Flaherty, James R.

(23)

RH-5A27

From: Clark, David P. "Dave"
Sent: Monday, February 16, 2004 10:18 AM
To: Drier, Ralph F.; Cook, David B.; CNS Shift Managers List
Cc: CNS HP Coordinators List; CNS Operations Training List; Flaherty, James R.; Lavigne, Crystal G.; Toline, Bruce C.
Subject: SS04030 Event Review SWS Gland Water Alignment

Importance: High

SS04030 - ER SWS Lineup.doc

Ralph, As required by Procedure 0-CNS-25.

Shift Managers, For use in briefing your folks pending SCR Evaluation.

Dave Cook, As required by Procedure 0-HP-IMPLEMENT. I will also send minutes that Crystal Lavigne wrote up from the event review (used for this document). Per procedure these are provided for inclusion in CAP documentation for the SCR evaluation.

Dave Montgomery, As required by 0-HP-IMPLEMENT.

Jim F., As requested for providing to Scott S.

Dave Clark
x2898

J-26

Snap Shot Assessment

Section One

Title: Event Review – Service Water Valve Lineup
Date: Event Review 2/11/2004 (Submitted 2/15/2004)
Number: SS04030

Section Two

Scope of Snapshot:
Collect data regarding the event involving Service Water Gland Water System B being lined up to Division I. Also identify error precursors and error prevention tools that could have prevented the event (if any). Reference Notification 10295021.

Objective(s):
This review was conducted as an Event Review in accordance with 0-HP-Implement and 0-CNS-25. Event Review held 02/11/2004 with 2 of 3 involved individuals. (The second NLNPO was interviewed by the Shift Manager and excluded from the event review since that NLNPO's part was simply to independently verify release of the clearance order.) The ER reviewed the event and potential corrective actions.

Reviewed error precursors (job site conditions, organizational processes or values, other process/organizational issues) and error prevention tools (work behaviors) that could have prevented the event.

Results:
Event Description:
While performing a valve line-up on the Service Water (SW) Gland Water System, Service Water Gland Water Subsystem 'B' was found lined up to Service Water System 'A'. SW-V-28 was closed and SW-V-1479 and 1480 were open. It appears this lineup was not properly restored following Maintenance on 'B' Zurn Strainer on January 21, 2004.

*Note-No statements were generated from this event because of the timing (occurred three weeks prior).

Sequence of Events:

- On 1/21/2004, the release for clearance order, section SWB-1-4324147 SW-STNR-B was verified at 0910, authorized at 1553, lifted at 1636 and completed at 1658.
  - Both NLNPOs were at prejob brief and felt comfortable they could perform the task.
  - NLNPOs do not recall discussion regarding restoration using 2.2.71. The WCO could not recall briefing the procedure, but stated that was the normal way of doing this (as 2 prejob briefs).
  - Neither NLNPO noted that the front page of the clearance order provided instructions to restore the system using 2.2.71.

- At 1706 on 1/21/04, the following log entry was created:

  "Service Water Zurn strainer has been returned to service and Operable status following strainer cleaning. This restores Service Water subsystem 'B' and DG2 to OPERABLE status. Exited LCO 3.7.2 condition A and LCO 3.8.1 condition B. Closed LCO order TS03-01-SW ZURN STNR WK 04-04.

- On 2/4/04 at 2140 the Control Room received annunciator A-4/D-7, Service Water Strainer High D/P. The Operators verified that the strainer was backwashing and D/P was 2psid and lowering. Following backwash the D/P readily returned to a value of 4psid.

- On 2/8/2004 at 1702 the Control Room received annunciator SW GLAND WTR SUPPLY SYS A TROUBLE, and ANN –ANN-(B-3/E-6), SW GLAND WTR SUPPLY SYS B TROUBLE, Bldg operator reported that the alarms were due to Low Pressure and they were both clear. The following parameters were noted:

A/C Gland water pressure 18#
SWP A Gland water flow 5.4gpm
SWP C Gland water flow 7.8gpm
B/D Gland water pressure 16.5#
SWP B Gland water flow 7.6gpm
SWP D Gland water flow 6.3gpm
No adjustments were made to the system, no other alarm were received, Notification 10294449 written.

