

Physical Security Position Paper

NRC SMR Licensing Workshop
August 10, 2011



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Physical Security for SMRs

- Current security performance objectives will be met
- Security-informed design is key
- Appropriate approach for SMR designs must be identified through detailed technical analysis

Technical Considerations Affecting SMR Physical Security

- Reactor Coolant Boundary contained entirely within the RPV
- More passive physical barriers
 - Underground
 - Underwater
 - Sealed vault
- Greater simplicity in systems required for safe shutdown means fewer targets

Technical Considerations Affecting SMR Physical Security

- Smaller source terms
- Relatively larger passive heat sinks
- Longer time constants before any fuel thermal limits are approached
- Smaller total plant footprint

SMR-Specific Considerations

- Pre-application meetings with NRC
 - Identify security related regulatory requirements in context of specific SMR designs
 - Establish clear approach to meeting performance objectives
- Design Centered Working Groups
 - Used to drive standardization
 - Facilitates integration of operational security considerations into design

SMR-Specific Considerations

- Technology neutral framework
- Performance-based licensing process
- Physical protection capabilities integrated into design
- Scope of security issues (e.g.)
 - Security staffing
 - Insider threat
 - Cyber security
 - Beyond design basis events

SMR-Specific Considerations

- Current regulations can be adapted to reflect design features
- SMR design features simplify security operations
- Integration of security at early design stage improves efficiency of the licensing process
- Security staffing needs to be appropriate for specific designs

Conclusions

- SMRs will meet performance-based outcomes consistent with current regulations
- Identify security related regulatory requirements in context of specific SMR designs early on
- Guidance developed from technology specific NRC and Design Centered Working Group engagements
- Anticipate completion of paper by end of 2011
- Look forward to further engagement with NRC at future public workshops

Industry Control Room Staffing Position Paper

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Control Room Staffing

- Getting it right is essential to safe and reliable performance during normal operations and accident management
 - Evaluating approaches to determine appropriate control room staff complement for SMRs
 - Analysis of operator workload indicates that appropriate control room staff complement will be different from that of operating fleet
- Engaging with the NRC staff to achieve alignment on approach

Position Paper Objectives

- To review the process for assessing crew complements for licensed operating personnel
- To identify lessons learned for ensuring appropriate control room staffing is achieved in timeframes that support SMR design, construction and startup
- To identify whether new regulations or regulatory policy changes are needed to support licensing SMRs

Evaluation of Current Regulatory Framework

- First-of-a-kind deployment will follow existing regulations using one of two options below
 - Staffing requirements will either reflect the numbers identified in 10 CFR §50.54(m) table or exemption requests may be pursued as allowed by current regulations
 - Staffing requirements exemption guidance in NUREG-1791 informs the SMR optimized staffing
 - Nine review areas provide a template

Important to Determine Appropriate Control Room Staffing Complement

- Exemption Process (first plants)
 - Address design-specific control room staffing complement and number of reactors controlled from one control room
 - NUREG-1791 appears reasonable
 - Benefits from the products developed from a robust Human Factors Engineering Program
 - Process applicable to both Part 50 and 52 applications
 - Per NUREG 0800, applications will address:
 - Chapter 13: procedures and training
 - Chapter 16: staffing complement
 - Chapter 18: human factors program
 - Chapter 19: human reliability analysis

Important to Determine Appropriate Control Room Staffing Complement

- Petition for Rulemaking
 - Subsequent SMR deployments may petition for rulemaking
 - An HFE process that conforms to the guidance in NUREG-0711 and evaluates issues identified in NUREG-1791
 - Could cover all SMRs with a process approach versus a prescriptive approach to staffing
 - Focus on a proven process that can consistently be used to identify the right staffing complement

Applying HFE Program Process to Control Room Staffing

- HFE program review model described in NUREG-0711
- Iterative process used to determine basis and level of staffing:
 - Analysis
 - Design
 - Verification and Validation
 - Implementation

