SW pumps and industry experience related to this issue. This information will then be used to determine the true cause of the past incidents of pump binding and will determine if the rotation frequency for the SW pumps can be relaxed.

DISCUSSION

DESIGN AND OPERATION OF THE SW PUMPS

Figure 1 shows the layout of the SW pump and motor. The suction of the SW pump is approximately 46 feet below the bottom of the SW pump motor and the suction of the SW pump is approximately 22" above the bottom of the pump bay.

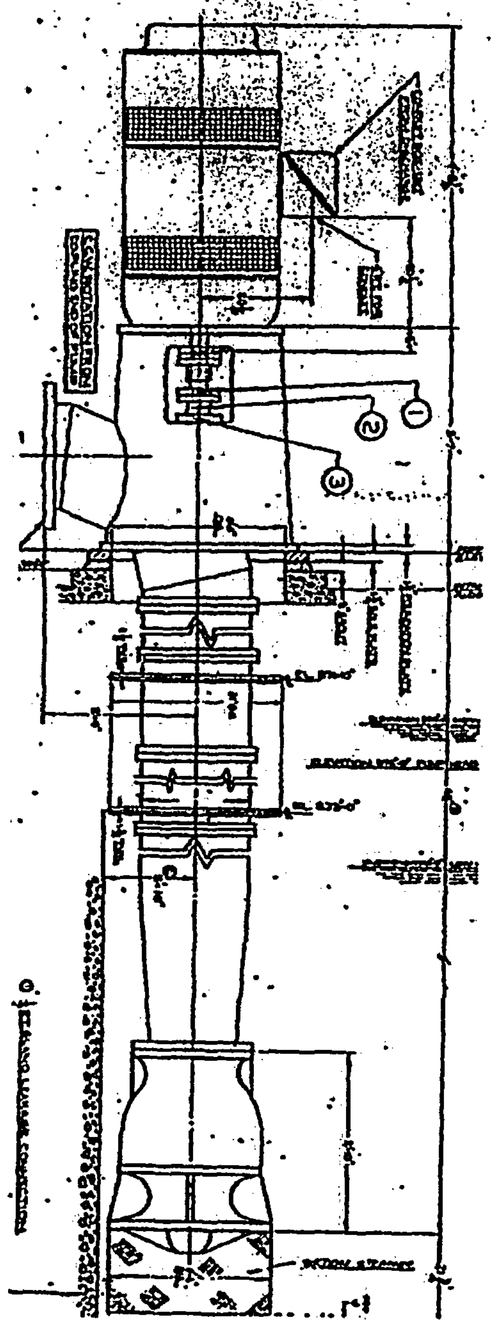


FIGURE 1

The SW pumps normally operate with an injection supp'y of gland water from the riverwell water system. This water source is injected in the stuffing box gland. Part of this water lubricates the packing and is discharged out of the pump packing to the environment, which then flows into the discharge elbow casing and through a hole back down into the pump bay. The rest of this water flows down the shaft in the enclosing tube (which encapsulates the pump shaft) lubricating the lineshaft bearings. The water then exits the top case bearing (top of the impeller see figure 2 item #12) and exists into the hollow chamber above the impeller. From here the water exits from the area between the top edge radius area of the impeller (figure 2 item #2) and the wear ring (figure 2 item 6), where it mixes with the pumped fluid. This gland water will flush any water out of the impeller/wear ring area when the pump is idle.

The stainless steel open style impeller of this pump matches the contour of the impeller liner (figure 2 item #9). The impeller is designed to be able to be raised above the impeller liner to allow for shaft stretch and for increasing or decreasing performance. As the impeller is raised, the impeller lift increases, which increases the dimension between the impeller and impeller liner. Increasing the lift decreases the pumps performance due to increased recirculation of the pumped fluid. This lift setting can be adjusted from 0.000" to approximately 0.500". At 0.000" the impeller is touching the liner, and in actuality would bind upon pump startup due to downthrust causing the shaft to stretch ,forcing it to rub against the liner. (explained in detail in following paragraphs). At 0.500" the top of the impeller comes in contact with the bowl of the pump.

The original lift setting specified by the pump manufacturer, Byron Jackson, was 0.021". The lift is set under a static condition (pumps off and water in column only up to river elevation). This recommended lift setting was changed by Byron Jackson in 1993 to be greater than 0.056". The reason for this change was due to shaft elongation resulting from the downthrust of the impeller pushing up on the column of pumped water. This stretch was determined to be 0.030" at 6000 gpm and 0.039" at shutoff (0 pumped flow).

These pumps are also exposed to another phenomena that will cause the lift to change on these style of pumps. This is caused by differential expansion of the impeller shaft and the pump outer column based on changes in the river water temperature and riverwell water temperature. As the river warms up this creates the lift to increase due to the shaft expanding a lower rate than the column and as the river cools down vice versa. The riverwater supply to the lineshaft bearings also plays a role but to a lesser degree. Based on design river water temperatures of 32 deg F to 90 deg F, the lift can vary up to 0.060" due to thermal expansion

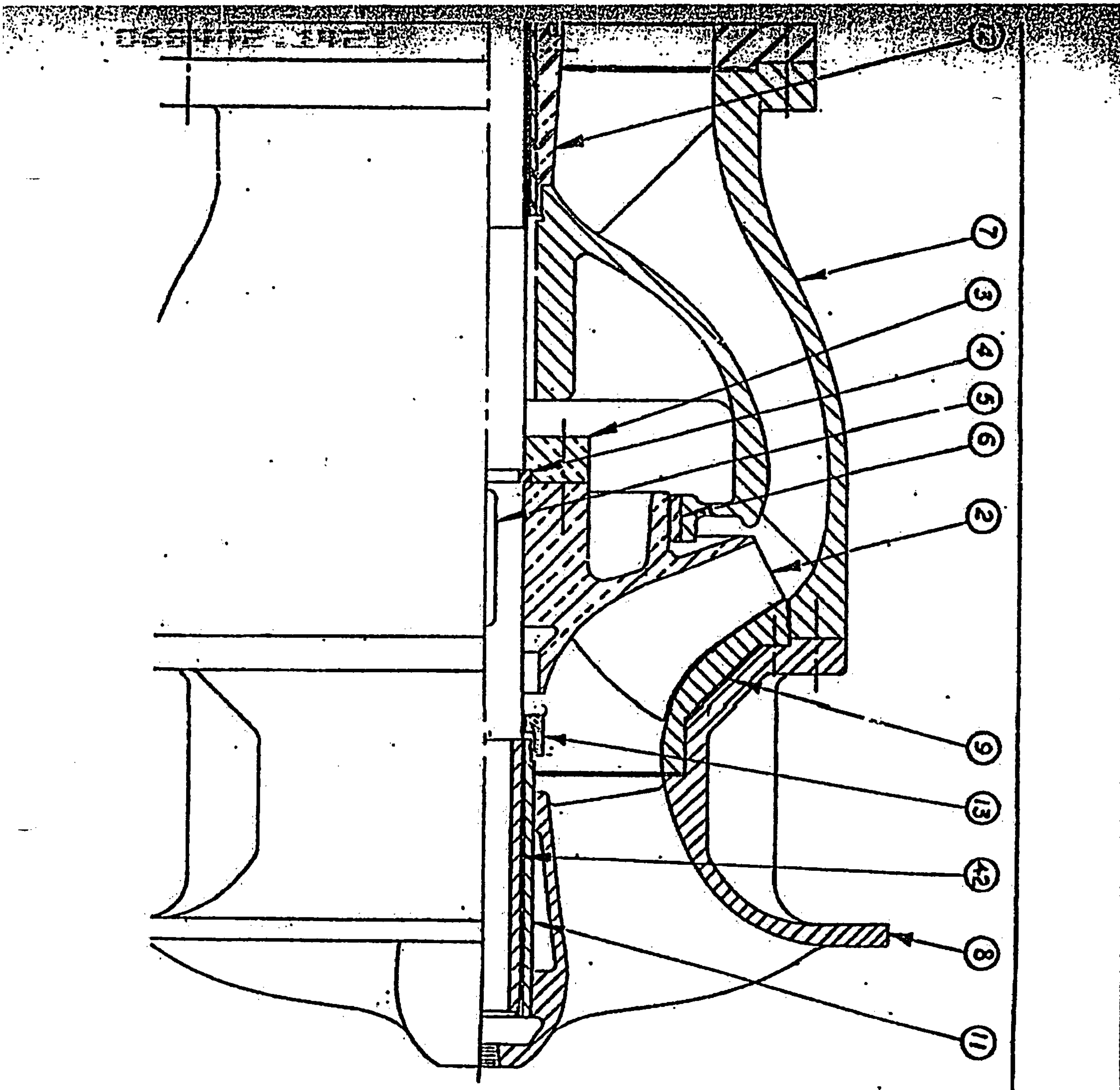


FIGURE 2

If the pumps were set at a lift of 0.021" and the shaft stretch is at least 0.030" from downthrust alon when the pump is started, it can easily be seen that the impeller will contact the liner. This is not even taking into account the effects the river temperature changes have on the impeller and liner clearance area. Both of these materials (impeller and liner) are stainless steel and rubbing of these two materials together under high speeds (1180 rpm) will produce galling of the surfaces. This could lead to pump binding and/or shaft breakage.

Figure 3 is from a recent SW pump bowl assembly after being replaced. The galling in the liner and at the impeller vane tips from rubbing can be easily seen and is typical of all of the SW pump bowl assemblies that are replaced.