- Based on the above alarms, work order 4342773 (a scheduled PM) was moved in the schedule from 2/25/04 to 2/11/04.

- Following a discussion between the Engineering Representative and Operations Manager, the Shift Manager was directed to complete a valve line-up per 2.2.71A "Service Water System Component Checklist" prior to tagging the 'A' Service Water Zurn Strainer for Maintenance.

- Before the lineup was performed, the cross-connect was looked at and appeared to be closed.

- At 0310 on 2/11/04, the valve line-up was completed and the discovery was made that the system was not in the correct configuration.

- At 0340 on 2/11/04, the Service Water System was restored to the normal configuration.

- The Shift Manager took the Non Licensed Nuclear Plant Operator out in the field and showed him the valves that were not in the correct configuration and asked him if he had ever operated the valves and the Non Licensed Nuclear Plant Operator answered no.

- Management was contacted and investigations began.

- At 1700 on 02/11/2004, an Event Review was held.

Error Precursors:

- Pre Job Brief was not adequate. (Procedure 2.2.71 was not briefed AND the brief was conducted early in the shift while the task was not performed until the end of shift.)
- First time performer on this evolution (Newly qualified NLNPO). This was the NLNPO's first time restoring this equipment.
- Procedure 2.2.71 was not taken to field during the restoration.
- Crew had a sense of urgency, imparting Time Pressure. (Crew felt as if this was coming from Crew Management.)
- Incorrect assumptions were made. (NLNPO assumed that the releasing of the Clearance Order would put the system in the configuration that it needed to be in and therefore did not question any further.)
- Procedure 2.2.71 does not contain performed by/verified sign off. (It should be noted that this was not a causal factor for the event since the personnel did not reference the procedure during restoration.)
- The activities to release the clearance order and hang clearance order for fish return line occurred in quick succession near end of shift and were not scheduled activities (i.e., were emergent).
    - Push on fish return line before dark and ice would form (high risk profile job).
    - Consequently schedule was not man-loaded for all the work going on.

Corrective Actions Taken/Recommended:

- Create a placard for the Service Water Gland Water (to indicate if system is cross-tied). (Rec-1: Notification 10295745)
- Revise procedure 2.2.71 to include placard and verifications. (Rec-2: Notification 10295765)

In addition, at the Shift Managers' Meeting on 2/12/2004, this event was discussed. The Operations Manager expressed concern that all crews were not using the same control methods and requested input from the Shift Managers on method to use going forward. The actions below

are for short-term use as error prevention tools and are not being entered in the Corrective Action Program. Use of reverse brief is already covered by procedure and this signifies a restatement and clarification of expectations. The second action is not required by procedure, but is intended to ensure focus is given to each element of restoration separately.

- Reverse brief at end of pre-job brief will be used to demonstrate understanding.
- Make 2 separate SAP confirmation entries (one for release of clearance order and one for restoration of system).

This snapshot assessment will be provided to the root cause team for the SCR evaluation.

Areas for Improvement:

Based on review of the error precursors for this event, the following additional actions are recommended pending completion of the SCR evaluation.

- **Review whether exposure exist with other systems that need placards for cross-connect or abnormal lineups.** (Rec-3: Notification 10295746)

- **Identify any other safety systems where need procedure revision to include independent verification for restoration (and implement process to correct condition if necessary).** (Rec-4: Notification 10295747)

Team Members:
Event Review Team: Quorum was met. [All personnels' work location is CNS.]
K.V. Chambliss, Operations Manager – Chairperson [Team Leader]
D. Montgomery, Site Human Performance Coordinator – Human Performance Representative
S. Minahan, Site Vice President – Senior Management
B. Murphy, Shift Manager – SRO
N. Beger, Control Room Supervisor – SRO
N. Egger, Station Operator – Peer Representative
C. Blair, Licensing – Licensing Representative
D. Tune, Operations Training Superintendent – Training Representative
S. Hoff, Licensed Reactor Operator – NLNPO Mentor
M. Holmes, Operations Training Liaison – Training Representative
J. Weiss, Licensed Reactor Operator – Work Control Operator
C. Carpenter, Station Operator – Non-Licensed Nuclear Plant Operator
K. Perry, Root Cause Team Member – Root Cause Team Representative

E-MAIL THE COMPLETED REPORT TO: Ralph Drier – Performance Analysis Department. Completed reports will be accessible through the Self-Assessment Web Page. Make additional distribution as you see fit.

