57
53

Turbine Bypass Valve 2-2 (SP13A2) Problem Analysis

Submitted by Matthew B. Raynes Plan #9a and 9b

This report has been prepared in accordance with the "Guidelines to Follow When Troubleshooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip, Rev. 2.

Introduction

It should be stated that all information obtained through data printouts and operator interviews points to the fact that the turbine bypass valve (TBV) failed between 06:55 and 06:57 on the morning of the June 9, 1985 reactor trip.

Summary of Data

The following information was obtained through review of data and through interviews with the following people from the operations staff present at the time the valve is thought to have failed; William O'Connor, Louis Simon, Scott Wise, and Gene Hillebrecht. When correlating the pressure vs. time graph with the alarm readout for the time around the June 9, 1985 reactor trip, the turbine bypass setpoint pressure of 1015 psig was exceeded for approximately two seconds before the Main Steam Isolation Valves (MSIVs) closed which changed the logic and prevented the TBV's from opening. On the morning of June 9, 1985 the following sequence of events was taken to heat up the main steam line to the Steam Generator (SG) pressure and temperature in accordance with procedure PP 1102.03, Trip Recovery. The TBV header isolation valves MS 709 and MS 710 were closed at or around 05:40 along with the majority of the steam traps on the main steam line. At 05:43 both MSIV bypass valves were open to begin line heat up. These MSIV bypass valves MS 100A and MS 101A are one inch lines. For this reason most of the traps are closed to facilitate a quicker heat up. Once the line had built up enough temperature and pressure the operators went down and opened the bypass around MS 709 and MS 710 to begin heatup of the TBV headers. At 06:42 both MSIV's opened and between this time and 06:54 the isolation valves MS 709 and MS 710 to the TBV headers were opened. (It should be noted that valves MS 709 and MS 710 are manually operated and when being operated one must stand facing the TBV's on both headers so any failures on the TBV's could have been noted.) At this time the reactor operator requested that two TBV's on each header be isolated to control the SG pressure more easily. On both headers the #1 and #3 valves were isolated from the condenser just down stream leaving the #2 valves on each header to control the SG cooldown. Also around this time all steam traps should have been reopened. At 06:54 the B header TBV's all opened with just SP13B2 controlling and dumping to the condenser. At 06:55 the A header, which has questionable water drainage, began to have its TBV's open with 1 and 3 opening first. At 06:56.00095 thru 6:56.01130 the TBV SP13A2 showed not closed, closed sequence twice and then had no further readings. This is believed to be the time of failure. At about this time the interviewed operators, who were in the control room, heard a loud cracking sound like that heard from a water hammer. Scott Wise went

down to the TBV headers and found the valve SP13A2 in the present condition. It should be noted that the A header as compared to the B header has a greater length of piping leading to it which may have had an effect on why no valves in the B header failed.

In reviewing maintenance done on SP13A2 the work was limited to repacking work and calibration of the position indicator. The TBV SP13A2 has no record of maintenance testing and there are no scheduled surveillance tests for the TBVs.

Change Analysis

The change analysis revealed no additional relevant data.

Hypotheses

The basis of the hypotheses were from the information provided by operators and from inspection of the valve as found. With both the yoke and the housing cracked many factors were taken into consideration. The two main facts that are very evident are the valve stem thread dimension which were logged in letter log #E85-152A File #MM5.1 and the fact that the pin connector was in contact with the sleeve assembly. When the above two factors were considered with the operator interviews the hypotheses were formed.

Hypotheses

1. Water hammer

2. Valve internals assembled in a fashion to inhibit proper operation.

3. Valve positioner malfunction

Th most likely cause is thought to be a combination of hypotheses 1 and 2.

sm b/5

TOLEDO EDISON

Log No. E85-152A
File No. MM 5.1

June 13, 1985

SP 13A2 and Associated Piping Walkdown 6/13/85 at 0930:

Hanger EBD-3-H33 - No movement apparent on snubber

B Header Valves and Actuators show no visible damage

Valve upper stem thread shown in inches:

13A1	7/8
13A2	2-1/8
13A3	1-1/16
13B1	47/64
13B2	1-1/8
13B3	1-3/16

MS 712 no visual damage.

