ACTION PLAN

ED 6408

PLAN NUMBER	PAGE
12	1 of 1
DATE PREPARED	PREPARED BY
6/12/85	J. Long

TITLE

AUXILIARY FEEDWATER SYSTEM VALVE PROBLEM ANALYSIS (AF 599 & 608)

SPECIFIC OBJECTIVE

Develop reasons for valve failure.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
1	Collect and analyze known information/operational data for conditions prior to, during, and after the transient.	J. Long				
2	Review recent maintenance history.	"				
3	Conduct change analysis (see attachment) - what has changed since last successful operation.	"				
4	Based on above, develop hypotheses for failure.	"				
5	Develop plan for testing hypotheses (i.e., checks, verifications, inspections, troubleshooting).	"		6/13/85	6/14/85	6/14/85
6	Document the above in a report and transmit to J. K. Wood.	"		6/13/85	6/14/85	6/14/85

INTRA-COMPANY MEMORANDUM
ED 6214-2

DATE

June 14, 1985

TO

J. K. Wood

FROM

JL MB
J. Long, M. Bajestani

SUBJECT

Hypothesis for failure of SG 2 AFW Isolation Valve 599 and SG 1 AFW Isolation Valve 608

Based on the information received during the transient, it appears that both valves torqued out when opening. There are several conditions that could cause the valves to torque out:

1. Improperly adjusted torque switch bypass contact (this hypothesis covered by Action Items 3 & 5).

2. Improper torque switch setting (this hypothesis covered by Action Item 2).

3. Wrong or improperly adjusted spring pack (this hypothesis covered by Action Item 7).

4. Failure of motor brake to release when energized (this hypothesis covered by Action Item 4).

5. Improper torque switch setting calculations (this hypothesis covered by Action Items 8-11).

6. Improper torque switch installation (this hypothesis covered by Action Item 6).

lrh

1. AF 599 and 608 are normally locked open valves and were open prior to the transient. During the transient, both valves went shut because of the improper initiation of SFRCS. After the error was corrected and SFRCS was reset, both valves failed to reopen automatically. Operators were sent to manually open the valves, according to the operator, the valves were placed in manual and the handwheel turned in the open direction. The handwheel was hard to turn and was only moved ≤ 1/2 turn in the open direction. The handwheel was then turned in the close direction ≤ 1/2 turn. This was repeated a second time and when turned in the close direction, a rattling noise came from the valve operator and the valve opened. The actual DP seen by these valves at the time they were attempting to open is unknown but they designed to open against a 1050 psid. At 1515 on 6/9/85, both valves were cycled satisfactorily within their required stroke time per ST 5071.02. At that time S/G pressure was 850 psig.

2. During the 1984 refueling outage, both valves had the motors and brakes replaced per FCR 83-067. In addition, AF 599 was disassembled, relubricated, all bearings replaced and reassembled. Both valves were cycled per ST 5064.01 (Ctmt. Iso. Valve post Maint. test) and the results were satisfactory.

3. When the valves were tested during the 1984 outage, the plant was in Mode 5, therefore, the valves were cold and no differential pressure across them. During the 6/9/85 transient, the valves were hot and a differential pressure existed across the valve disc.

ACTION PLAN
ED 6408

PLAN NUMBER	PAGE
12	1 of 3
DATE PREPARED	PREPARED BY
6/14/85	M. Bajestani

TITLE

AFW SYSTEM VALVE PROBLEM ANALYSIS (AF 599 and 608)

SPECIFIC OBJECTIVE

To determine the root cause of motor operated valves AF 599 and 608 failure to open.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
1	Before beginning troubleshooting work, document the as-found condition of the valves (limit to those conditions which can be recorded without changing conditions - i.e., valve position, general condition, environmental conditions).[1]	J. Long				
2	The torque switch settings were changed for MV 599 and 608 under FCR 84-039 (1.5 open and 1.0 closed). These settings should be verified.	J. Long				
3	The stem thrust load should be measured to verify the thrust calculation. MOVATS (Motor Operated Valve Analysis & Test System) should be used to measure valve stem thrust, time of control switch actuation, and dynamic motor current).	J. Long				
4	MV 599 and 608 are fast speed operators. A magnetic brake is provided to oppose the motor inertia after the power is removed from the motor. The brake and motors were replaced	J. Long				

ACTION PLAN

ED 6408

PLAN NUMBER	PAGE
12	2 of 3

TITLE

AFW SYSTEM VALVE PROBLEM ANALYSIS (AF 599 and 608)