Additional Distribution:
Shift Manager List
Operations Training List
Dave Cook (SCR Team Leader)
Dave Montgomery (Site Human Performance Coordinator)
Jim Flaherty

Flaherty, James R.

From: Tackett, Michael L.
Sent: Wednesday, February 18, 2004 5:39 PM
To: Seeman, Glen A.; Sutton, Kent E.; Flaherty, James R.
Cc: Chambliss, Kevin V.; Schaible, Mark D.; Holmes, Mark A.; Fleming, Paul V.
Subject: Time Validation of Loss of 125VDC A from 100% Power with SWGW Cross-tied

Time Validation of Loss of 125...

Time validation of a loss of 125A from 100% power with SWGW crosstied with the A side supplying the B side.

Mike Tackett
Operations Supervisor

Time Validation of Loss of 125VDC A from 100% Power with SWGW Cross-tied

Conditions:

- Got permission from CRS to use his new NLO and his RO. I told him why and informed him not to tell his operators anything except to work with me.
- Used newly qualified NLO (qualified ~3 months)
- Used on watch RO. I told him I would be calling him in the future time validating a scenario and he would need to tell me what he would do.
- Informed NLO that we would be performing a time validated scenario and that we would be simulating. He would need to point to anything he would be looking at and I would tell him what he sees. If he would be contacting other people, he would let me know who and what he would ask and I would talk to them.
- Time validation started from the relief crew office.
- I told him initial conditions of Reactor Scram, the Turbine has tripped, a lot of lights are out and the Control Room has just called you and informed you of a SWGW trouble alarm on the B side.
- Time started when he understood.

Timeline

- 1405 – left relief crew office
- 1407 – in SW Pump room (did not run)
- 1407 – asked which alarms were in on SWGW panel
- 1407 – NLO pulled alarm card
- 1408 – NLO verified SW-MO-2129 open
- 1409 – NLO asked values of SWGW pressure and flows. I told him 0.
- 1410 – NLO completed looking for obvious leaks per alarm card.
- 1411 – I called the control room per NLO guidance and told the RO the noted conditions in the SWP room.
- 1412 – RO gave the order to check the lineup back to 2129 and report status.
- 1421 – NLO walked down piping and found SW-V-28 closed (simulated).
- 1422 – I talked to Control Room per NLO guidance and told them I found SW-V-28 closed and that it was the gland water supply from the SW Loop B.
- 1422 – Control Room order was to open the supply valve and check and close the cross connect valves. NLO did not know what valves they were and asked for more guidance.
- 1423 – Guidance from Control Room was to check closed SW-V-1479 and SW-V-1480 and then open SW-V-28. NLO repeated back to me.
- 1425 – SW-V-1479 and 1480 simulated closed
- 1426 – SW-V-28 open, gland water restored.

Scenario presented by Mark Holmes assumed 30 minutes to perform the activity. It took 21 minutes with one of the newest qualified NLOs. A more experience NLO would have done in much quicker due to more familiarity with operating the system. The RO was a senior RO and it may have taken a little more time with a new RO, but the new RO may have quickly asked for help from CRS or other RO if he was having difficulty. A small

amount of time was added by me being a third party in all of the communications (~1 minute). A small amount of time was added by him having to ask me what he sees instead of him seeing what he saw and moving on (~1 minute).

This time validation was performed by Mike Tackett, Operations Supervisor on 2-18-04.

Risk Assessment of SW GW Issue

Issue
Gland water for Division II Service Water cross-tied to Division I SW on Jan 21. Restored on Feb 11.

Impact
Failure of Division I Service Water results in failure of Division II Service Water (if gland water not restored in 30 minutes).

Purpose
Determine risk significance of issue when reviewed using CNS PRA Model. Assumptions used to perform risk assessment will be reviewed by Operations and Plant Engineering.

Assumptions
1. Failure of both Division I SW Pumps leads to failure of both Division II SW pumps when GW is being supplied by Division I pumps to Division II pumps.

