

PLANT HATCH FEEDWATER SYSTEM OPERATING EXPERIENCE

Significant events from 2015

ICES Report #315779

- Hatch Unit 2
- March 10, 2015
 - Startup from 2R23 refueling outage
- Feedwater Control System (RWL Control)
- Startup Level Controller – 2C32R619
 - Yokogawa SLPC 281
- Startup Level Control Valve – 2N21F111
 - 12” angle valve with side mount Fisher 476L actuator & Fisher 546 I/P transducer

Controller Failure

- RAM chip failure in Yokogawa controller
- Controller reverted to default program
- Automatic control of valve was lost, valve actuation was erratic
- Operations attempted to control RWL during startup by operating the controller in manual
- Efforts were not successful, and Unit 2 was shut down to make repairs

Valve Failure

- Failed controller resulted in erratic operation of valve
- Manual control of valve resulted in overshoot
- I/P failed due to heavy cycling
- Actuator air leaks contributed to erratic valve operation

Causes

- Controller RAM chip failure deemed a random failure
 - No vendor recommended PMs for periodic replacement
 - Limited OE on this type of subcomponent failure, regardless of vendor & component
- I/P failure due to heavy cycling
 - Following controller failure
 - Manual operation
- Actuator issues due to inadequate PMs
 - U2 valve actuator PMs -12 year frequency
 - U1 equivalent – 2 year
 - Similar service valve PMs set to ~6 years

Corrective Actions/Lessons Learned

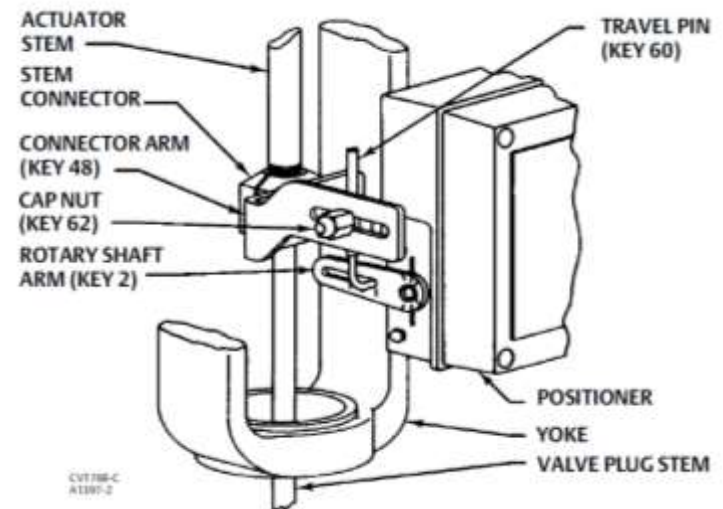
- Replaced Controller, Power Supply, Fuse, & Backup Battery for controller
- Replaced I/P
- Rebuilt valve actuator
- Reevaluated PM frequencies
 - BOP AOV PM “project”
- Enhanced PMCR procedural requirements to require Engineering (System and/or Program) review

ICES Report #314922

- Hatch Unit 1
- January 17, 2015
- Feedwater Heater Level Control System
- 2nd stage C/D MSR Drain Tank Level Control Valve –
1N22F1108B
 - 4” Fisher EWD valve with 667 actuator

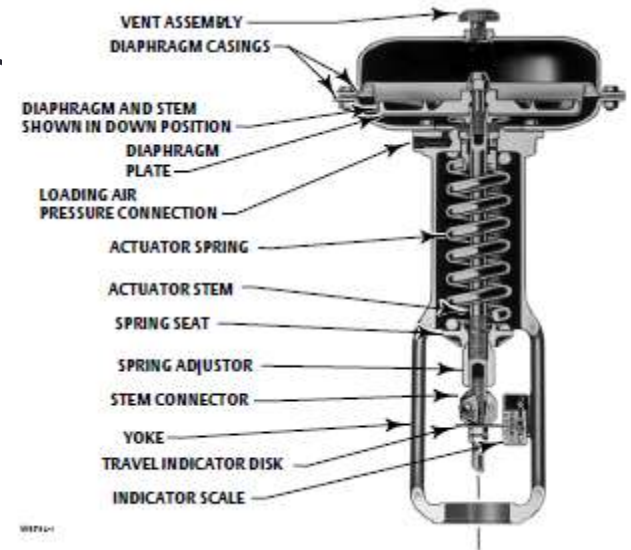
Valve Failure

- AOV Positioner stem connector arm broke & detached
- Valve control was lost
- FWHLC system oscillations occurred
- 8th stage B FWH isolated on high level