EBD-108-H5 - minimal movement in south direction.

No visual damage to insullation upstream of valve.

MS 47

Line from SP13A2 to condenser shows no visual signs of water hammer damage.

End 1010, 6/13/85.

Matthew B. Raynes
Matthew Raynes
Assistant Engineer

Mike Kusnir
Mike Kusnir
Assistant Engineer

ACTION PLAN

ID #408

TITLE

To Determine the Cause of Turbine Bypass Valve 2-2 (SP13A2) Failure

SPECIFIC OBJECTIVE

PLAN NUMBER	PAGE
9a & 9b	1 of 1
DATE PREPARED	PREPARED BY
6/18/85	M. Raynes

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
	All steps of this Action Plan are to be performed in accordance with the latest revision of "Guidelines to Follow When Trouble-shooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip."					
1.	To test Hypotheses 1 and 2 Disassemble valve and inspect components for damage and improper assembly. Compare conditions to design and assembly information.	M. Raynes				
2.	To test Hypothesis 3 Test and/or calibrate valve positioner.	M. Raynes				

Turbine Bypass Valve 2-2 (SP13A2) Problem Analysis

Submitted by Matthew B. Raynes Plan #9a and 9b

June 18, 1985 Page 1 of 3

This report has been prepared in accordance with the "Guidelines to Follow When Troubleshooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip, Rev. 2.

Introduction

It should be stated that all information obtained through data printouts and operator interviews points to the fact that the turbine bypass valve (TBV) failed between 06:55 and 06:57 on the morning of the June 9, 1985 reactor trip.

Summary of Data

The following information was obtained through review of data and through interviews with the following people from the operations staff present at the time the valve is thought to have failed; William O'Connor, Louis Simon, Scott Wise, and Gene Hillebrecht. When correlating the pressure vs. time graph with the alarm readout for the time around the June 9, 1985 reactor trip, the turbine bypass setpoint pressure of 1015 psig was exceeded for approximately two seconds before the Main Steam Isolation Valves (MSIVs) closed which changed the logic and prevented the TBV's from opening. On the morning of June 9, 1985 the following sequence of events was taken to heat up the main steam line to the Steam Generator (SG) pressure and temperature in accordance with procedure PP 1102.03, Trip Recovery. The TBV header isolation valves MS 709 and MS 710 were closed at or around 05:40 along with the majority of the steam traps on the main steam line. At 05:43 both MSIV bypass valves were open to begin line heat up. These MSIV bypass valves MS 100A and MS 101A are one inch lines. For this reason most of the traps are closed to facilitate a quicker heat up. Once the line had built up enough temperature and pressure the operators went down and opened the bypass around MS 709 and MS 710 to begin heatup of the TBV headers. At 06:42 both MSIV's opened and between this time and 06:54 the isolation valves MS 709 and MS 710 to the TBV headers were opened. (It should be noted that valves MS 709 and MS 710 are manually operated and when being operated one must stand facing the TBV's on both headers so any failures on the TBV's could have been noted.) At this time the reactor operator requested that two TBV's on each header be isolated to control the SG pressure more easily. On both headers the #1 and #3 valves were isolated from the condenser just down stream leaving the #2 valves on each header to control the SG cooldown. Also around this time all steam traps should have been reopened. At 06:54 the B header TBV's all opened with just SP13B2 controlling and dumping to the condenser. At 06:55 the A header, which has questionable water drainage, began to have its TBV's open with 1 and 3 opening first. At 06:56.00095 thru 06:56.01130 the TBV SP13A2 showed not closed, closed sequence twice and then had no further readings. This is believed to be the time of failure. At about this time the interviewed operators, who were in the control room, heard a loud cracking sound like that heard from a water hammer. Scott Wise went

down to the TBV headers and found the valve SP13A2 in the present condition. It should be noted that the A header as compared to the B header has a greater length of piping leading to it which may have had an effect on why no valves in the B header failed.

