Crown PZM11
Flush-Mount Boundary Layer Microphone
(Ceiling Mics $120.00)
Crown Audio PZM10LL Miniature Security Microphone with Line-Level Output
(Panel Mics $200.00)
Panasonic WVSC384 High Definition Dome Network Camera $850.00
WHEN PLANT DATA COMPARISONS GO ROGUE

Scott Cupp
Arkansas Nuclear One
Assumptions are made and most assumptions are wrong

- Albert Einstein
Arkansas Nuclear One

ANO1 – B&W, 880 MW (1973)
ANO2 – CE, 1020 MW (1980)

December 2015:
Column IV, Recovery
Policy Note 14 Imminent
Biennial QA Training Audit
INPO OPS Accreditation Team Visit
Arkansas Nuclear One – ANO1

Three parallel feedwater flow paths:
- Startup flow control valves (6” air operated globe valve)
- Low load control valve (10” air operated globe valve)
  - LL/SU valves stop when main block opens / interlock
- Main feedwater block valves (>55%)
Arkansas Nuclear One – ANO1

The event - December 15, 2015:

During a plant downpower to replace an EH power supply, CV-2672 B low load control valve failed to close. Subsequently, CV-2674 B low load block valve began to close and caused a loss of feed to E-24B OTSG. The reactor was manually tripped due to loss of feed and EFW actuated.
Arkansas Nuclear One – ANO1

• ICS signal to begin closing B low load valve failed (equipment)
• Operators placed low load valves in manual but left the startup valves in automatic (human performance)
• Operators tried to manually close B low load valve to 90% but saw no immediate valve movement
Arkansas Nuclear One – ANO1

• Another crew had handled similar transient correctly in 2014
• Operations representative on root cause team was a former simulator instructor
• Assumption made regarding “deadband” on low load valve
• Theory was tested in the simulator ...
Arkansas Nuclear One – ANO1

CR-ANO-1-2016-780

During the investigation ... it was identified that the Main Feedwater Low Load Control Valves have a dead-band that the crew was unaware of, which works as follows:

While opening, the LLCV reaches full open with a 93% demand, and when closing, does not begin to close until the demand signal is lowered below 93%.

During a review of LLCV performance in the simulator, it was discovered that the dead-band does not appear to be modeled properly in the simulator.
Arkansas Nuclear One – ANO1

15. Did deficient simulator performance, modeling, or fidelity negatively impact operator performance in the actual plant during a reportable event?

- **NO**
  - Green Finding

- **YES**
  - White Finding
Arkansas Nuclear One – ANO1

What actually happened:

• Event facts were not challenged by training management
• Simulator issue called out as contributing cause in RCE
• NRC resident requests meeting with training management
• QA audit determines simulator effectiveness unsat
• Accreditation prep team drafts SIF on simulator fidelity
Arkansas Nuclear One – ANO1

What should have happened immediately – Event Facts:

- No significant deadband existed
- Valve moved minutes after demand lowered (stuck)
- Maintenance discovered that valve positioner had drifted 7% over the current fuel cycle

(discovered by training)
Arkansas Nuclear One – ANO1
Arkansas Nuclear One – ANO1

Two months later:

• Root cause is revised removing simulator as issue
• NRC agrees no simulator issue exists
• QA agrees to revise audit report and determines simulator effectiveness is satisfactory
• Accreditation prep team eliminates draft SIF from ASER
Arkansas Nuclear One – ANO1

Lessons Learned:

• Stay ENGAGED in simulator issues
• Be willing to challenge initial conclusions
• Understand small variations in plant performance will occur
  • Time in position
  • Calibration drift
  • Ambient temperature and vibration
  • Time in core life
Questions?