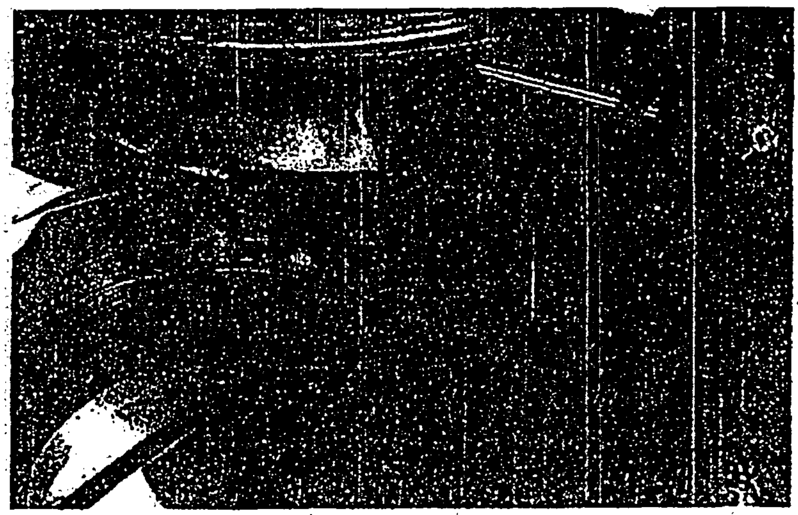


FIGURE 3

These problems with this type of pump are common in the industry and have come to light in the early 90's. Many utilities are still struggling to deal with these seasonal changes in pump lift.

DESIGN AND OPERATION OF THE E B.'.Y (SW PUMP BAY)

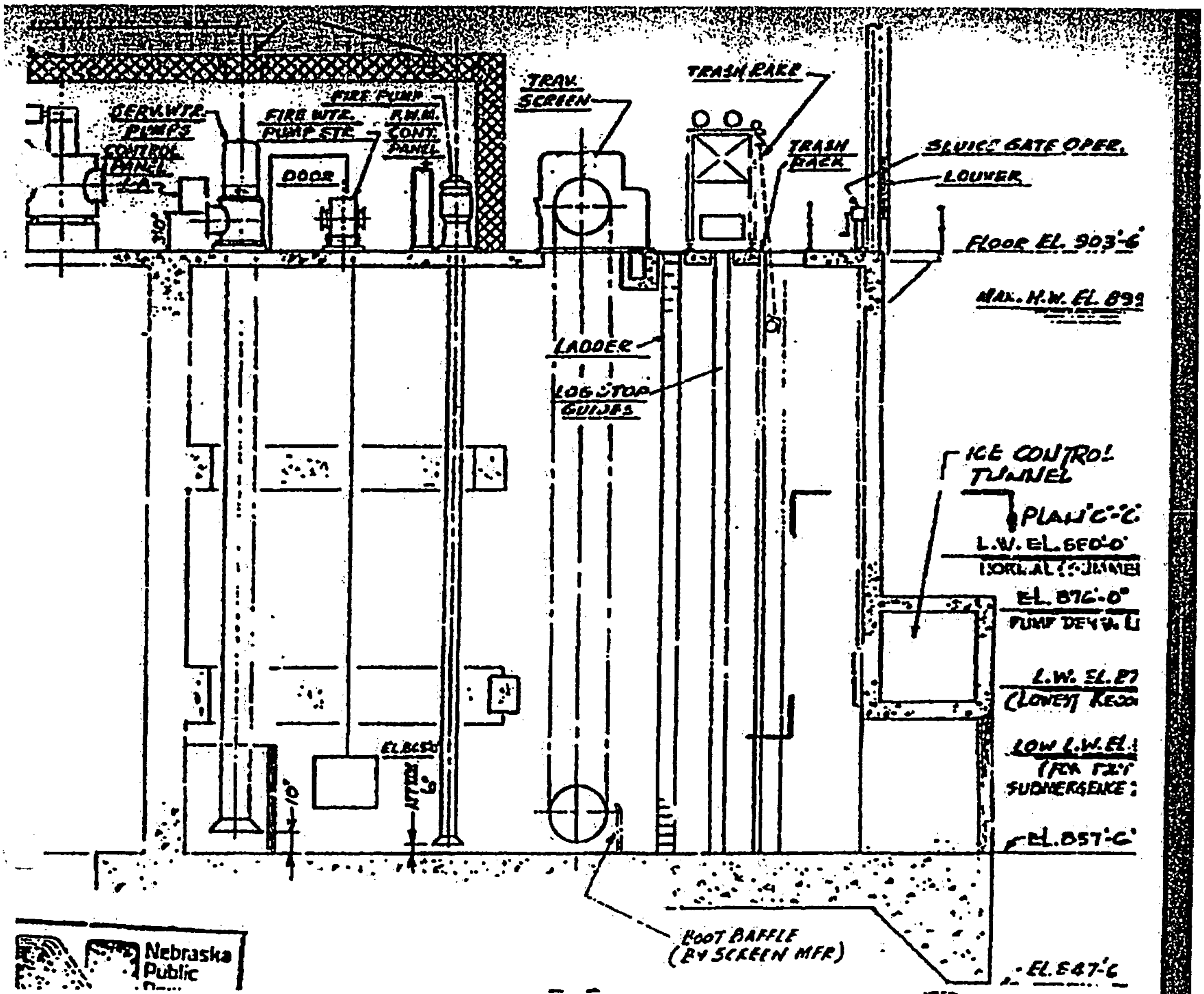
A guide wall, known as the weir wall, has been constructed in front of the Intake Structure to reduce sediment buildup in the Intake Structure. The primary purpose of the weir wall is to reduce the sediment input to the Intake Structure by forcing bed load and other material contained at lower elevations in the river to flow past the intake to a point where inflow to the intake will not influence river behavior. The upper elevations of the river containing relatively finer sediment flow over the submerged weir. A model study[2] indicated a potential reduction of as much as 75% in the amount of sediment to be carried into the Intake Structure with the weir wall installed.

A reinforced concrete intake structure is constructed at the river bank. The operating floor of the structure, on which the Service Water pumps are mounted is at Elevation 903.5 feet. The bottom elevation of the SW pump bay is 857.5 feet. (see figure 4)

The shape of the SW pump bay can be described as follows; Where the water enters the bay it necks down to nine feet, eight inches wide at the area where the trash racks and travelling screens are. The bay then widens out approximately 16' upstream of the SW pumps. (see figure 5)

The spray wash assembly and/or the traveling screens may be turned off for short periods of time (seven days) to perform maintenance. Silting has been evaluated and determined not to be a problem for these short periods of time. In addition to the above, flow, pressure and temperature data from the critical heat exchangers is periodically analyzed to detect any trends that could occur as a result of silt accumulation per Generic Letter 89-13.

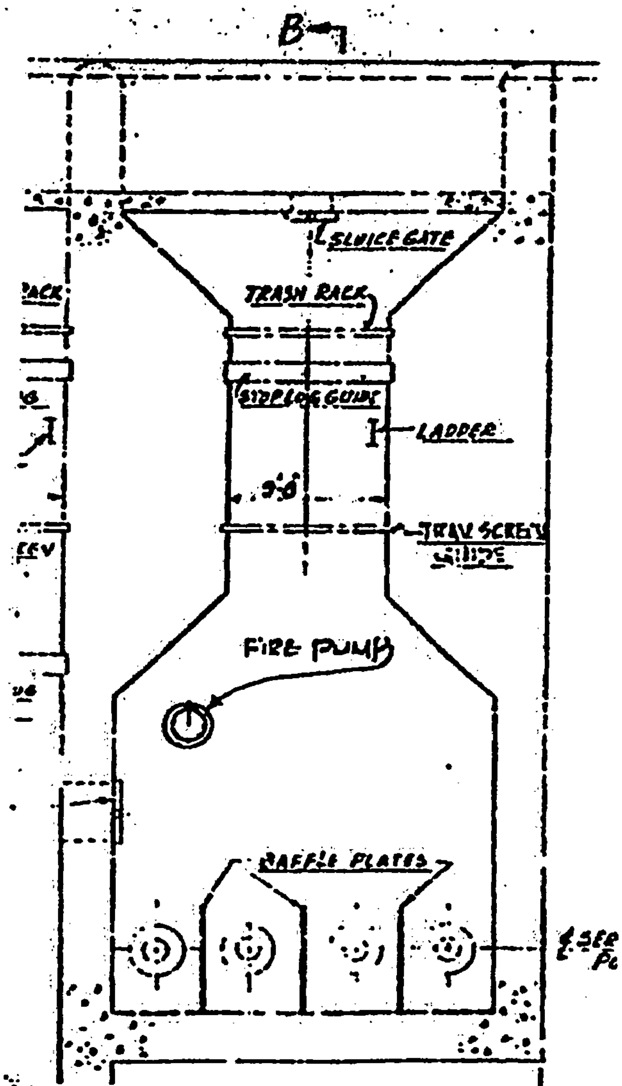
Silt accumulation in the entrance and interior of the intake is controlled by the following: A water jet sparging system is installed near the bottom of the Intake Structure to agitate the silt and keep it in suspension, thus preventing its settling out. The sparging system consists of five rows of high pressure water spray nozzles in the SW bay. Each set is approximately 1 foot off the floor of the pump bay. Figure 6 shows one set of spargers, J4-C which are the closest to the SW pumps. Sparger jet J-3 is installed within the traveling screens to keep the screen boot area free of silt buildup. The above-mentioned principal operating jet J-3 is utilized on an automatic sequential schedule. J-2 header is used to clear the guides for the screens when they are replaced following maintenance. SW bay jets J-4A agitate silt 1.5 feet upstream of the centerline of the Fire Pumps where the bay expands. Sparger jet J-4B agitate silt 3.5 feet downstream of the Fire Pump, yet upstream of the SW pumps. Sparger jets J-4C are installed approximately 3 to 6 inches upstream of the SW pumps.