Causes

- Actuator stem was loose and could rotate freely
- Rotation caused wearing of the positioner stem connector, and its eventual failure
- Wearing identified during previous refueling outage (2014), but no investigation was done. (parts replaced only)
- 8th stage B FWH level indicator (Yarway) had drifted out of calibration low.
 - Caused erroneous low level alarms
 - Level was raised in FWH to prevent alarms, reducing margin to high level isolation



Corrective Actions/Lessons Learned

- Rebuilt valve actuator
- Revised maintenance procedure to include checking actuator stem for rotation
- Reevaluated PM frequencies & scope
 - BOP AOV PM “project”
- Increased priority placed on digital FWHLC upgrade project
 - Evaluating use of no-contact positioners

ICES Report #316011

- Hatch Unit 1
- March 27, 2015
- Feedwater Heater Level Control System
- 2nd stage C/D MSR Drain Tank Level Control Valve – 1N22F1108B
 - 4” Fisher EWD valve with 667 actuator

Valve Packing Failure

- Packing nuts backed off
- Packing was ejected out from the valve
- Resulted in large steam leak



Effects

- Sudden steam leak relieved system pressure
 - Condensate in the drain tank flashed
 - High level switch actuated
 - 2nd stage MSR steam supply isolated
- Reactor pressure increased
 - Main Turbine Bypass valve #1 opened ~15%
- Reactor power reduced manually 0.5% via recirc
- Repairs required Unit 1 downpower to 17% and Main Turbine Tripped
 - Unable to isolate leak, High Temperature, High dose

Causes

- Vibration induced nut loosening
- Vulnerable design
 - Multiple pipe elbows & elevation changes
- System not upgraded for EPU
- Inadequate pneumatic control system
- Proposed digital upgrade not implemented
- CCI drag valves used for high level dumps
 - CCI valves installed in 2012
 - Snap acting relay results in actuation from 0-17% open instantly before controlling
 - Closes fully from 17% open
 - Causes water hammer

Corrective Actions/Lessons Learned

- Add second packing nut to the 2nd stage drain tank valves
- Further emphasis on digital FWHLC system
- System study performed to identify vulnerabilities and recommend system improvements

ICES Report #318420

- Hatch Unit 1
- September 14, 2015
- Feedwater System
- Reactor Feed Pump Turbine – 1N21C005A
 - GE DVR 631, 6 stage, dual inlet
- HP Control Valve – 1N11F177
 - GE Stop/Control valve

Valve Stem Failure

- The valve stem for the HP control valve failed, preventing the valve plug from lifting when demanded



Effects

- As the 1B RFPT was being removed from service, the 1A RFPT attempted to increase speed to maintain feedwater flow.
- The LP steam at reduced power was insufficient
- Controls demanded HP steam
- HP steam was not supplied, 1A RFPT speed did not increase as much as required
- Reactor water level decreased
- Reactor Recirc Pump runback on low level
- ~20% power reduction (unplanned)

Causes

- HP valve stem was drilled twice
 - Each hole was 90 degrees from each other
 - Valve stem cross sectional area was reduced
- Inadequate Vendor Oversight
- Overreliance on vendor drawings
- Not utilizing maintenance procedures properly



Corrective Actions/Lessons Learned

- Improved maintenance procedures
 - Added requirement to use lock tabs
- Updated vendor drawings in GEK documents
- Include this item in Pre-Outage Turbine Team briefings