Evaluation
GW trouble is alarmed in the Control Room. The alarm procedure was reviewed by Operations. This procedure describes the expected conditions of the GW but does not describe the valve lineup. The procedure refers the Operator to the System Operating procedure which contains a section on GW flow and steps to verify the proper GW lineup.

The time required to restore GW in a plant trip has been estimated by Operations to be 60 minutes, including 30 minutes for diagnosis. The present information from the SW pump vendor is that pump failure would occur if GW is not restored in 30 minutes. The pump vendor has been contacted to determine length of time pump can be run without GW and still meet the PRA mission time. Further discussion with the vendor indicates that loss of GW flow for 60 minutes has been evaluated in the industry. Potential for GW flow recovery becomes viable, with expected failure rate of 0.1 given the expected operator response.

To assess the increase in core damage frequency (CDF), gates were added to the Division II SW pumps which would result in failure if both Division I SW pumps do not operate. When this dependency is added to the PRA model without recovery, the resulting increased core damage probability (ICDP) appears to be greater than GREEN.

The new CDF was reviewed and it was determined that ~80% of the CDF is due to a loss of DC bus A initiating event. The majority of this is due to two sequences.

The first sequence contains cutsets with failure of HPCI due to room cooling failure (RCIC fails with the initiator). Depressurization is successful but low pressure injection fails – CS due to room cooling failure and LPCI due to other failures (majority =

miscalibration of the initiating switch for low reactor level which can be recovered by manual initiation of the LPCI pump).

The second sequence contains successful operation of CS for injection, however, core damage occurs long term due to containment heatup. Extended CS injection is possible by aligning the suction to the CST and using containment vent for heat removal (expected ERO response by adapting existing system procedure in Mode 4.)

Recovery of these two sequences (and other CDF sequences) is provided by the EOPs with 5.2SW and 5.2REC which will provide injection using the available CRD pump. Containment venting is still available via the Drywell vent path and the Torus Hard Pipe Vent.

Calc for Demin wtr cooling of REC.

Operations has reviewed the recovery using the CRD pump and Containment venting and verified using prints and the simulator to ensure they are available.

Adding these recoveries to these sequences would reduce the CDF. In addition, the TDCA initiating event frequency was reviewed and compared to the initiating event frequency used in the SPAR model. Both initiating event frequencies are generic data values. The SPAR model uses updated information and is the lower frequency. Use of this updated frequency would also lower the CDF.

Initiating Condition: LOSS OF 125 VDC Bus "A" from 100% Power DRAFT

Plant Response:

- Loss of selected level, both RFPs (Reactor Feed Pumps) transfer to MDEM (Manual Demand Mode), "B" LI sees a high level trip
- RPV low water level alarm + one RFP seen tripped (due to power loss) – "B" RRMG runs back to 45%
- Actual RPV water level raises rapidly and Main and "B" RFP Turbines trip ("A" will not trip except locally), resulting in a reactor scram.
- When Main Turbine trips, 3310 and 3312 open (Field breaker must be opened locally)
- When the Main Turbine trips, Division I SWP's (Service Water Pumps) will lose motive force.
- Breaker 1BS will close, maintaining power to 4160 VAC Busses 1B and 1G.
- Breaker 1BE will see the loss of 4160 "A" Bus voltage and close in. (1AE will not trip)
  - 1BE will trip on over current condition.
- Division I Electrical Busses will be lost.
- Division I SW will be lost.
- SW-MO-37 will Close due to loss of Division I SWPs
- SW Loop "B" pump selected to "Auto" will start on low pressure.

↳ F pump xfer Due to loss of control pwr

Electric Plant Status:

- 4160 VAC Bus 1B is powered from SSST (Startup Station Service Transformer).
- 4160 VAC Bus 1G is powered from 4160 VAC Bus 1B
- 4160 VAC Busses 1A, 1E, and 1F are de-energized.

Service water System Status:

- SW-P-A and SW-P-C are not operating
- SW-P-B and SW-P-D are operating.
- SW-MO-37 is Closed. Auto pump would probably stay running due to low river level conditions (Will not obtain 75 psig.)