In reviewing maintenance done on SP13A2 the work was limited to repacking work and calibration of the position indicator. The TBV SP13A2 has no record of maintenance testing and there are no scheduled surveillance tests for the TBVs.

Change Analysis

The change analysis revealed no additional relevant data.

Hypotheses

The basis of the hypotheses were from the information provided by operators and from inspection of the valve as found. With both the yoke and the housing cracked many factors were taken into consideration. The two main facts that are very evident are the valve stem thread dimension which were logged in letter log #E85-152A File #MM5.1 and the fact that the pin connector was in contact with the sleeve assembly. When the above two factors were considered with the operator interviews the hypotheses were formed.

Hypotheses

1. Water hammer

2. Valve internals assembled in a fashion to inhibit proper operation.

3. Valve positioner malfunction

The most likely cause is thought to be a combination of hypotheses 1 and 2.

sm b/5

TOLEDO EDISON

Log No. E85-152A
File No. MM 5.1

June 13, 1985

SP 13A2 and Associated Piping Walkdown 6/13/85 at 0930:

Hanger EBD-3-H33 - No movement apparent on snubber

B Header Valves and Actuators show no visible damage

Valve upper stem thread shown in inches:

13A1	7/8
13A2	2-1/8
13A3	1-1/16
13B1	47/64
13B2	1-1/8
13B3	1-3/16

MS 712 no visual damage.

EBD-108-H5 - minimal movement in south direction.

No visual damage to insulation upstream of valve.

MS 47

Line from SP13A2 to condenser shows no visual signs of water hammer damage.

End 1010 6/13/85.

Matthew B. Raynes
Matthew Raynes
Assistant Engineer

Mike Kusnir
Mike Kusnir
Assistant Engineer

ACTION PLAN

ID #408

TITLE

To Determine the Cause of Turbine Bypass Valve 2-2 (SP13A2) Failure

SPECIFIC OBJECTIVE

PLAN NUMBER	PAGE
9a & 9b	1 of 1
DATE PREPARED	PREPARED BY
6/18/85	M. Raynes

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
	All steps of this Action Plan are to be performed in accordance with the latest revision of "Guidelines to Follow When Trouble-shooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip."					
1.	To test Hypotheses 1 and 2 Disassemble valve and inspect components for damage and improper assembly. Compare conditions to design and assembly information.	M. Raynes				
2.	To test Hypothesis 3 Test and/or calibrate valve positioner.	M. Raynes				

Turbine Bypass Valve 2-2 (SP13A2) Problem Analysis

Submitted by Matthew B. Raynes Plan #9a and 9b

This report has been prepared in accordance with the "Guidelines to Follow When Troubleshooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip, Rev. 2.

Introduction

It should be stated that all information obtained through data printouts and operator interviews points to the fact that the turbine bypass valve (TBV) failed between 06:55 and 06:57 on the morning of the June 9, 1985 reactor trip.