SERV. WTR. PUMPS
FIRE WTR. PUMP STR.
FIRE PUMP
DOOR
TRAV. SCREEN
TRASH RAKE
TRASH RACK
SLUICE GATE OPER.
LOUVER
FLOOR EL. 903'-6"
LADDER
LOG STOP GUIDES
ICE CONTROL TUNNEL
EL. 876'-0"
EL. 857'-6"
BOOT BAFFLE (BY SCREEN MFR)
EL. 847'-6"
Nebraska Public

FIGURE 4

RIVER



SW PUMPS

FIGURE 5

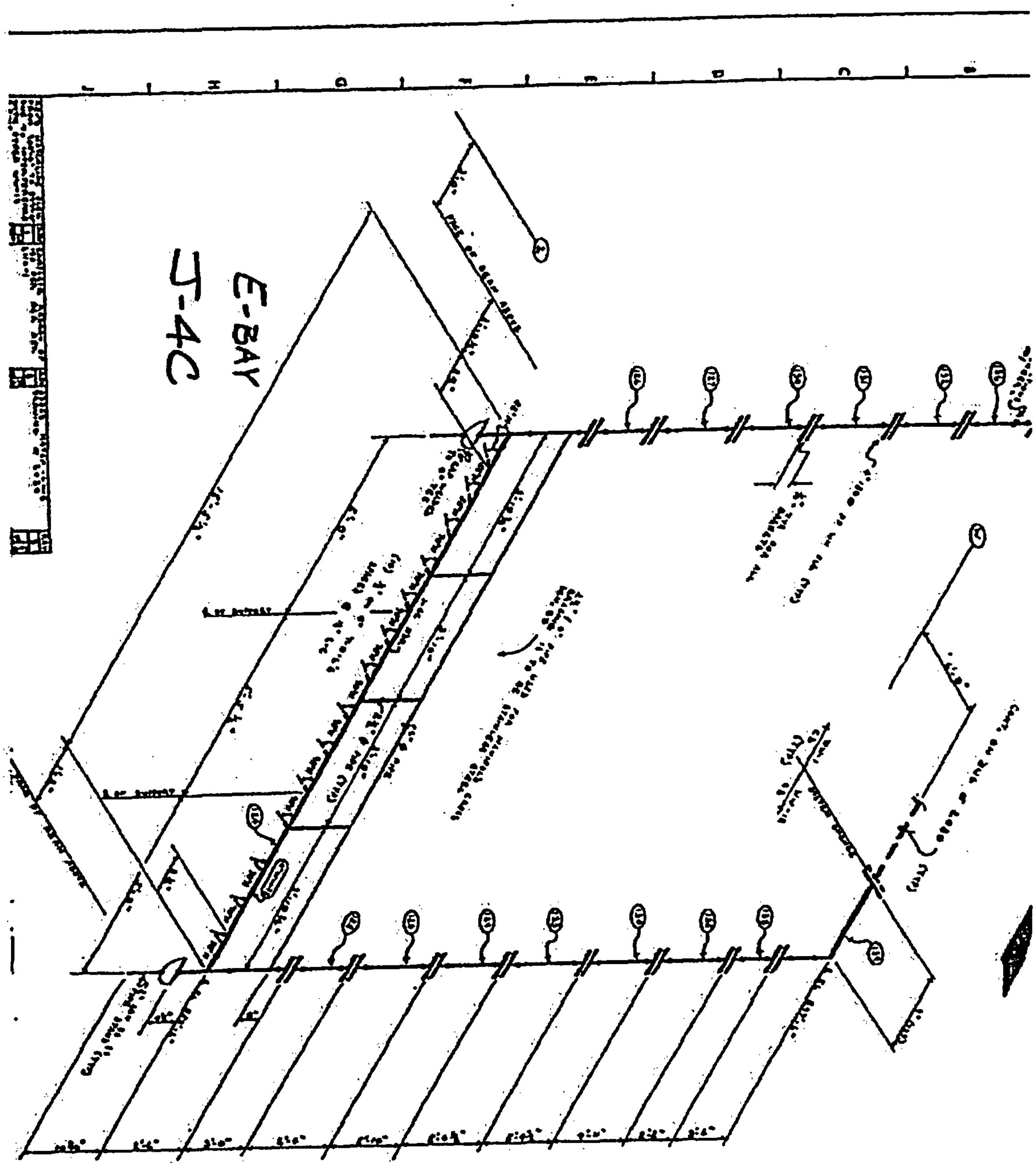


FIGURE 6

HISTORICAL REVIEW OF PROBLEM

A review of the unidata database was performed on this subject and many operations personnel were interviewed including individuals with many years of Cooper Nuclear Station experience. The referenced documents that were identified as being related to this issue via the unidata search were reviewed and referenced.

These documents center around significant issues of silt entrainment in the SW and CW pump bays and in the systems themselves from the Missouri River. Most of these documents were from the early 1970's timeframe.

This review did not show any documented cases of significant amounts of silt directly in front of the SW pumps. This review did identify 4 previous instances of SW pump binding but the details of these events are lacking. These events all incorrectly classified the failure of the pumps as being silt related as opposed to galling from contact with the impeller and wear ring. Although, it was noted several times, just as passing thoughts, that impeller, wear ring contact could have been the cause of some of these failures.

These four events are:

- The first two events occurred on 3/7/94 (reference 14). At appproximately 0210 hours on 3-7-74, SW pump D failed to start during routine pump switching operations. The pump motor breaker tripped on overload, and the pump shaft was not observed to rotate. Subsequently, while performing surveillance procedure 6.3.18.1 as required by Technical Specifications, section 4.11.C.2, SW pump "A" failed to start. With observations identical to those on SW pump D, neither pump could be rotated by hand. An orderly reactor shutdown was commenced as required by section 3.11.C.3 of the technical specifications. All control rods were inserted and the reactor mode switch was placed in "shutdown" at 1134 hours on 3-7-74.

  The apparent cause was determined to be higher than normal silt concentrations being experienced adjacent to the intake structure due to weir wall construction upstream, and because of this, sand had infiltrated into the wear rings of these pumps. The spargers were operational at this time. SW pump D had been shut down for a period of approximately 52 hours and SW pump A for approximately 34 hours. SW pump A was freed and placed into service at approximately 1130 hours on 3-7-74 and SW pump D was freed and placed into service at approximately 1600 hours on 3-7-74. The pumps were freed by simply uncoupling the motor from the shaft, which essentially raised the impeller lift setting, and recoupling the motor.

  Corrective actions were to change operational procedures (approved by the Byron Jackson service representative) which was to alleviate this particular problem until the weir wall was completed. At the time it was believed that the buildup of sand in the pump wear rings was a function of river silt concentration and the length of time that the pump remains idle. Corrective actions were to run two SW pumps in one loop and one pump in the remaining loop continuously with routine manual rotation of the idle pump to assure that the impeller was free to rotate. This procedure change was to ensure maximum availability of all SW pumps.

- The third event occurred on 3/2/87 (reference 48). Upon startup of SW pump D, blue smoke came out of the motor. Prior to the pump start, it was rotated with a pipe wrench and was difficult to rotate at first but was rotating freely before attempting to start it. When it was started the shaft was observed to rotate and a ground alarm on breaker 1BG was received and the motor tripped. NCR 87-016 was written and documented the cause of this failure to be silt in the wear rings.

- The fourth event was the failure of the A SW pump motor in December 1988. The inspection report by GE (reference 52-56) indicated several problems with the motor. The rotor was removed and inspected. It was found that the motor shaft was twisted and bent, most noticeably near the lower end. The upper and lower shaft keyways were out of line by approximately five degrees. Also, a fault occurred in a motor coil midway through the stator. The top coil in the slot had burned completely through, and the bottom coil was also damaged. Damage to the stator iron next to the fault also occurred.

  The conclusion as to the cause of the failure is that age-related insulation breakdown contributed to the fault, which occurred at the weakest insulation point in the windings. Loading problems on the motor are also considered to have been present because of the mechanical condition of the rotor high vibration readings for the motor immediately prior to the failure. It was determined that these two items were probably unrelated. A recommendation was also made to inspect the A SW pump and motor for possible impeller or shaft damage.

  Once again it was thought that silting in the wear ring clearance areas was the cause of this failure.

During the timeframe of these events, the pump lift setting was always specified to be in the 0.021" range and review of these work packages confirm this value. It should also be pointed out that all of these events occurred even after performing frequent rotations of the pumps and no failures occurred after adjusting the lift setting on the SW pumps to 0.056" in 1993. The lack of understanding of the real issue has caused many operational changes to the SW pump starting frequency overburdening the operating staff and the operations procedures group. I

The timeline of these changes to Procedure 2.2.71, "Service Water System" and justification for each change is identified below and in the references.

- 1974, based on suspected SW pump binding problems and input from Byron Jackson, pump rotation by hand using a wrench was initiated every 4 hours.

- Procedure 2.2.71, Rev 2, added a requirement to manually rotate the SW pumps once per 8 hour shift (circa 1975).

- Procedure 2.2.71, Rev 15, per standing order 78-5, shift running and standby SW pumps each 8 hour shift (4/83).

- Procedure 2.2.71, Rev 20, per nonconformance report 87-004 (smoked SW motor due to bound pump caused by heavy silting) added a requirement to manually rotate each SW pump before each non-automatic start (7/87).

- Procedure 2.2.71, Rev 25, standardized method of rotating idle pumps daily (7/89)

- Procedure 2.2.71, Rev 34, instituted 12 hour pump rotation to be consistent with procedure 2.1.11, "Station Operations Tour" and management direction (8/94).

- Procedure 2.2.71, Rev 36, deleted manual rotation requirements.