Indications:

- Several Red Bezel alarms (Scrams, Turbine Trip, 4160 VAC Undervoltage, etc.)
- 125 VDC Bus failure alarms on Division I
- SWGW (Service Water Gland Water) System Trouble alarm
- SWGW Low Pressure alarm

RPV Water Level and Pressure control:

- EOP-1A – RPV Control
- 2.4RXLVL - RPV WATER LEVEL CONTROL TROUBLE

Reactor Power Control:

- 2.1.5 - REACTOR SCRAM

Loss of one Reactor Recirculation Pump:

- 2.4RR - REACTOR RECIRCULATION ABNORMAL

Loss of DC Power:

- 5.3DC.125 - LOSS OF 125 VDC:
  - Place 1BE to Pull-To-Lock – Lose backfeed capabilities to 4160 "F" Bus
  - Trip "A" RRMG locally
  - Transfer 4160 "B" to SSST per 2.2.18 (would have occurred on Main Turbine trip)
  - Locally open the Generator Field breaker
  - Locally trip "A" RFP

Loss of AC Power:

- 5.3EMPWR - EMERGENCY POWER:
  - Attachment 2 has operator return the SW Zurn strainer(s) to service.
  - NLNPO responding to the SWPR (Service Water Pump Room) will identify that alarm window 1B/A-3 on the "B" SW Gland Water System annunciator panel is alarming.
    - With flow on the operating pump < 1.5 gpm would call the CR to have them start another available pump. CRO would ask NLNPO to verify the other pump is ready to start and response would be that it also has inadequate gland water flow.

* Op Action Recovery?

- 2.3_SW-GLAND-B - SW GLAND WATER SUPPLY PANEL - ANNUNCIATOR 1B provides no additional guidance but does reference SOP 2.2.71. NLNPO will get 2.2.71 in attempts to determine the problem.

→ Did OP carry out these actions on prev. GW Alarms?

Loss of SW:

- 5.2SW - SERVICE WATER CASUALTIES
  - Start available pumps and IF pressure is > 38 psig, ensure SW-MO-36 and/or SW-MO-37 are Open.
    - Would result in lowering pressure and SW-MO-37 should re-close.

Loss of SW Gland Water Pressure:

- 2.2.71 - SERVICE WATER SYSTEM:
  - Section 10, step 10.2 would be the requisite guidance (Placing SW Discharge Supply to Gland Water Subsystem B In Service)
  - Step 10.2.1: would not be applicable (not a planned evolution)
  - Step 10.2.2: NLNPO (Non-Licensed Nuclear Plant Operator) would inform SM that "B" loop SW pumps are inoperable
  - Step 10.2.3: Would not be applicable because at least one pump should be running.
  - Step 10.2.4: Would not be applicable (FP (Fire Protection) and Riverwell are not supplying GW flow).
  - Step 10.2.5: Would see the lights illuminated for SW-MO-2129MV.
  - Step 10.2.6: Would see the Red light on for SW-MO-2129MV, ensuring it is open.
  - Step 10.2.7 would find SW-V-28 Shut and would Open it, restoring Gland Water flow to the operating Div II SW pump(s)
  - Step 10.2.8 would not be applicable (FP not supplying GW flow).
  - Step 10.2.9 would not be applicable (Riverwell not supplying GW flow).
  - Step 10.2.10 would not be applicable (FP not supplying GW flow).
  - Step 10.2.11 would inform Control Room of restored flow to B loop pumps.

Can this be done before pump Damage 1.0hr

Reasonable time line for Operator response dealing only with the loss of gland water to the Division II Service Water Pumps:

- Time to recognize that the in service SWPs are operating with gland water trouble alarms in ~ 30 minutes (This black bezel annunciator will not receive a higher priority for investigation due to the other red and yellow alarms and other mitigating actions that are being taken.)
- Time to get an NLNPO into the SWPR ~ 5 minutes
- Time for the NLNPO to recognize the alarm condition and determine that the alarm response card does not restore gland water flow ~ 5 minutes, call Control Room and inform them that SOP 2.2.71 is needed.
- Time to go to Control Room to get SOP 2.2.71 and return to the SWPR ~ 10 minutes
- Time to go through Section 10, Step 10.2.7 to restore Gland water ~ 10 min

1 hr.