Applying HFE Program Process to Control Room Staffing

- Analysis Phase
 - Operating Experience Review
 - Experience from existing nuclear facilities and other industries
 - Use of engineering simulator and mock up in an iterative design process
 - Provide basis for incorporation of feedback into plant design at the beginning of the design process
 - Functional Requirements Analysis and Function Allocation
 - Evaluate new and different functions associated with SMR designs (e.g. passive features, design simplicity, increased response time)
 - Capitalize on human strengths and avoid allocating functions that would be negatively affected by human limitations

Applying HFE Program Process to Control Room Staffing

- Analysis Phase (continued)
 - Task Analysis
 - Address design-specific considerations
 - Similar to process for existing reactors
 - Staffing Qualifications
 - Design-specific considerations for number and qualifications of personnel
 - Develop specific job definitions and staffing plan
 - Human Reliability Analysis
 - Evaluate the potential for human error that may affect plant safety
 - Minimize personnel errors, allow their detection, and provide recovery capability

Applying HFE Program Process to Control Room Staffing

- Design Phase
 - Human-System Interface (HSI) Design
 - Translate functional and task requirements to the detailed design of displays, alarms, controls and other aspects of the HSI
 - Procedure Development
 - Develop procedures from the same design process and analyses as the HSI and training
 - Training Program Development
 - Based on the systematic analysis of job and task requirements
 - Establish an approach for developing personnel training
 - Evaluate the knowledge and skill-requirements
 - Coordinate the development of the training program
 - Implement training consistent with human factors principles and practices

Applying HFE Program Process to Control Room Staffing

- Verification Phase
 - Human Factors Verification and Validation
 - Comprehensively confirm that the final design conforms to the HFE design principles
 - Verify that the HSI supports personnel task requirements as defined by task analysis
 - Verify that the HSI is designed to accommodate human capabilities and limitations
 - Validate the integrated system design acceptably supports safe plant operation

Applying HFE Program Process to Control Room Staffing

- Implementation Phase
 - HFE Design Implementation
 - Well-defined and carefully monitored during startup procedures and testing
 - Human Performance Monitoring
 - Verify the confidence developed by the completion of the integrated system validation is maintained over time
 - Submit a human performance monitoring strategy to ensure that no safety degradation occurs due to plant changes and to verify that the conclusions remain valid over time