- Procedure 2.2.71, Rev 45, added a specific section providing guidance for performing the pump rotations.

Testing of siltation in the SW pump bays with and without the sparger systems in 1973 was also reviewed (reference 76).

A test to determine siltation levels in the E bay was performed operating only the A and C SW pumps between October 5 and 12, 1973. During this period of time the travelling screens and spargers were secured, the sluice gate between bays D and E was open and the spargers and screens in bay D were off. During the test, river levels and condition were recorded. During this period of time the river level varied between 881.5' to 890.5' (emergency flood procedure entered at elevation 895') and river condition was described as muddy to very muddy at the higher river level. The muddy condition described at the higher river level is as expected due to the known increase in suspended solids with increased river level and velocity, which also results in conservative test results.

The following conclusions were reached from these events:

- With the two SW pumps running, the area around the SW pumps and fire pumps remained almost entirely free of sediment, except for small lumps near the side walls.

- The sediment deposition in other areas gradually increased during the test period of a week as follows:

  From 2' 6" to 9' 6" at the trash racks
  From 2' 6" to 7" 0" in front of the travelling screen
  From 2' 6" to 5' 0" behind the travelling screens

- After this test the bay was easily cleared of silt by putting the spargers J1, J2 and J3 on with low pressure water (30 psig). However, high dps were experienced across the SW pump discharge strainers due to the spargers lifting sediment into the waterway to be carried into the pumps and strainers.

Silt accumulating in the area between the top side of the impeller and wear ring to the extent that the pump could not start is just not feasible considering the amount of force applied to the shaft when the motor starts. Silt would have to be completely packed into the whole pump and would have to be dry with no lubrication. The motor shaft would not physically contort from the forces exerted by sand in the wear ring, the sand would give as opposed to metal/metal contact

If the pump was completely packed and encased in silt, the pump would still operate and pump silt. The relatively high amount of porosity in samples taken from the river, which is typical of sand, indicates that when fully saturated, the sand still remains "flowable." In other words, unless a binding agent is added which creates additional cohesion between the individual sand particles (sand is naturally non-cohesive), or unusual compressive forces "squeeze" out the normal amount of porosity, the water which fills the interstices acts as an internal lubricant and keeps the material "fluidized." Such water saturated sand will simply flow in accordance with the usual characteristics of a liquid with a high specific gravity. At saturated conditions, sediment that would be found in the intake bays has a density of about 2.02 and a porosity of about 37%. (reference # 77)

Previous inspections of the pump impellers and the area above the impeller during overhauls have not shown any signs of silt or sand in the wear ring areas. Normal wear is also seen on these surfaces. Normal operation of the gland water supply to the pumps will also flush this area out and keep it free of debris.

Previous inspections of the SW pumps' stainless steel impellers and liners during overhauls do support galling and rubbing between these surfaces. This can be seen by the deep grooves and rolling over of stainless steel material (up to ¼" depth) along the liner and grooving and rolling over of the stainless steel material of the vane tips. (figure # 3)

The issue of thermal expansion differences between the pump shafts and columns causing the impeller lift to change in combination with the downtrust experienced during pump runs is now well understood at Cooper and is being addressed separately. This will ultimately improve the performance of the SW pumps and allow less frequent maintenance to be performed.

Current actions in place by the SW system engineers for monitoring and setting lift adjustments are in place to preclude binding from impeller/liner contact in the future.

INDUSTRY OPERATING EXPERIENCE

FORT CALHOUN

The SW pumps at Fort Calhoun Nuclear Plant are the same style Byron Jackson pumps that are at Cooper Nuclear Station with the exception that they are two stage pumps and smaller with a shorter shaft length. The water supply for their SW system is also the Missouri River and they do have significant amounts of siltation in the pump bays. The silt is kept in suspension in the bays via a sparger system. They have 4 SW pumps and they take a suction 7" off the bottom of a concrete platform in their bay.

Discussions with the SW system engineer indicate that they have historically swapped their SW pumps once per shift due to potential perceived binding and have overhauled their SW pumps on a 2 year frequency due to perceived wear due to sand erosion. However approximately 3 years ago, they changed the operation of their SW system due to gained knowledge on proper lift settings on the SW pump and the notion that silt in the clearance area between the wear ring and impeller would not cause a SW pump to bind. They now run one to two SW pumps all the time and twice a week start and run their idle SW pumps for a couple of minutes. They do not swap pumps and basically run one pump to failure, prolonging the life on nonoperational pumps.

Since they have changed their operating philosophy, they have not had any degradation in performance on their sacrificial pump in 3 years. Nor have they had any operational problems with operation of the idle SW pumps when started bi-weekly.

BEAVER VALLEY

The SW pumps at Beaver Valley Nuclear are the same style Byron Jackson pumps that are at Cooper Nuclear Station with the exception that they are larger capacity pumps and have a longer shaft length. The water supply for their SW system is the Ohio River which is high in suspended solids also. They do have significant amounts of siltation in the pump bays but do not operate with a sparging system. They have 3 SW pumps and they take a suction 7" off the bottom of their pump bay.

Discussions with the SW system engineer and pump component engineer indicate that they have historically had problems in the past with the lift settings of their pumps affecting performance from river temps, gland water temps and downthrust. They typically run one pump all the time and do not routinely rotate or swap their SW pumps. They do infrequently swap them to equal the run time.

On February 8, 2000 (OE 334-000208-1) 2 of their 3 SW pumps were made inoperable due to an overcurrent trip during start attempts from the control room. The cause of both of these overcurrent trip conditons was due to physical contact between the rotating element (impeller) and the lower casing of the pumps. The cause of this condition was due to differential thermal expansion between the pump shaft and the pump casing. This was caused by injecting an alternate lube water supply which was approximately 30 degrees higher than the normal supply. This in combination with the downthrust upon pump start created the impeller to contact the liner and bind. This event was not attributed to silt binding.

SURRY

On 11/06/87, a SW pump was discovered to be binding and difficult to turn. This was also attributed to binding between the impeller and liner from thermal expansion and downthrust, not silt binding.

ROTATING SW PUMPS VS STARTING AND STOPPING

The four SW pumps each have a selector switch which has three positions; Auto, Manual, or Standby. One of the two SW pumps in each loop is required to be in Auto and the other in Standby. The pump in Auto will autostart (if not running) on a low System pressure of 20 psig and will trip off (if running) at a pressure of 75 psig. The pump in Standby would load shed on a loss of power and be powered from a DG.

Historically it was thought that the running pump should be the pump in Standby as an added measure of conservativism. Since the pump is operating and if a LOOP were to occur, the pump would be assured to start when powered from the DG since it was just running and would not be, as they thought, susceptible to silt binding. Since it is known that the cause is not from silt binding, there should be no requirement to have the selector switch for the running pump in Standby. This will eliminate unncecessary LCO's when swapping pumps, resulting from moving the selector switches for the pumps while rotating.

Also, there is no requirement to rotate the pumps, only to start the pump and run it for a couple of minutes. This will flush any silt around the suction of the pump, where it would then combine with the flow from the other pump in that division directly upstream of the SW strainer. To equal run times on the pumps, the run times, which are currently logged, can be monitored and pumps can be rotated on an infrequent interval.

CONCLUSIONS

This through review has determined that the cause of the previous events of SW pump binding upon startup have been misdiagnosed. The binding is due to galling between the SW pump impeller and liner and not due to silt in the clearance area between the impeller and wear ring.

As a result the requirement to rotate SW pumps on a twelve hour frequency can be relaxed. An appropriate frequency would be seven days. This interval is appropriate based on all of the above discussion and referenced documentation. However, it is recommended that if the sparger system in the E bay was disabled for long durations, more frequent starts of the SW pumps may be necessary during this down time to keep silt levels down in the bay. This will reduce the amount of silt introduced into the SW system up sparger system startup, which could cause higher than normal dp's across the SW strainers for short periods of time.

There is no requirement to rotate the pumps but simply start the idle pump for several minutes before securing it. And there is no basis for keeping the running pumps selector switches in Standby verses Auto.

Prepared by: [signature]
Dwight Vorpahl
Senior SW System Engineer
PED-BOP Group

Approved by: [signature]
Bob Thacker
BOP Supervisor
PED-BOP Group

REFERENCE LIST

1. Drawing # 2009 – (J-4A)

2. Drawing # 2008 – (J-4B)

3. Drawing # 2007 – (J-4C)

4. Drawing # 2056

5. Drawing # 2C-4747

6. March 28, 1973 – Letter from I. Gabel to (obstructed view) concerning proposed sectionalizing walls in intake structure service bay.

7. April 18, 1973 – Memo from I. Gabel and M. Kushner to Distribution with attached letter listing areas of possible silt build-up.

8. June 13, 1973 – Letter from M. N. Kushner to E.R. Scott, Burns & Roe Inc. – Confirms engineering authorization to run pilot test program on two stage cyclone separators for CNS river water silt.

9. September 24, 1973 – Evaluation of Screen Wash and Sparging Pump Arrangement, prepared by Eric Haemer, Mechanical Engineer, Burns and Roe, Inc. – Discusses various problems noted in the screen wash and sparging systems.

10. September 26, 1973 – Factual data and calculations confirming that pump size CSK 1½ x1-6 successfully passed seismic qualification.

11. November 21, 1973 – Shipping Invoice from CNS to Byron Jackson for 28" KxH-1 stage VCT, S/N-681-11-0441/44, & parts.

12. December 6, 1973 – Letter from E. R. Scott, Director, Generation Projects to E. M. Kuchera, Burns & Roe, Inc. – Discusses diesel generator cooling water strainers.