Vendor – 1hr acceptable w/ No Gland water

.Questions to answer:

Which REC Heat Exchanger was in service and what was it's SW flow rate?

- REC-HX-A was in service during the entire period of time, with a Maximum flow rate of ~ 2142.86 gpm.

How does REC-AOV-TCV451A fail on a loss of 125 VDC "A" bus?

- SW-AOV-451A will fail open when MCC-M is de-energized. Comes from 4160 VAC Bus 1F
  - (Procedure 5.3AC480 - 480 VAC BUS FAILURE) If REC HX A was the only heat exchanger in service at the time power was lost, Instructions are also provided to adjust the service water side flow as REC-TIC-451A fails open upon loss of 480V Bus 1F.

How does SW-AOV-TCV2797A fail on a loss of 125 VDC "A" bus?

- A loss of 125 VDC power would result in de-energizing the DG DC Control Power which would result in establishing SW flow through that EDG (Emergency Diesel Generator).
- (DCD 01 Service Water System Design Criteria Document, Attachment "B", step 5.2.2) The service water flows to the engine through the admission valve that is controlled by diesel control voltage (125 VDC).
  - (Procedure 2.2.20 - STANDBY AC POWER SYSTEM (DIESEL GENERATOR)) NOTE - Placing DC CONTROL POWER AND MAINTENANCE LOCKOUT switch to OFF will cause SW-AOV-2797A(B) AV, DG1(2) SUPPLY, to open. This will divert ~ 2000 gpm from SW System.

What is the normal position for SW-V-122 - CRITICAL SW HEADER TO REC HXS CROSSTIE?

- Sealed Closed

Which Service Water Pumps were selected to "Auto" during the period of time from 1/21/2004 to 2/11/2004?

- This information is not retrievable.
- SW Pumps are shifted twice per week, and typically, the selector switches are not repositioned.

Misc
12

Configuration Control Control Issue

Following the recent configuration control event associated with Service Water Gland Water, Actions to provide additional rigor to the status control of equipment manipulations are being taken.

All components that are manipulated to align systems for clearance orders that are not part of the clearance order boundary shall be listed on the clearance order as "No Tag" components. The as-left position of the component will be documented on the clearance order. Upon release of the clearance order the component will be returned to the normal check off list position.
All components associated with Safety Related or Essential systems will require independent verification.

When plant components are being manipulated in accordance with a station operating procedure with the intent of leaving the components in a configuration that is contrary to the normal check off list position, a narrative log entry should be made identifying the condition. Completing a Component Status Control Check List will provide status control. This checklist will include the reason for the configuration condition, plant system designator, component name, location, normal check off list position, actual position left, performed by and verified by initials. The CRS or the SM will authorize all component manipulations. When the system components are returned to their normal check off list position the Component Status Control Check List will be completed to show the restoration positions.
For safety related or essential equipment, independent verification will be required
All individuals performing or verifying actions for a Component Status Control Checklist will print their name, provide there initials, and sign and date the checklist.
When the Status Control Check List has been reconciled, the CRS or SM should affix his/her signature to acknowledge the restoration. A narrative log entry should be made to identify that the system components have been returned to their normal configuration.

When plant components are being manipulated in accordance with a station operating procedure, and the steps of the procedure that are to be performed will return the component to its original position, and appropriate verification signatures are imbedded within the procedure, no additional actions are needed. When configuration sign off steps associated with safety related or essential are not part of the actual procedure then a narrative log entry will be made to indicate that the system has been restored to normal status and verified by independent means.

Component Status Control Check List

CRS/SM Authorization _____ Date_____ Reason for Configuration_____ System_____

Component	Description	Normal Position	Actual Position	Performed By	Date	Verified* By	Date	Restored Position	Performed By	Date	Verified* By	D

*** Required for Safety Related and Essential equipment.**

Component Status Control Check List

Performers/Verifiers

Printed Name	Initials	Signature/Date
Printed Name	Initials	Signature/Date
Printed Name	Initials	Signature/Date
Printed Name	Initials	Signature/Date
Printed Name	Initials	Signature/Date
Printed Name	Initials	Signature/Date

CRS/SM Acknowledges Restoration_____Date_____