DATE PREPARED	PREPARED BY
6/14/85	M. Bajestani

SPECIFIC OBJECTIVE

To determine the root cause of motor operated valves AF 599 and 608 failure to open.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
4	last refueling outage. These brakes should be checked for proper operation.					
5	Verify number of turns on the handwheel of the valve from fully closed position the limit switch contact 33/AC bypass the torque switch contact 33/TO.	J. Long				
6	With valve in midposition (spring pack relaxed) verify that the torque switch is not preloaded.	J. Long				
7	Verify by visual inspection[1] the spring pack model number. If the heavy spring number 60-600-0068-1 is used - no problem. However, if light spring number 60-600-0062-1 is used, the torque switch should prevent valve opening.	J. Long				

ACTION PLAN

ED 6408

PLAN NUMBER	PAGE
12	3 of 3

TITLE

AFW SYSTEM VALVE PROBLEM ANALYSIS (AF 599 and 608)

DATE PREPARED	PREPARED BY
6/14/85	M. Bajestani

SPECIFIC OBJECTIVE

To determine the root cause of motor operated valves AF 599 and 608 failure to open.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
*8	Motor horse power calculations should be performed in order to determine if the motor is capable of providing enough torque.	J. Long				
*9	Actuator size should be checked to determine if it is capable of operating against a 1050 psi differential pressure.	J. Long				
*10	Tortional stem stress and tensile stress should be checked to verify that these stresses do not exceed the ASME design allowable values.	J. Long				
*11	Torque dial settings should be established by opening and closing positions based on the extreme stem operation loads expected during the hot and pressurized condition.	J. Long				
	NOTE: [1]Follow guidelines for troubleshooting/investigative work.					

*Steps 8-11 are not dependent on Steps 1-7 and can be performed in any order.

PDR

INTRA-COMPANY MEMORANDUM
ED 6214-2

DATE
June 14, 1985

TO
J. K. Wood

FROM
J. Long, M. Bajestani

SUBJECT
Hypothesis for failure of SG 2 AFW Isolation Valve 599 and SG 1 AFW Isolation Valve 608

Based on the information received during the transient, it appears that both valves torqued out when opening. There are several conditions that could cause the valves to torque out:

1. Improperly adjusted torque switch bypass contact (this hypothesis covered by Action Items 3 & 5).

2. Improper torque switch setting (this hypothesis covered by Action Item 2).

3. Wrong or improperly adjusted spring pack (this hypothesis covered by Action Item 7).

4. Failure of motor brake to release when energized (this hypothesis covered by Action Item 4).

5. Improper torque switch setting calculations (this hypothesis covered by Action Items 8-11).

6. Improper torque switch installation (this hypothesis covered by Action Item 6).

lrh

1. AF 599 and 608 are normally locked open valves and were open prior to the transient. During the transient, both valves went shut because of the improper initiation of SFRCS. After the error was corrected and SFRCS was reset, both valves failed to reopen automatically. Operators were sent to manually open the valves, according to the operator, the valves were placed in manual and the handwheel turned in the open direction. The handwheel was hard to turn and was only moved ~ 1/2 turn in the open direction. The handwheel was then turned in the close direction ~ 1/2 turn. This was repeated a second time and when turned in the close direction, a rattling noise came from the valve operator and the valve opened. The actual DP seen by these valves at the time they were attempting to open is unknown but they designed to open against a 1050 psid. At 1515 on 6/9/85, both valves were cycled satisfactorily within their required stroke time per ST 5071.02. At that time S/G pressure was 850 psig.

2. During the 1984 refueling outage, both valves had the motors and brakes replaced per FCR 83-067. In addition, AF 599 was disassembled, relubricated, all bearings replaced and reassembled. Both valves were cycled per ST 5064.01 (Ctmt. Iso. Valve post Maint. test) and the results were satisfactory.