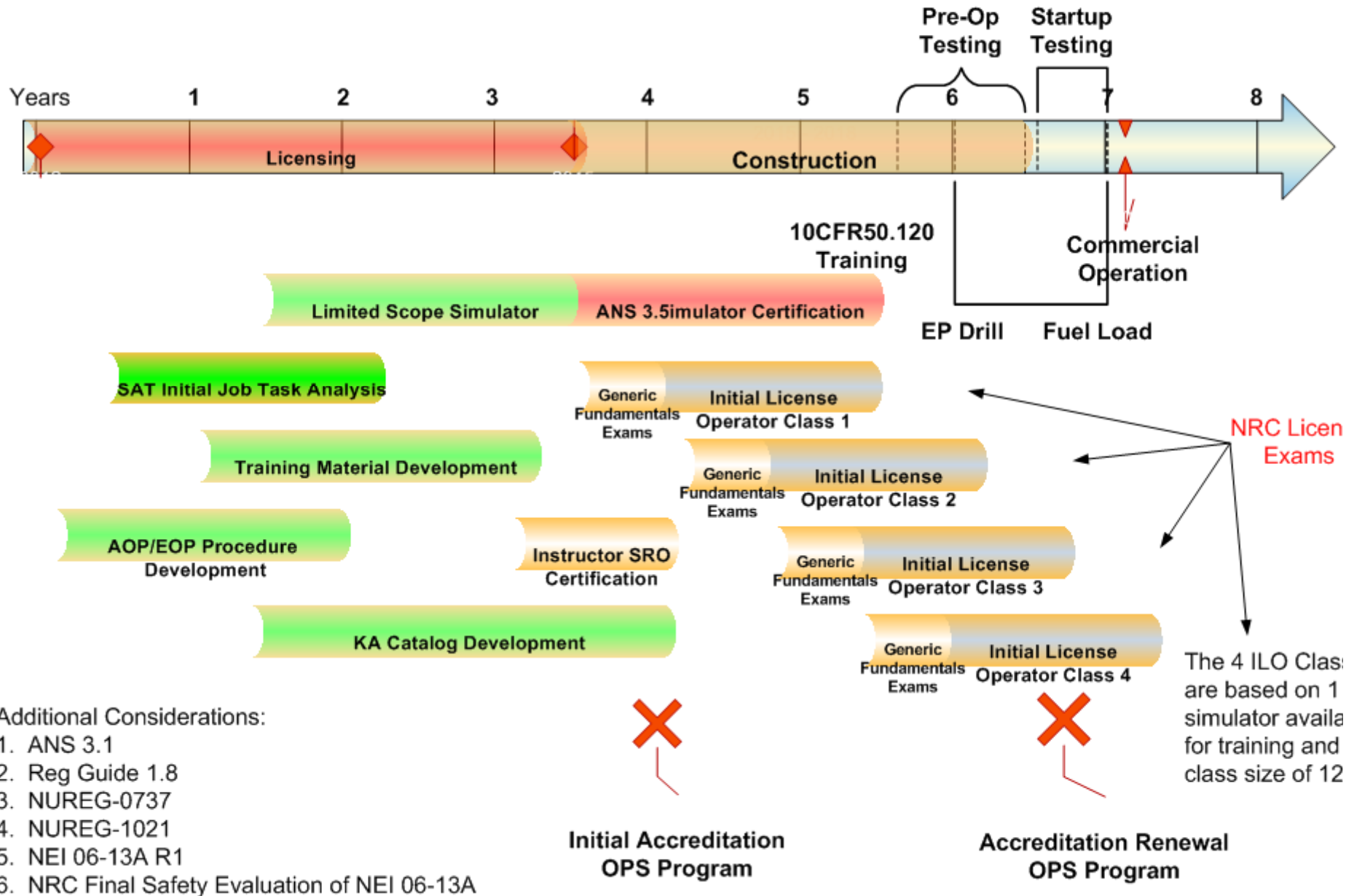
Near-Term ALWR Lessons Learned

- Standardization is key
- Knowledge and Ability Catalog needs to be developed in parallel or immediately following job/task analysis
- The initial accreditation process for new training programs can be used to identify and correct training deficiencies before training of first students
- Training task analysis must be comprehensive and complete prior to starting training design phase
- A close relationship must exist between the utility training material developers and the vendor design

Near-Term ALWR Lessons Learned

- Early use of simulator
 - Supports iterative design process
 - Allows for human factors evaluation and for development of training materials
 - Validates normal, abnormal, and emergency procedures
- Simulator development is important to instructor certification
- Careful consideration of class size, simulator availability, staffing lead times, initial class duration, must be factored in to the planning and scheduling

Representative Timeline for License Operator Training



Conclusions

- Getting it right is essential to safe and reliable performance during normal operations and accident management
- Standardization throughout is key
- The human factors engineering program review model described in NUREG-0711 provides a reasonable basis for analysis, design, verification and validation, and implementation of the process
- Iterative design process supports identification of appropriate control room staffing complement
- Near term SMRs can be licensed using existing regulations including the exemption process
 - The exemption process outlined in NUREG-1791 appears reasonable
- For follow-on SMRs, rulemaking may be petitioned using a process similar to that outlined in relevant NUREGs

Position Paper Schedule

- Draft position paper in progress
- Feedback to be incorporated from today's meeting and recently-issued SECY-11-0098
- Task Force review in August
- Paper completion expected 3rd quarter