13. March 12, 1974 – NCR 132 – SW-P-A & SW-P-D and MWR 74-3-102.

14. March 15, 1974 – Letter from L.C. Lessor, Station Superintendent, CNS, to E. Morris Howard, Director, US AEC – Discusses abnormal occurrence at CNS on 3/7/1974.

15. March 18, 1974 – Letter from S. M. Peterson, Site Mechanical Engineer, CNS, to R. P. Lovci – Abnormal occurrence involving service water pumps.

16. March 21, 1974 – Letter form R. P. Lovci, Project Manager, CNS, to Burns and Roe, Inc. – Service Water Pumps.

17. March 28, 1974 – Burns and Roe, Inc. – Record of J. Butz's telephone conversation with A. Acton of Byron Jackson – Discusses W.O. 2978-02 – NPPD/CNS, Service Water Pumps Failure to Rotate and Start.

18. April 11, 1974 – Letter from S. M. Peterson, Site Mechanical Engineer, CNS, to W. G. Conn – Discusses service water pump degradation.

19. April 11, 1974 – Letter from L.C. Lessor, Station Superintendent, CNS, to Irv Gabel – J. Butz's "Record of Telephone Conversation" with A. Acton of Byron Jackson.

20. April 25, 1974 – Letter from Paul B. Davis, Project Engineer, Burns & Roe, Inc. to A. Acton, Byron Jackson Pump Division – Confirms Byron Jackson is studying methods of redesigning service water pumps.

21. April or May, 1974 – Letter from C. P. Noyce to Leo concerning degradation curves.

22. May 9, 1974 – Letter from L. C. Lessor to R. P. Lovci concerning SW and CW pumping systems.

23. May 20, 1974 – Letter from L. C. Lessor to Bill Conn concerning SW pump degradation.

24. June 28, 1974 – Letter from H. A. Swarthout to Sam Peterson concerning Service Water Pumps and W.O. 2593.

25. July 9, 1974 – Letter from A. J. Acton, Sales Engineer, Byron Jackson Pump Division to Paul B. Davis, Burns & Roe, INC. – Discusses binding problem caused by silt build up in the balance wear ring of service water pumps.

26. July 10, 1974 – NCR 317 and Functional Test of Service Water Pumps – less than 6000 gpm at 125' TDH.

27. July 16, 1974 – Letter from Paul B. Davis to R. P. Lovci concerning W.O. 2978-02 – Service Water Pumps Modification.

28. August 8, 1974 – Letter from K. L. Meyer to W. G. Conn and C. R. Noyes about Service Water Pumps.

29. August 9, 1974 – Letter from M. N. Kushner for Paul B. Davis, Project Engineer, Burns and Roe, Inc. to A. J. Acton, Byron Jackson Pump Division – Requests

Byron Jackson to investigate feasibility of specific modifications to service water pumps.

30. August 23, 1974 – Memo from M. L. Alexander to L. C. Lessor concerning Service Water Pump Testing.

31. September 5, 1974 – Letter from L. C. Lessor to C. R. Noyes – SW pumps.

32. October 4, 1974 – Letter from L. C. Lessor to Meeting Attendees – SW booster pump meeting minutes.

33. November 12, 1974 – Operations Manual Procedure Change Notice – Adds "Manually Rotate each idle pump once per shift" to Procedure 2.2.71 Rev. No. 2.

34. December 4, 1974 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to A. J. Acton, Byron Jackson Pump Division – Confirms telecons and requests feedback on service water pump design proposals.

35. December 16, 1974 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to A. J. Acton, Byron Jackson Pump Division – Request for Byron Jackson to review potential effects of design modifications on seismic analysis of service water pumps.

36. February 4, 1975 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to R. P. Lovci, CNS – Discusses stainless steels used to manufacture impellers.

37. March 17, 1975 – Letter from L. C. Lessor to K. L. Meyer concerning SW pumps and SW booster pumps.

38. March 26, 1975 – Letter from L. C. Lessor to Meeting Attendees – SW and SWBP meeting – minutes.

39. March 27, 1975 – Letter from A. J. Acton, Sales Engineer, Byron Jackson Pump Division, to Paul B. Davis, Project Engineer, Burns & Roe, Inc. – Discussion of proposed service water pump modifications.

40. April 16, 1975 – Letter from L. C. Lessor, Station Superintendent, CNS, to John Butz, Burns and Roe, Inc. – Discusses service water pump binding.

41. May 8, 1975 – Letter from Paul B. Davis, Project Engineer, Burns and Roe, Inc. to R. P. Lovci, CNS – Summarizes and reports the Engineering status and recommendations for PAW list item 0-10 on the service water pump binding problem.

42. July 9, 1975 – Letter from L. C. Lessor to T. G. Hoeman – Service Water Pump Binding.

43. September 9, 1975 – NCR 603 – SW pump 1B was inop on 9-5.

44. December 30, 1975 – Letter from L. C. Lessor to C. R. Noyes – Indicates more than normal binding of SW pumps.

45. December 9, 1980 – MWR 08-0457 – SW-P-A vibrates excessively: overhaul.

46. March 23, 1983 – Operations Manual Procedure Change Notice – Incorporated Special Order 78-5, dealing with shifting the running and standby service water pumps on 0000-0800 shift, in Procedure 2.2.71, Rev 15.

47. December 12, 1986 – MWR 86-4320 – "Overhauled Service Water Pump as needed and replaced expansion boot."

48. April 8, 1987 – MWR 87-0827 – "Disconnect SW-MOT-SWPD electrically, Verified motor grounded at motor, Put motor on, Set lift, and Returned to service."

49. June 26, 1987 – Operations Manual Procedure Change Notice – Changes valve letter designations in Procedure 2.2.71, Rev 20.

50. March 2, 1988 – NCR 87-016 – SW pump motor 1D had a certificate of compliance, not a technical letter report provided with the repaired motor.

51. May 12, 1988 – NCR 88-130 – SW pump A failed to run during surveillance testing for post maintenance testing.

52. December 20, 1988 – NCR 88-230 – SW-P-A failed to start twice.

53. December 20, 1988 – MWR, WI.No 88-4941 – SW-P-A.

54. December 28, 1988 – Letter from R. A. Schultz to J. L. Peaslee – SW-P-A Reference Values and Acceptance Criteria.

55. January 23, 1989 – Record of phone conversation between J. D. Dykstra, CNS, and Jim Mokri, G.E. – SW-P-A motor vibration data.

56. January 25, 1989 – Letter from J. D. Dykstra, Electrical/I&C Engineer to J. R. Flaherty – Trip Report, January 16, 1988, for Service Water Pump Motor Failure.

57. May 19, 1989 – Procedure change notice – Changes mode selector from Pull-to-Lock to Manual in Procedure 2.2.71, Rev 25.

58. August 14, 1989 – Letter from J. M. Meacham, Sr. Manager, Operations, to D. J. Brager, Services Project Manager, GE – Authorization for a Task 156 Item for CE to review vibration data and operating history on SW pump motor A.

59. February 12, 1993 – Procedure Change Notice – Changes operating configuration of service water gland water systems and other service water changes in Procedure 2.2.71, Rev 34.

60. November 6, 1993 – DR 93-438 and evaluation / corrective action – Service Water Pump lift adjustment settings.

61. November 30, 1993 – VMCF 93-350 – Change to vendor manual 0180 replacing initial release and change record page 681-H-0441/4.

62. February 25, 1994 – Closure of DR 93-438 – Service water pump lift adjustment settings.

63. March 1, 1994 – VMCF 94-093 – Change to vendor manual 0180 with revised instruction manual pages affecting SW-P-A, B, C, D.

64. August 7, 1994 – Temporary Procedure Change Notice – Station Operators Tour – Procedure 0.4.2 – no longer necessary to rotate all SWBPs.

65. August 7, 1994 – Temporary Procedure change notice to 2.2.71 – shift SW pumps once per 12-hr. shift.

66. February 28, 1995 – Procedure Change Notice – changes procedure # 2.2.71 by changing reference for low river level effects.

67. June 29, 2000 – CNS Operations Manual System Operating Procedure 2.2.71 – Service Water System.

68. September 28, 2000 – CNS Operations Manual System Operating Procedure 2.1.11 – Station Operators Tour.

69. December 21, 2000 – CNS Operations Manual System Operating Procedure 2.1.12 – Control Room Data.

70. December 21, 2000 – CNS Operations Manual System Operating Procedure 2.2.3.1 – Traveling Screen, Screen Wash, and Sparger System.

71. February 1, 2001 – CNS Operations Manual System Operating Procedure 2.1.11 – Station Operators Tour.

72. February 13, 2001 – Failure Report with Unit Information – SURRY 2 – 2-SW-P-10B.

73. February 13, 2001 – Two of three safety-related river water pumps made inoperable by change to seal water supply – 334, Beaver Valley 1.

74. February 13, 2001 – Failure Report with Unit Information – SW-P-A.

75. February 13, 2001 – E-mail from Dwight J. Vorpahl, Jr. to Dwight J. Vorpahl, Jr. – OE 10760 – (Update to OE 10671) BVPS-1 B and C River Water Pumps Tripped on Overcurrent During Pump Starts.

76. *Cooper Intake Performance of Sparging System.*

77. February 7, 2001 – Laboratory Report, "Specific Gravity and Porosity Measurements of Sediment from Near the Plant Intake and Sediment in the Service Water Booster Pump Sub-System" – Randall Noon.

CWIT search printouts producing the above references.