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ACTION PLAN
ED 6408

PLAN NUMBER	PAGE
12	1 of 3

TITLE

AFW SYSTEM VALVE PROBLEM ANALYSIS (AF 599 and 608)

DATE PREPARED	PREPARED BY
6/14/85	M. Bajestani

SPECIFIC OBJECTIVE

To determine the root cause of motor operated valves AF 599 and 608 failure to open.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
1	Before beginning troubleshooting work, document the as-found condition of the valves (limit to those conditions which can be recorded without changing conditions - i.e., valve position, general condition, environmental conditions).[1]	J. Long				
2	The torque switch settings were changed for MV 599 and 608 under FCR 84-039 (1.5 open and 1.0 closed). These settings should be verified.	J. Long				
3	The stem thrust load should be measured to verify the thrust calculation. MOVATS (Motor Operated Valve Analysis & Test System) should be used to measure valve stem thrust, time of control switch actuation, and dynamic motor current).	J. Long				
4	MV 599 and 608 are fast speed operators. A magnetic brake is provided to oppose the motor inertia after the power is removed from the motor. The brake and motors were replaced	J. Long				

ACTION PLAN

ED 6408

TITLE

AFW SYSTEM VALVE PROBLEM ANALYSIS (AF 599 and 608)

PLAN NUMBER	PAGE
12	2 of 3
DATE PREPARED	PREPARED BY
6/14/85	M. Bajestani

SPECIFIC OBJECTIVE

To determine the root cause of motor operated valves AF 599 and 608 failure to open.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
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5	Verify number of turns on the handwheel of the valve from fully closed position the limit switch contact 33/AC bypass the torque switch contact 33/TO.	J. Long				
6	With valve in midposition (spring pack relaxed) verify that the torque switch is not preloaded.	J. Long				
7	Verify by visual inspection[1] the spring pack model number. If the heavy spring number 60-600-0068-1 is used - no problem. However, if light spring number 60-600-0062-1 is used, the torque switch should prevent valve opening.	J. Long				

ACTION PLAN

ED 6408

PLAN NUMBER	PAGE
12	3 of 3

TITLE

AFW SYSTEM VALVE PROBLEM ANALYSIS (AF 599 and 608)

DATE PREPARED	PREPARED BY
6/14/85	M. Bajestani

SPECIFIC OBJECTIVE

To determine the root cause of motor operated valves AF 599 and 608 failure to open.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
*8	Motor horse power calculations should be performed in order to determine if the motor is capable of providing enough torque.	J. Long				
*9	Actuator size should be checked to determine if it is capable of operating against a 1050 psi differential pressure.	J. Long				
*10	Tortional stem stress and tensile stress should be checked to verify that these stresses do not exceed the ASME design allowable values.	J. Long				
*11	Torque dial settings should be established by opening and closing positions based on the extreme stem operation loads expected during the hot and pressurized condition.	J. Long				
	NOTE: [1]Follow guidelines for troubleshooting/investigative work.					

*Steps 8-11 are not dependent on Steps 1-7 and can be performed in any order.

47 45

PDR

INTRA-COMPANY MEMORANDUM
ED 6214-2

DATE

June 13, 1985

June 15, 1985, Rev. 1
June 15, 1985, Rev. 2

Action Item Lead Individuals

FROM

J. K. Wood JKWood

SUBJECT

Guidelines to Follow When Troubleshooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip

1 For each item on the Equipment Freeze list (Attachment 1), an action plan shall be developed for investigative or troubleshooting work which provides the basis for the Maintenance Work Order. Personnel (lead and/or support) developing the action plan shall have knowledge of the design criteria of the specific area being considered. Vendor engineering support will be utilized as necessary to accomplish this requirement. When used, vendor assistance shall be documented.

Troubleshooting and investigative activity shall be preceded by event evaluation and analysis to determine hypothesis(ses) and probable causes of failure or abnormal operation. Analysis and evaluation shall proceed as follows:

2
a. Collect and analyze known information/operational data for conditions prior to, during and after the transient.

b. Review maintenance and surveillance/testing history.

c. Develop a summary of data including a and b above that support any proposed probable cause of failure or abnormal operation.

d. Conduct a change analysis (i.e., what has changed since the last known successful operation of the system or equipment).

e. Based on above Items a-d, develop primary and alternate hypothesis(ses) for the root cause of the problem.

f. Develop plans for testing the probable causes/hypothesis (i.e., checks, verifications, inspections, troubleshooting, etc.). In developing inspection and troubleshooting plans, care must be taken to insure when possible that the less likely causes/hypotheses(ses) remain testable. When planning troubleshooting activity try to simulate as closely as practical the actual conditions under which the system or component failed to operate properly on June 9, 1985.

g. Document the above in a report.

It is very important that the performance of our investigations do not in any way result in the loss of any information due to disturbances of components or systems. Investigations need to be conducted in a logical, well thought-out and documented manner. To avoid the loss of information

and to assure the capture of reliable information, the following guidelines in addition to the requirements of AD 1844.00 need to be addressed and followed when initiating and implementing an MWO.

