



FENOC

FirstEnergy Nuclear Operating Company

FirstEnergy

Nuclear Energy Institute Simulator Lessons Learned



Simulator Lessons Learned



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Sponsored By:

The Nuclear Energy Institute

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TOPICS



Simulator Lessons Learned

- Simulator Fidelity
- Reactivity Manipulations
- ANS-3.5 and NRC Inspections

History



- Two Full Scope Simulators by Westinghouse
 - Unit 1 Simulator delivered in 1985
 - Unit 2 Simulator delivered in 1991

The Challenge

- By 1999 we could no longer perform core updates
- Datapool, memory, disk drives, Y2K, and OS limitations
- Failing equipment ENCORE 97s, Aydin & Ramtek display generators
- Unstable building power supply, voltage fluctuations

The Plan

- Migration to PC Windows NT platform
- Reactor Core, Thermal Hydraulic, Containment Upgrades
- Advanced Instructor Station Capabilities
- Improve Simulator Reliability
- Support Future Expansion and model upgrades
- Add a line voltage power conditioner

Implementation Concerns

- Back to back simulator upgrades
- Discrepancy count rises
- Everything changes ...
- Only Two full time software engineers available
- Station ownership changed during the upgrades

All Challenges were met

- Additional benefits
 - Stand alone PC Simulators facilitate exam development
 - Classroom simulators available on a PC
 - Interface with MS Office products via DDE
 - Web Based instructor interface
 - Ability to run EPP exercises from the simulators

Simulator Fidelity



- Aspects of Fidelity
 - Plant Configuration (tagging)
 - Discrepancies
 - Core Performance
 - Plant Modifications

Simulator vs Plant Configuration

- Historic INPO Comments on tagging
- Two Simulators = Twice the Fun!
- Improvements made but were not programmatic
- INPO Findings Continued
- Finally conducted MANTG Survey in early 2002

Conduct of Simulator Training

- A new administrative procedure was written
 - Review the plant status
 - Identifies Items that should be reviewed
 - Duration > length of the training module
 - Reviewed by Operations Line Management
 - Included in “Pilot Week”
 - Identified in the Lesson Plan

Station Corrective Action Program

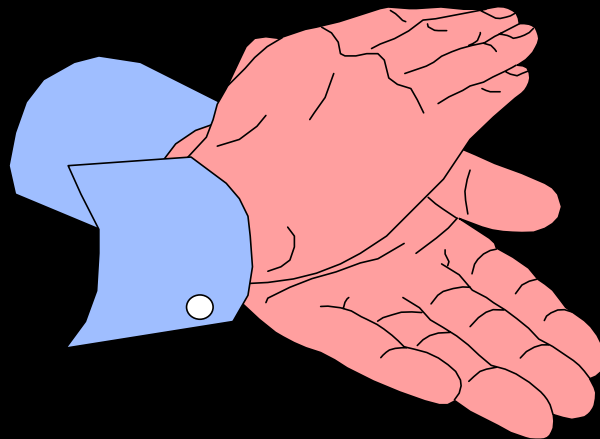


- Used to ensure management oversight
- Discrepancies entered when adverse to quality training
- Plant design change process tracking
- Operator Work Around reviews
- Training committee reviews
- Lost training time