Change Corrective Action Program 4216374: Operation Overview

0005		[illegible]	CNS	PM01			[illegible]	20.0	H	1	350	D	Maint.	TECH
0020		NEPM	CNS	PM01					H			H		
0030		NEPM	CNS	PM01					H			H		
0040		NEPM	CNS	PM01					H			H		
0050		NEPM	CNS	PM01					H			H		
0060		NEPM	CNS	PM01					H			H		
0070		NEPM	CNS	PM01					H			H		
0080		NEPM	CNS	PM01					H			H		

Notification: 10132527

Notification	10132527		*Notification type*	CR
Description	SW-P-D STARTED, NO DISCHAPGE PRESSURE			Condition Report
Reported by	DJBROME	11:10:56	*NotifictnDate*	12/26/2001
Start date	12/26/2001		*End date*	01/02/2002
Start time	11:10:56		*End time*	09:10:56
Priority	CM			
FunctLocation	CNS-2-SW-P-D	SWP D		
SORT	SW-P-D			
Equipment				
Order	4216374			
Assembly				
MaintPlanGroup	CNS	Planning Dept	*Tel.*	
Malf. Start Date			*Malf. End date*	
Malf. Start time	00:00:00		*Malf. End time*	00:00:00

12/26/2001 11:20:00 David J. Bromen (DJBROME)

1) Description of Condition: Started D SWP, system pressure did not change and steady state pump amps were 18. Expected response would be an increase in the system pressure with pump running amps at 35-40. Pump discharge pressure was noted to be 1.5 psig prior to and after pump operation.

2) Requirement Not Met: SWP-D did not develope discharge pressure when started.

3) Method of Discovery: Starting SWP-D

4) Immediate Actions Taken: Notify CRS, secure D SWP.

5) Recommendations: Investigate cause.

6) Location of Evidence: SWP-D
12/26/2001 11:38:25 Steven P. Norris (SPNORRI)

1) Immediate Actions Taken: Secured SW pump D

2) Basis For Ops Review: Basis for review N/A for on-shift operations generated notifications.

3) Basis For Classification: RCR-apparent cause # III-C-1 # cause unknown for SW pump D being air bound.

4) Basis For Disp. Department: System engineer responsible for evaluating eauipment performance

5) Apparent Cause: unknown

6) Clarification Comment: Determine cause of SW pump D being air bound and correct as necessary. Perform OD on remaining SW pumps. Modify Standing order 2001-0011 as necessary.

Notification: 10132527

Task REVIEW OPRV INOPERABLE, NARRATIVE LOGS 12-26-01/932
Partner
System Status TSCO

12/26/2001 13:34:28 Andrew R. Ohrablo (AROHRAB)
OPERATIONS REVIEW OF NOTIFICATION

Equipment Identification Section

Affected Equipment/System: SW-P-D

Equipment/System Classification (check all that apply):

[X] TS
[ ] TS SUPPORT
[X] SAFETY-RELATED
[ ] TRM
[ ] ODAM
[ ] PASS.
[X] MRRS
[ ] FHA/APP. R
[ ] SBO
[ ] RG 1.97 CAT 1 or CAT 2
[ ] HELB
[ ] ATWS
[ ] FLDG
[ ] EMERGENCY FACILITY/EQUIPMENT

Operations Review Screening Section

Operations Review of Notification required if any question below is yes:

[X] YES; [ ] NO Any classification above marked and not PLANNED WORK?

[X] YES; [ ] NO Condition may apply to similar equipment, including non-SSC (generic concern/common cause failure)? If YES, document in Comments section below.

[X] YES; [ ] NO Present OPERABILITY concern - includes conditions with an indirect impact on OPERABILITY? Past OPERABILITY concerns should be addressed under the REPORTABILITY question below.

[ ] YES; [X] NO POTENTIALLY REPORTABLE per 10CFR20, 10CFR26.73, 10CFR50.72, 10CFR50.73, or 10CFR73.71? Reportability concerns for past events should be identified below for Licensing review.

[ ] YES; [X] NO Immediate personnel or equipment safety concern not yet adequately addressed. If YES, document in Comments section below.

[ ] YES; [X] NO Plant operational concern, including Reactivity event?

[ ] YES; [X] NO Fitness for Duty issue?

[ ] YES; [X] NO Site Security issue?

[X] YES; [ ] NO Operations Review of Notification required?

Immediate Actions Taken:
DISCUSSIONS WERE HELD WITH MANAGMENT ON ADDRESSING THIS ISSUE.

Comments:
PREVIOUS OD WRITTEN ON SW-P-A, ALL 4 SERVICE WATER PUPMS HAVE A STANDING ORDER THAT THE PUMP IS TO BE STARTED WHEN DISCHARGE PRESSURE OF THE SECURED PUMP REACHES 2 PSIG.

Operability Determination Screening Section

An OD is required if any question below is YES, unless declared INOPERABLE:

[ ] YES; [X] NO Degraded condition of SSCs where functionality is called into question?

[ ] YES; [X] NO Nonconforming conditions affecting SSCs where the qualification is called into question?

[ ] YES; [X] NO Existing but previously unanalyzed condition affecting SSCs?

[ ] YES; [X] NO OD required? If NO, provide BASIS below.

Basis for No OD:
DECLARED INOPERABLE NO OD PER 0.5OPS 3.1.11.5b.

Operability/Reportability Review Section

[ ] YES; [X] NO Risk assessment required? If YES, ensure assessment performed per Procedure 0.49, Schedule Risk Assessment. NOT REQUIRED TO BE OPERABLE IN PRESENT PLANT CONDITIONS.

[X] YES; [ ] NO Previous OD/OE/BCO written for an identical concern? If YES, identify previous OD/OE: 10131419 FOR SW-P-A

[X] YES; [ ] NO OPEN OD/OE File for aggregate effect?

[X] YES; [ ] NO System, Structure, or Component determined to be INOPERABLE?

[ ] YES; [X] NO Safety Function Determination required?

[ ] YES; [X] NO LCO, TLCO, or ODAM Action Statement entered?

Date/Time Entered: 11-26-01/ 09:32
TS/TRM/ODAM LCO Action Statement(s):
LCO Work Order Number:NARRATIVE LOGS

[ ] YES; [X] NO Condition Immediately Reportable per Procedure 2.0.5, Reports to NRC Operations Center?

Report Completed at Date/Time:
Report Number:

[X] YES; [ ] NO SS signature required?

Notification: 10132527

Equipment/System Comments:

Safety Function Determination Comments:

Reportability Comments

Task REVIEW CAP RCR-R/C I.B.1 PED
Partner
System Status TSCO

12/28/2001 09:45:37 Ronnie Deatz (RCDEATZ)
RCR-R/C I.B.1 PED

Task REVIEW SCRN PRI 21 MODE R MWR M-SHOP, CM
Partner
System Status TSCO

Task REVIEW LIC INDETERMINATE
Partner
System Status TSCO

12/27/2001 14:46:21 Coy L. Blair (CLBLAIR)
12/27/01 BY CLBLAIR - REPORTABILITY FOR NOTIFICATION 10132527 IS INDETERMINATE. INFORMATION IN THE NOTIFICATION (AND OTHER REPORTS) RAISES A QUESTION ABOUT THE PAST OPERABILITY OF THE SERVICE WATER PUMPS, BECAUSE THE COUPLING FAILURE MAY REPRESENT A "SINGLE CAUSE THAT COULD HAVE PREVENTED FULFILLMENT OF THE SAFETY FUNCTION OF TRAINS OR CHANNELS IN DIFFERENT SYSTEMS". PER PROCEDURE 0.5.CLSS, THE ACTION OWNER FOR THIS NOTIFICATION, PED, SHALL PROVIDE THE LICENSING DEPARTMENT WITH INFORMATION ON WHICH TO BASE THE REPORTABILITY DETERMINATION WITHIN 14 DAYS OF DISCOVERY, I.E., BY 01/09/02.

Task REVIEW MRUL EXPORT
Partner
System Status TSCO TSSC

Task REVIEW OPRV PREPARE OD
Partner
System Status TSCO

12/29/2001 06:00:14 John R. Myers (JRMYERS) Phone 5624

Notification Number: 10132527

Revision Number: 0

1. Identify affected equipment/system(s): Service Water Pumps (A, B, C, and D).

2. Identify all Safety Functions of affected SSC(s): The system shall continuously provide a supply of cooling water directly to the diesel generator and to the secondary side of the REC heat exchangers and to the RHR service water booster pumps adequate for the requirements under both normal operations and under transient and accident conditions.

The system shall be capable of providing direct cooling to essential REC heat loads following a 7-day post accident time period or after a passive REC failure.

The service water pumps supply cooling water to the systems necessary to achieve and maintain a safe shutdown condition during and following Design Basis Events.

For transient and accident conditions, a SW pump degraded to the minimum allowable must be able to meet the minimum post LOCA flow and RHR SWBP suction head.

References:
USAR Volume IV, Section 8.0, Service Water and RHR Service Water Booster System.
DCD-3, Volume 1, Service Water (SW) and Residual Heat Removal Service Water Booster System.

3. Identify when the Safety Functions of affected SSC(s) are required:

[X] Mode 1
[X] Mode 2
[X] Mode 3
[X] Mode 4
[X] Mode 5 </= 21' above flange
[X] Mode 5 >/= 21' above flange
[X] Fuel movement in Sec Cont
[ ] Core Alterations
[ ] OPDRVs
[X] Other: When supported systems are required operable.

NOTE - Common cause failure analysis of the Emergency Diesel Generator (EDG) in the opposite division shall be performed within 24 hours of an EDG being declared inoperable per Technical Specification LCO 3.8.1. This is not required if Surveillance Testing per Technical Specification SR 3.8.1.2 is performed.

4. Identify potential failure mechanisms, including common mode failure/generic concerns of redundant or similar equipment as a result of the degraded and/or nonconforming condition. Identify commitments or requirements not met.

