

Power Plant Simulators – NRC Perspectives

Theresa Buchanan
Reactor Engineer – Examiner Qualified
Operator Licensing and Training Branch
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Agenda

- Simulator Regulations
- Regional Perspectives
- Simulator Modification and Testing
- Simulator Fidelity
- Exam Security Violations
- Positive Performance Example



Simulator Regulations

- 10 CFR Part 55.4 “Definitions”
 - Plant-referenced simulator – simulator modeling the systems of the reference plant with which the operator interfaces in the control room, including operating consoles, and which permits use of the reference plant’s procedures
- 10 CFR Part 55.31(a)(5) “How to Apply”
 - Control manipulations required for licensing may be performed on a plant-referenced simulator meeting 10 CFR 55.46(c).

Simulator Regulations

- 10 CFR Part 55.45(b) “Operating Tests”
 - Operating test performed in plant and on plant-referenced or commission-approved simulator
- 10 CFR Part 55.46 “Simulation Facilities”
 - Plant-referenced simulators must demonstrate expected response
 - Sufficient in scope and fidelity to conduct evolutions listed in 55.45(a)(1)-(13) AND 55.59(c)(3)(i)(A)-(AA)

Simulator Regulations

- 10 CFR Part 55.46 “Simulation Facilities”
 - Allow for completion of control manipulations
 - If used for the control manipulation requirement in 55.31(a)(5)
 - Most recent core load
 - Without procedure/simulator exceptions or training scenario deviation
 - Conduct testing, correct discrepancies, and have uncorrected performance test failures available for NRC review before initial or requalification test

Simulator Regulations

- 10 CFR Part 55.49 “Integrity of Examinations and Tests”
 - Ensure that simulator set-up does not compromise test integrity

Regional Perspectives

- Software modification testing and documentation
- Decreasing experience levels of simulator staff
- SBT evaluation
- Plant modifications
- Increase in simulator fidelity issues, findings, and violations

Simulator Modification and Testing

- Alarms observed in plant but not on simulator
- Relief valve failure to close
- Feedwater regulating valve leakage significantly different from reference plant
- Four green findings since 2014 on failure to conduct and evaluate simulator testing
- One green non-cited violation for failure to retain performance tests

Simulator Fidelity

- Seven green and one white violation since 2014
- Green violation of 10 CFR 55.46(c)
 - Manual control of reactor pressure using safety relief valves
 - Water level swings due to operation of safety relief valves much larger than simulator
- Green violation of 10 CFR 55.46(c)
 - Once through steam generator turbine bypass valve
 - **Negative training that challenged orderly shutdown (not reportable event)

Simulator Fidelity

- Green violation of 10 CFR 55.46(c)(1)
 - Did not model plant response when using main feed regulating valves in manual
 - Discrepancy existed since 1985
- Green violation of 10 CFR 55.46(c)
 - Instruments not modeled correctly
 - Control rod drift without the malfunction inserted
 - Enthalpy error in moisture separator reheater caused erratic main generator output readings

Simulator Fidelity

- Green violation of 10 CFR 55.46(c)(1)
 - Emergency diesel generator control switch
 - Caused equipment inoperability
- Green violation of 10 CFR 55.46(c)(1)
 - Condensate storage tank level would not lower below 5 feet
 - Reactor protection system fuses failure to de-energize

Simulator Fidelity

- Green violation of 10 CFR 55.46(c)
 - Control rod motor generator sets modeling resulted in control rods remaining withdrawn up to two minutes longer than plant design
 - Simulator modeled a safety injection with certain ATWS events
 - Since 1989

Simulator Fidelity

- White violation of 10 CFR 55.46(c)(1)
 - Simulator did not model feedwater leakage and resulting reactor level response after scram
 - Did not provide correct alarm response
 - Did not correctly model behavior of startup feedwater regulating valve controller
 - **Negatively impacted operations personnel performance in the actual plant during a reportable event**

Examination Security

- Three Green Violations related to simulators since 2014
- Green SL-IV violation of 10 CFR 55.49
 - Plant computer screens deleted data, but not parameter and axis labels

Examination Security

- Green violation of 10 CFR 55.49
 - Personnel in simulator booth not on security agreement
 - Exam material left in simulator
- SL-IV violation of 10 CFR Part 55.49
 - Exam related material not appropriately removed
 - Multiple occasions

Positive Performance Example

- Two unit site
- Modification installed on Unit 2, but not yet on Unit 1
- Unit 1 is reference unit
- Installed modification in simulator
- Training needs assessment performed
- Allowed by the applicable ANSI standard

Questions??



Theresa Buchanan
Theresa.Buchanan@nrc.gov
301-415-2789