2002 WANO Peer Review

INPO/WANO Simulator Fidelity Issue was

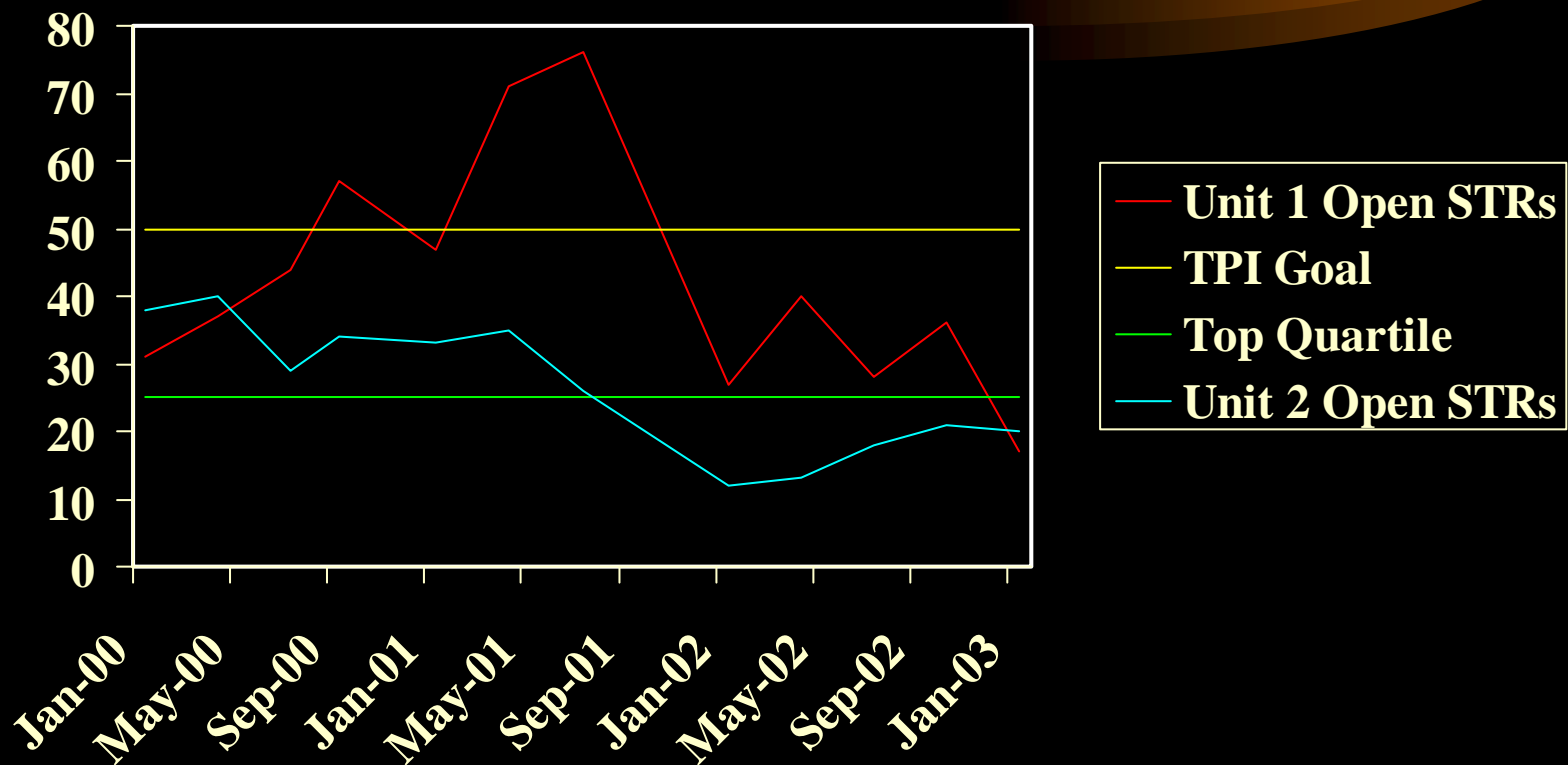
Finally Closed



Simulator Discrepancies

- The number of discrepancies increased while back to back upgrades were performed
 - Resources were limited – 2 engineers
 - Steep learning curve for new tools & technology
 - Vendor performance/delivery shortfalls
 - Upgrade testing finds non-vendor issues
 - Higher standards were applied
 - A new performance indicator (TPI) was established below the existing discrepancy level

Simulator Discrepancies



Reactivity Manipulations

- Review of 10CFR Part 55
- Regulatory Affairs review requested
- Reg Guide 1.149 reviewed
- Determined that transition to ANS-3.5 1998 was not required
- Current core cycle is installed but what testing is required? (Gap Analysis)

Core Performance Verification



- Review of core performance testing methodology
 - Verification testing conducted by Nuclear Fuels Group
 - Comparison of core design model with simulator model
 - Extensive report provided by Nuclear Fuels Group

Core Performance Validation

- Validation Testing by BV Simulator Group
 - ECP verification
 - Reactor startup and $1/m$ plot
 - POAH performance
 - Axial Flux Targets
 - Operations at power compared to standard reactivity plan used in the plant

Simulator Manipulations

- Unit 1 candidates needed manipulations
- Plant maneuvering reactivity plan was requested from Reactor Engineer
- Plan was validated on the simulator
- Candidates performed maneuvers
- Data captured and rosters used for documentation

NRC Inspection Procedure

- Procedure 7111.11 Appendix C
- BVPS Inspection Oct 2002
- Pre-inspection request received 2 weeks prior

Pre-inspection request

- All performance tests for the previous year
- All open simulator discrepancies
- Summary of all discrepancies cleared in the last year
- Current core installation test
- Configuration control procedures
- Organizational chart

Post Inspection Report



- No significant findings

Site Resident Inspection Followed 71111.11 Inspection

Comments on fidelity

- Fewer tags than plant
- Plant lens covers are faded simulators are not
- Different (LED) light bulbs used in the simulator
- Simulator lighting level different than plant
- Design change in the simulator that precedes the plant

All comments were entered in the corrective action program for resolution

Lessons Learned



- Three simple rules
 - Establish procedures
 - Follow your procedures
 - Actively manage your discrepancies