4.1 Potential failure mechanisms: The pump casing and shaft are manufactured from different materials. These materials expand and contract at different rates with temperature changes of the pumped fluid. As river temperature lowers, the clearance between the impeller and pump bowl lowers. The potential failure mechanism is that when the pump impeller comes in contact with the pump bowl liner, due to inadequate impeller lift (clearance), the pump may not perform its design function. A metallurgical flaw (see NRC Information Notice 93-68) in some couplings make it the weakest link in the pump shaft, which can lead to failures from the increased starting loads caused by the impeller being forced into the bowl.

4.2 Commitments: None.

5. [ ] YES; [X] NO Are any potential failure mechanisms time dependent? Does the condition have the potential to continue to degrade and/or will any potential consequences increase? If so, describe tracking mechanism including procedures and formal processes:

An impeller to bowl clearance change is caused by a temperature change due to the different coefficient of expansion between the pump column and pump shaft. This change is not directly related to time.

6. List potential cumulative effects, if any.

[X] None
[ ] Credit Taken For Alarms
[ ] Interfacing Systems
[ ] Fire Loadings
[ ] Gross ECCS Leakage
[ ] Electrical Load Calculations
[ ] Pipe Support/Hanger
[ ] Electrical Separation
[ ] Operator Actions
[ ] Other:

Comments: None.

7. [X] YES; [ ] NO Impact of this condition on Open OD/OEs reviewed?

Comments: The issue previously identified in Notification 10131419 (air binding) does not impact the condition of this OD (inadequate impeller lift)

8. Technical Basis for OPERABILITY:

On 12/26/01, during an attempted start of Service Water Pump SW-P-D, the motor started but pump parameters indicated the pump was not functioning. An inspection of the pump revealed a failed coupling. Investigation into the coupling determined that it did not conform to the required metallurgical properties. A review of the repair and parts issue records for the other service water pumps could not provide assurance that couplings manufactured in the same time frame were not installed in the other service water pumps. This OD provides a basis for operability of SW pumps A, B, and C with couplings which may contain manufacturing defects similar to the defect found on the D SWP shaft coupling. Couplings on SW-P-D have been replaced.

Additionally, the pump lift must be periodically adjusted to accommodate changes in river temperature. The lift setting procedure does not provide specific requirements related to river temperature. Therefore, the lift settings for all of the pumps are being checked and adjusted for the existing river temperatures to ensure that adequate clearance exists to prevent impeller-bowl interference while not impacting the ability of the pump to meet performance requirements. This OD will provide adequate controls for pump operability until the procedure has been appropriately modified to accommodate changes in river temperature.

Upon visual inspection of pump, SW-P-D, it was determined (as indicated by sharp edged indications on the bowl and impeller) that the impeller had contacted the bowl liner. Investigation indicated this was caused by a temperature decrease in the river temperature from the time the lift to set clearance was last adjusted (12/5) to the time of failure. Each one degree lowering of river temperature results in a clearance reduction of 0.0015 inches. Based on the temperature of the river at the time the lift was adjusted and present river temperature, and elongation of the shaft due to hydraulic loading of the impeller, an interference of up to ~0.016 inches could have existed, or a significant bending load could have been applied to the coupling. When attempting to start pump D, a higher than normal torque was created as a result of the inadequate impeller clearance. This increase in torque caused the weakest link (shaft coupling, see factor 2 below) to fail.

The failure of the coupling was the result of a combination of two circumstances:

Factor 1: Based on visual inspection, the impeller was impinging upon the bowl liner. The resulting friction between the bowl and impeller significantly increased the amount of torque needed to rotate the impeller.

Factor 2: The coupling had a metallurgical flaw as a result of manufacturing and heat treating. This caused the coupling to be the weakest link in the transmission of the higher than normal torque from the motor to the impeller. Consequently, when the pump experienced a higher torque requirement, the coupling failed first.

To ensure operability of the pumps until the couplings can be inspected and those which were improperly manufactured are replaced, it will be necessary to ensure the impeller lifts are properly set to prevent the impeller from contacting the bowl liner. Work orders have been initiated to accomplish this action. The lift for each of the SW pumps has been set per MP 7.2.45, with the lift set at near the minimum procedural limit of .040#, with the river at the lowest expected temperature (~32 degrees F). At this lift setting the impeller will not come in contact with the bowl liner, normal starting torque on the pump will not be exceeded, and therefore reasonable assurance exists that even an incorrectly manufactured coupling will not fail. A temperature of ~32 degrees F is appropriate as the pumps could see this temperature during a transient or accident when de-icing flow is lost.

The pump impeller to bowl clearances can also adversely impact pump performance as the clearances widen (due to rising temperatures). At large clearances, pump efficiency will degrade and the IST performance requirements may not be met. Setting the impeller clearance in the range required by MP 7.2.45 (0.040 to 0.060 inches), will keep the clearances such that pump performance will remain within IST requirements as river temperatures rise. This conclusion is valid for temperatures up to 50 degrees F. It is conceivable that a transient could occur while the plant is in a condenser backwash lineup, and for some period the SW pumps could be required to operate at a temperature above river temperature.

With the above actions to adjust lift complete, and limitations on service water temperature in place, the service water pumps can be considered conditionally operable. An LCO Tracking Order will be initiated to ensure these requirements are observed and tracked.

References: Evaluation of Failure of Service Water Pump D, Rev 1
Maintenance Procedure 7.2.45
WO 4216375 (Pump D)
WO 4216873 (Pump B)
WO 4216874 (Pump C)
WO 4216875 (Pump A)

9. [ ] YES; [X] NO Are interim compensatory actions required? If so, describe actions and tracking mechanism and review Step 13:

N/A

NOTE - Manual operator action cannot be used in place of automatic action for protection of safety limits to justify OPERABILITY.

10. [ ] YES; [X] NO Is manual action being substituted for automatic actions? Is local action being substituted for remote action? If so, describe actions and tracking mechanism and review Step 13:

N/A

11. List or describe any operating modes, plant conditions, or seasonal variations not supported by this OD (i.e., OPERABILITY is CONDITIONAL):

Operability is conditional based on a service water temperature between 30 F and 50 F. (PMIS Points M138 and M137 are the preferred source of data)

The 30 degree F service water temperature will ensure the pump impeller will not come in contact with the bowl liner after the lifts are set.

The 50 degree F service water temperature will ensure that the pump satisfies IST flow requirements.

12. List the mechanism(s) in place to control the condition(s) necessary for CONDITIONAL OPERABILITY (i.e., LCO Tracker, Night Order, procedure change, etc.) and review Steps 13 and 14:

Potential LCO 1002002 has been initiated to track this limitation. 6.LOG.601 or 6.LOG.602 will be utilized to monitor service water (river) temperature.

13. [ ] YES; [X] NO; [ ] N/A Is a 10CFR50.59 Review required for action(s) identified above? Basis (if NO): A 50.59 review is not required due to the proposed interim compensatory actions being supported by current SORC approved procedures.

13.1 [ ] YES; [ ] NO; [X] N/A 10CFR50.59 Evaluation required for implementation?

14. [ ] YES; [X] NO; [ ] N/A Is a Safety Assessment required for the required action(s) identified above? Basis (if NO): A safety assessment is not required due to the proposed interim compensatory actions being supported by current SORC approved procedures.

15. [ ] YES; [ ] NO; [X] N/A OE Required.

OE due from Engineering - Date/Time:

[ ] YES; [X] N/A Engineering Notified.

16. OD Performed By/Date/Time:

Mike Matheson - John Myers / 12-29-01 / 0535

17. OD Accepted - SS/Date/Time:

Task REVIEW OPRV APPROVE OD
Partner
System Status TSCO

Task REVIEW OPRV STATUS OD
Partner
System Status TSCO

12/29/2001 07:29:20 Steve Wheeler (SCWHEEL)
OD/OE STATUS

Notification Number: 10132527

OD/OE Revision Number: 00

Basis for SS Approval for OD Extension Beyond 24 hrs: SW PP D WAS DECLARED INOPERABLE.

[] YES; [X] NO Cumulative Effects.

[] YES; [X] NO Interim Compensatory Action Required.

[] YES; [X] NO Manual Action Substituted for Automatic Action.

[] YES; [X] NO Local Action Substituted for Remote Action.

[] YES; [X] NO Condition has Potential to Degrade Over Time.

[X] YES; [] NO Operability is Conditional.

[] YES; [X] NO OD Awaiting OE.

NOTE - If none of the above are checked YES, the OD/OE may be closed.

OD/OE [] CLOSED

OD/OE [X] OPEN

Actions Required to Allow Closure (if initially open):

IMPLEMENT PROCESS CHANGE TO ASSURE LIFT OF SW PUMPS ARE ADEQUATE TO COMPENSATE FOR RIVER TEMPERATURE CHANGES.

EXIT LCO 1002002.

REMOVE SUPPLEMENTAL RIVER TEMPERATURE MONITORING FROM TECH SPEC LOGS.

[X] YES; [] NO OD/OE Logged in OD/OE Database:

OD/OE Closed (if initially open) based on (provide short explanation):

[] YES; [] NO OD/OE Logged in OD/OE Database:

Task REVIEW OPRV PREPARE OD QUALITY CHECK
Partner
System Status TSCO

12/29/2001 13:07:08 Andrew R. Ohrablo (AROHRAB)
Notification Number: 10132527

Revision Number: 00

OD Quality Criteria:

G = Very Good

A = Adequate

I = Improvement Needed

N = Not Applicable

[N] The OD was completed within 24 hours of the Notification Supervisor review or a justification for exceeding 24 hours is provided.

[A] The OD is correctly characterized as open or closed and the appropriate criteria are referenced.

[A] The conditions required for closing the OD are objective, reasonable, and clearly stated.