Summary of Data

The following information was obtained through review of data and through interviews with the following people from the operations staff present at the time the valve is thought to have failed; William O'Connor, Louis Simon, Scott Wise, and Gene Hillebrecht. When correlating the pressure vs. time graph with the alarm readout for the time around the June 9, 1985 reactor trip, the turbine bypass setpoint pressure of 1015 psig was exceeded for approximately two seconds before the Main Steam Isolation Valves (MSIVs) closed which changed the logic and prevented the TBV's from opening. On the morning of June 9, 1985 the following sequence of events was taken to heat up the main steam line to the Steam Generator (SG) pressure and temperature in accordance with procedure PP 1102.03, Trip Recovery. The TBV header isolation valves MS 709 and MS 710 were closed at or around 05:40 along with the majority of the steam traps on the main steam line. At 05:43 both MSIV bypass valves were open to begin line heat up. These MSIV bypass valves MS 100A and MS 101A are one inch lines. For this reason most of the traps are closed to facilitate a quicker heat up. Once the line had built up enough temperature and pressure the operators went down and opened the bypass around MS 709 and MS 710 to begin heatup of the TBV headers. At 06:42 both MSIV's opened and between this time and 06:54 the isolation valves MS 709 and MS 710 to the TBV headers were opened. (It should be noted that valves MS 709 and MS 710 are manually operated and when being operated one must stand facing the TBV's on both headers so any failures on the TBV's could have been noted.) At this time the reactor operator requested that two TBV's on each header be isolated to control the SG pressure more easily. On both headers the #1 and #3 valves were isolated from the condenser just down stream leaving the #2 valves on each header to control the SG cooldown. Also around this time all steam traps should have been reopened. At 06:54 the B header TBV's all opened with just SP13B2 controlling and dumping to the condenser. At 06:55 the A header, which has questionable water drainage, began to have its TBV's open with 1 and 3 opening first. At 06:56.00095 thru 06:56.01130 the TBV SP13A2 showed not closed, closed sequence twice and then had no further readings. This is believed to be the time of failure. At about this time the interviewed operators, who were in the control room, heard a loud cracking sound like that heard from a water hammer. Scott Wise went

down to the TBV headers and found the valve SP13A2 in the present condition. It should be noted that the A header as compared to the B header has a greater length of piping leading to it which may have had an effect on why no valves in the B header failed.

In reviewing maintenance done on SP13A2 the work was limited to repacking work and calibration of the position indicator. The TBV SP13A2 has no record of maintenance testing and there are no scheduled surveillance tests for the TBVs.

Change Analysis

The change analysis revealed no additional relevant data.

Hypotheses

The basis of the hypotheses were from the information provided by operators and from inspection of the valve as found. With both the yoke and the housing cracked many factors were taken into consideration. The two main facts that are very evident are the valve stem thread dimension which were logged in letter log #E85-152A File #MM5.1 and the fact that the pin connector was in contact with the sleeve assembly. When the above two factors were considered with the operator interviews the hypotheses were formed.

Hypotheses

1. Water hammer

2. Valve internals assembled in a fashion to inhibit proper operation.

3. Valve positioner malfunction

The most likely cause is thought to be a combination of hypotheses 1 and 2.

sm b/5

TOLEDO EDISON

Log No. E85-152A
File No. MM 5.1

June 13, 1985

SP 13A2 and Associated Piping Walkdown 6/13/85 at 0930:

Hanger EBD-3-H33 - No movement apparent on snubber

B Header Valves and Actuators show no visible damage

Valve upper stem thread shown in inches:

13A1	7/8
13A2	2-1/8
13A3	1-1/16
13B1	47/64
13B2	1-1/8
13B3	1-3/16

MS 712 no visual damage.

EBD-108-H5 - minimal movement in south direction.

No visual damage to insullation upstream of valve.

MS 47

Line from SP13A2 to condenser shows no visual signs of water hammer damage.

End 1010, 6/13/85.

Matthew B. Raynes
Matthew Raynes
Assistant Engineer

Mike Kusnir
Mike Kusnir
Assistant Engineer

ACTION PLAN

ED 6408

TITLE

To Determine the Cause of Turbine Bypass Valve 2-2 (SP13A2) Failure

PLAN NUMBER	PAGE
9a & 9b	1 of 1
DATE PREPARED	PREPARED BY
6/18/85	M. Raynes

SPECIFIC OBJECTIVE

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
	All steps of this Action Plan are to be performed in accordance with the latest revision of "Guidelines to Follow When Trouble-shooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip."					
1.	To test Hypotheses 1 and 2 Disassemble valve and inspect components for damage and improper assembly. Compare conditions to design and assembly information.	M. Raynes				
2.	To test Hypothesis 3 Test and/or calibrate valve positioner.	M. Raynes				