1 | 1. All action plans for troubleshooting and investigative work shall be reviewed with NRC personnel prior to implementation.

2. All MWOs relating to the 6/9/85 trip investigation shall be handled as NSR.

3. Troubleshooting and repair shall be accomplished on separate MWOs.

4. MWO's are to be approved by the Action Item Lead individual and reviewed by QC prior to their implementation. Copies of MWOs, when approved by the Action Item Lead Individual, shall be forwarded to D. J. Mominee (Stop 3070). It is the Lead Individual's responsibility to assure that the investigative actions are appropriate, sufficient, properly defined, documented, and data is preserved.

1 |

5. Only those MWO's approved by the Action Item Lead Individual and QC may be worked on any of the "frozen systems" identified on the attached list.

6. Assure that only current drawings and controlled vendor manuals are used.

7. Consider the need for vendor representatives. Vendor representatives should be used to assist in troubleshooting if appropriate expertise is not available in-house. The representatives will need to be given specific guidance for what they are and are not to do. Vendor representatives must follow the guidelines of this memorandum and requirements of the Maintenance Work Order.

1 |

8. The MWO must clearly document the scope, affected equipment, and the desired objective of the investigative activity.

9. The sequence of activity needs to be documented on the MWO or procedures specified in the MWO. If the sequence can be determined prior to the activity being performed, define that sequence and provide a checkoff for each step. If the desired sequence cannot be determined prior to the activity, as a minimum define the fundamental sequence to be taken and document each specific step as it is performed.

10. Document on the MWO all as found conditions. Visual inspect and document any missing, loose or damaged components, note positions (open, closed, up, down, knob settings, switch positions, setpoints, etc.) abnormal environmental conditions, operation of cooling devices, water leaks, oil leaks, loose fittings, cracks, evidence of overheating or water damage, cleanliness, bent tubing, fluid levels, jumpers, lifted wires, etc. Describe the overall condition or

1 |

1 |

appearance. Whenever possible, use photographs to document as found conditions. When considered necessary, retain a sample of fluids or their residue for further analysis.

11. When discrepancies are noted during the investigation, stop work and notify the Action Item Lead Individual. Document the deficiency. The Lead individual must sign off on the discrepancy prior to continuing the investigation.

12. Document the results of the investigation on the MWO.

13. Prior to starting any repair activities the Action Item Lead Individual must document that all investigations have been properly completed.

1 14. No equipment is to be shipped off site without prior approval of Nuclear Facility Engineering and Quality Engineering for including appropriate hold and witness points. Use the "Q" purchase order process to obtain these approvals.

NOTE: In all cases, applicable procedure must be followed. The requirements of this memorandum must be communicated to craft personnel to avoid any confusion or misunderstandings during this investigative period.

15. All failed or removed components/equipment shall be retained for ongoing review and examination. Complete traceability shall be maintained.

1 The NRC shall be notified when the determination of the root cause of the malfunction/failure has been made. As soon as practical, the results of the troubleshooting process, root cause determinations and justification will be presented to the NRC (e.g., next day in a meeting).

The NRC shall be advised as soon as practical of plans and schedules for corrective action work, prior to the work being performed.

NOTE: Any communication with the NRC personnel will be coordinated through John Wood.

JKW/SGW/bjs

Attachment

EQUIPMENT FREEZE

The following list of items is the licensee's proposal for continued quarantine:

1. MFP's Turbine and Controls
2. SFRCS and Associated Instrument Channels
3. Aux Feed Pump Turbines and Controls
4. MSIV's Including Controls - Actuating Circuits, Pneumatic Supplies
5. S/U Feed Valve SP-7A - and Controls
6. Source Range Instrument Channels
7. Turbine Bypass Valve SP-13A2 - Any other components for which there is found an indication of water hammer damage
8. PORV and Controls and Actuation System
9. Main Steam Safety Valves
10. AF 599 and AF 608 Valves, Actuators and Controls
11. MS 106 and Controls

This item was released by the Fact-Finding Team:

1. SPDS

This item was added by the Fact-Finding Team:

1. SW Valve and Controls on AFW Alternate Supply

It is agreed that no work will be done in the proximity of, or on, this equipment.

The licensee agreed to complete a walkdown outside Containment of the Main Steam System by appropriate personnel to identify any additional damage that may have been caused by water hammer.

The Fact-Finding Team stated that:

a. If required for safety, work shall proceed.

b. Surveillance Requirements of the Technical Specifications should be satisfied.

c. The team should be advised of any actions taken in the two areas above.

SGW/bjs