[A] The affected equipment is accurately identified.

[A] The safety function of the affected equipment is accurate and complete, and refers to appropriate design and licensing basis requirements. Appropriate references are identified.

[A] When the safety functions are required is accurate and complete.

[A] Potential failure mechanisms are identified. Similar equipment is identified and generic concerns and common mode failures are evaluated.

[A] Cumulative effects (e.g., multiple operator actions, multiple degraded hangers, etc.) are addressed.

[A] The time and operational dependency of the potential failure mechanism and associated consequences is addressed.

[N] Interim compensatory actions, operational restrictions, and/or mode/configuration limits are identified and a tracking mechanism specified (e.g., additional surveillances being required, manual or local operations being necessary, system capability limitations).

[A] The evaluation is logical and can be followed without talking to the Originator.

[A] Assumptions or Engineering judgements made are clearly stated and adequately discussed. Where feasible, the basis for Engineering judgements is quantitative rather than qualitative.

[A] The bases for evaluation logic is clearly stated and references listed.

[A] If used, informal inputs (e.g., telecons, faxes) are identified.

[A] Applicable codes, standards, etc., are referenced where appropriate.

[N] Where actions are required as a basis for operability, the necessary 10CFR50.59 paperwork is attached.

[N] Where actions are required as a basis for operability, the necessary Safety Assessment paperwork is attached.

[N] A date and time are assigned for the OE, if required.

[A] The OD package is well organized, in accordance with procedural requirements, and in a manner that makes it easy for a reviewer to follow and understand.

[X] YES; [] NO OD is Acceptable (No I Areas).

I Areas (Notify Operations Supervisor):

Resolution of I Areas:

Item detail 0001

Text	BULMER,J -CHECKED CAL ON DISCHARGE PRESS
Object part	P PUMP
Damage	
Cause of damage	UNK UNKNOWN
Cause text	BULMER,J -INDICATOR IS INDICATING WITHIN
Assembly	
Error class	

12/26/2001 16:46:02 Jerry W. Bulmer (JWBULME)
BULMER,J -PI IS WITHIN REQUIRED TOLERANCE.

12/26/2001 16:42:42 Jerry W. Bulmer (JWBULME)
BULMER,J -CHECKED CAL ON DISCHARGE PRESSURE INDICATOR SW-DPI-360D PER IAC PROCEDURE 14.28.1. FOUND NO EVIDENCE OF STICKING OR DRAGGING ON INDICATOR. INDICATOR RESPONDED SMOOTHLY THROUGHOUT THE ENTIRE RANGE. THE LOW END (1 PSI) INDICATED LOW (0 PSI, BUT STILL IN TOLERANCE) AND NEAR THE HIGH END, (75 PSI) READ 74.5 PSI, OTHERWISE ALL OTHER TEST POINTS WERE EXACTLY AS EXPECTED. SAT

Notification: 10132527

Item detail 0002

Text

Object part M102 PLANT EVENT

Damage OTH Others not listed or unknown

Cause of damage A408 MAINTENANCE (REPAIR OR REPLACE EQUIPMENT

Cause text PUMP, RE20

Assembly

Error class

Item detail 0003

Text

Object part M000 DISC METH N/A

Damage

Cause of damage

Cause text

Assembly

Error class

Activity PUMPSYS CHK

CHECKED PI CALIBRATION. AS FOUNDS ARE SA

End of report

Display CNS Planned Maintenance 4216875: Central Header

HeaderData | Operations | Components | Costs | Partner | Objects | Add.data | Location | Planning

Person responsible

PlannerGrp	CNS / CNS	Planning Dept
Mn.wk.ctr	MNTSHOPM / CNS	MAINTENANCE SHOP

Notif.		
Costs	982.11	USD
PMActType	008	Perform
SystCond.		
Address	IS-SWP RM	

Dates

OrderStart	12/28/2001 01:27	Priority	Important	
Fin.date	12/31/2001 09:25	Sched Wnd	RE20	CNS REFUELING OUTAGE RE20

Reference object

FunctLoc.	CNS-1-SW-P-A	SWP A
Equipment		
Assembly		

Prints the window's content

SAP

Display CNS Planned Maintenance 4216873: Central Header

Order BM 4216873 SET IMPELLER LIFT PER 7.2/45

Sys.status REL CNF PRT MACM PRC SETC

HeaderData | Operations | Components | Costs | Partner | Objects | Add.data | Location | Planning

Person responsible

PlannerGrp	CNS / CNS	Planning Dept
Mn.wk.ctr	MNTSHOPM / CNS	MAINTENANCE SHOP

Notif.		
Costs	830.11	USD
PMActType	008	Perform
SystCond.		
Address	IS-SWP RM	

Dates

OrderStart	12/28/2001 08:17	Priority	Important	
Fin.date	12/31/2001 13:25	Sched Wnd	RE20	CNS REFUELING OUTAGE RE20

Reference object

FunctLoc.	CNS-2-SW-P-B	SWP B
Equipment		
Assembly		

Prints the window's content

SAP

Display CNS Planned Maintenance 4216874: Central Header

HeaderData | Operations | Components | Costs | Partners | Objects | Add.data | Location | Planning

Person responsible

PlannerGrp	CNS / CNS	Planning Dept
Mn.wk.ctr	MNTSHOPM / CNS	MAINTENANCE SHOP

Notif.		
Costs	668.11	USD
PMActType	006 Perform	
SystCond.		
Address	IS-SWP RM	

Dates

OrderStart	12/28/2001 08:21	Priority	Important	
Fin.date	12/31/2001 13:28	Sched Wnd	RE20	CNS REFUELING OUTAGE RE20

Reference object

FunctLoc.	CNS-1-SW-P-C	SWP C
Equipment		
Assembly		

Prints the window's content

Display CNS Maintenance Order 4216375: Central Header

HeaderData | Operations | Components | Costs | Partner | Objects | Add.data | Location | Planning

SuperOrder 4216374 RCR 2001-1667 #1

Person responsible

PlannerGrp	CNS / CNS	Planning Dept
Mn.wk.ctr	MNTSHOPM / CNS	MAINTENANCE SHOP

Notif.		
Costs	0.00	USD
PMActType	006	Calibrate/Adjust
SystCond.	E	Out of Service
Address	IS-SWP RM	

Dates

OrderStart	12/28/2001 02:00	Priority	Urgent 2	
Fin.date	01/02/2002 13:47	Sched Wnd	RE20	CNS REFUELING OUTAGE RE20

Reference object

FunctLoc.	CNS-2-SW-P-D	SWP D
Equipment		
Assembly		

Prints the window's content

Mitchell, Lisa R.

From: Estrada, Roman M.
Sent: Monday, March 04, 2002 4:56 PM
To: Danny Snyder; Mark Ray; Ronnie Deatz; Donny Anderson; Jacqueline Campbell; Lisa Mitchell
Subject: Upfront Trend coding

As of 3/4/02, the following practices need to occur to support our coding of Notifications:

1) The use of AC-5 and AC-6 will not be used unless it is provided in the apparent or root cause section of the evaluation report when doing coding by the CAP evaluators.

2) All root cause evaluations that are turned in to the NAIT staff will have an upfront coding review prior to completion of processing. THe NAIT staff will use the most available CAP evaluator to get these done in real time space.

3) IF the Notification is going to be a RCR, SCR, or CBOAT and no apparent cause or an unknown cause is provided AND you cannot get an apparent cause from the information provided, the Notification will be returned to get more clarifying information.

This change is a result of the February CAP Trend report which reflects UNKNOWN as the top cause coded item. This is in part our fault for not getting an APPARENT cause code and partly the supervisor's fault for not being held to come up with a cause for the issue.

Mark please update the CAP Guide 1 to reflect this and to add the fact that Jacque is placing an OD code in CAP orders for items that had an OD performed.

ATTACHMENT 3 NAIT FEEDBACK FORM

ACTION ITEM TRACKING STATUS FEEDBACK FORM

CAP ID NUMBER: RCR 2001-1667

CAP ACTION NUMBER: 2

SAP CAP ORDER NUMBER: 4230095

SAP ORDER TYPE: CAP (CAP Order, Tech Support Order)

ASSIGNED DEPARTMENT: NEPM (PED)

ACTION REQUESTED:

RC/EP

[X] Closure [ ] Extension [ ] Action Owner Transfer

[ ] Resp. Transfer [ ] Status Update [ ] Reopen PMActType: ____

(Present Over Due Date: 3/31/02) [ ] (New Over Due Date: / /)

RESPONSE/EXTENSION/TRANSFER JUSTIFICATION:
EXTENSIVE DISCUSSIONS HAVE BEEN HELD WITH THE PLANT MANAGER, MAINTENANCE MANAGER, AND WORK CONTROL MANAGER ON THE IMPORTANCE OF PERFORMING SW PUMP LIFT ADJUSTMENTS WHEN REQUIRED. RECENT PERFORMANCE BY THE ORGANIZATION CONFIRMED THAT THERE IS AN ADEQUATE LEVEL OF UNDERSTANDING OF THE IMPORTANCE OF PERFORMING THE SW PUMP LIFT ADJUSTMENTS IN A TIMELY MANNER.

SAFETY IMPACT/GENERIC IMPLICATIONS: NONE. THIS ACTION IS ADMINISTRATIVE IN NATURE.

SUBMITTED BY: [signature] **DATE:** 3/28/02

RESPONSIBLE MANAGER: [signature] **DATE:** 3/28/02

ENTERED 03/28/02

OTHER REVIEW #1: N/A **DATE:**

OTHER REVIEW #2: N/A **DATE:**

OTHER REVIEW #3: N/A **DATE:**

RECEIVED
MAR 28 2002

CAER 4236530