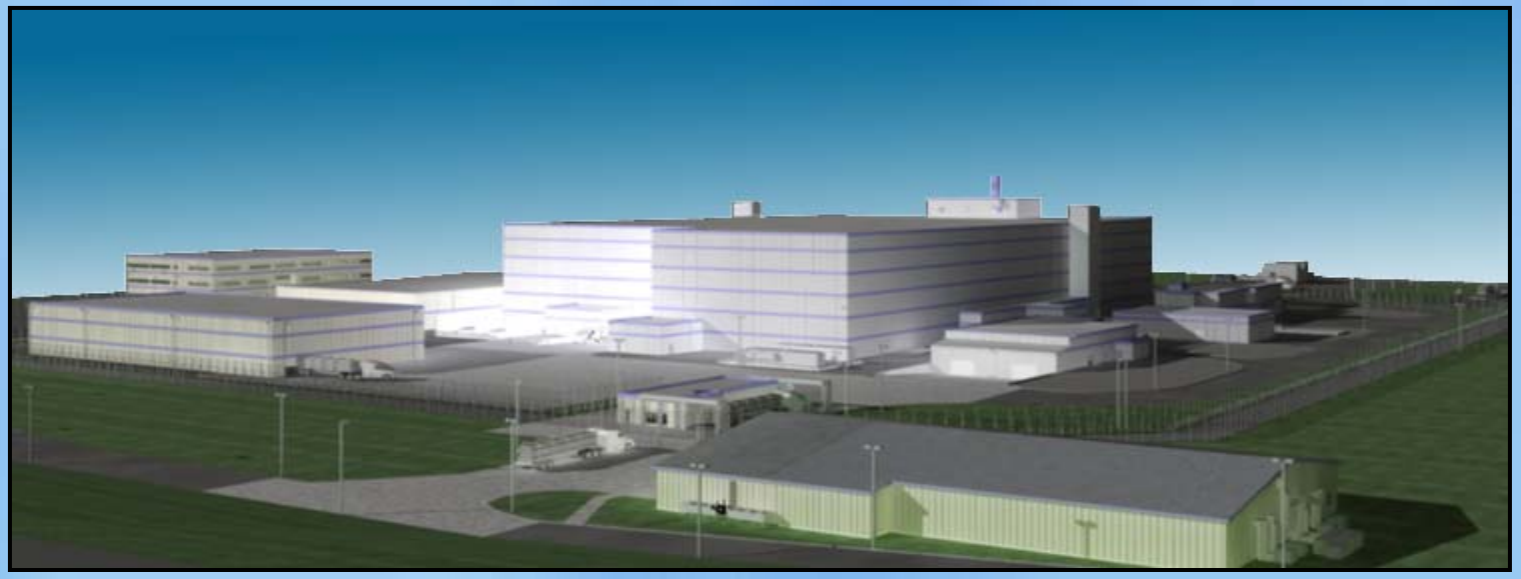
MOX FUEL FABRICATION FACILITY

NNSA National Nuclear Security Administration

DOE 2010 ISM Champions Workshop

The Safety Component of Design for the MOX Fuel Fabrication Facility (MFFF)



ISA Process/Event Development

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Presenter

- Scott Salzman is a nuclear engineer in the Nuclear Safety Group working on the MOX Project for Shaw AREVA MOX Services here at Savannah River Site (SRS). He is an employee of AREVA Federal Services and has worked on the MOX Project since March 2000.
- Mr. Salzman has 35 years of experience in the nuclear field including naval nuclear propulsion, commercial power reactor, test reactor, and nonreactor nuclear facilities. Mr. Salzman has been performing safety analysis activities for nonreactor nuclear facilities since 1989. Currently he supports the Integrated Safety Analysis and License Application for the MOX Fuel Fabrication Facility (MFFF) under construction at SRS.

Integrated Safety Analysis

- Purpose
  - Provide a systematic approach to identify all relevant hazards that could result in unacceptable consequences
    - Conservatively evaluates hazards
    - Identifies appropriate protective measures
  - ISA is required by 10 CFR 70.62 to demonstrate compliance with performance requirements of 10 CFR 70.61
    - High consequence events are made highly unlikely
    - Intermediate consequences are made unlikely
    - Criticality events are prevented

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Integrated Safety Analysis

- Risk-informed / performance-based regulation
  - Allows for qualitative approach for evaluating event likelihood
    - Highly unlikely: Events originally classified as Unlikely or Not Unlikely to which sufficient IROFS are applied to further reduce their likelihood to an acceptable level
    - Unlikely: Events originally classified as Not Unlikely or those that are not expected to occur during the lifetime of the facility to which sufficient IROFS are applied to further reduce their likelihood to an acceptable level
    - Not unlikely: Events that may occur during the lifetime of the facility

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Integrated Safety Analysis

- Highly unlikely is achieved by applying the following design criteria to Items Relied on For Safety (IROFS)
  - Application of the single failure criteria or double contingency
  - Application of 10 CFR 50 Appendix B / NQA-1
  - Application of Industry Codes and Standards
  - Management Measures, including surveillance of IROFS (i.e., failure detection and repair, or process shutdown capability)

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ISA Methodology Major Steps

- Determine hazards
  - Internal to the facility
  - Natural phenomena hazards (NPHs)
  - External man-made hazards (EMMHs)
- Determine radiological hazards
- Determine chemical hazards
  - Associated with licensed material and hazardous chemicals produced from licensed material
- Develop potential event scenarios for hazards

ISA Methodology Major Steps

- Determine consequence and likelihood of potential events
- Determine Items Relied On For Safety (IROFS)
  - Including safety function characteristics of their preventive / mitigative features
- Demonstrate that the IROFS will perform their intended safety functions when necessary
- Prepare the ISA and maintain it for the life of the facility

ISA Methodology

- 1st Phase: Safety Assessment / Construction Authorization Request

- 2nd Phase: Integrated Safety Analysis / License Application and ISA Summary

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ISA Methodology

- Safety Assessment Phase
  - Identify hazards and events associated with MFFF design and operations
  - Identify safety strategy and associated Principal System, Structures and Components (PSSCs) required to mitigate or prevent these events, and identify their design bases
  - Describe PSSCs capability through commitment to codes, standards, and preliminary design
  - Proper implementation of PSSCs verified during NRC construction inspections

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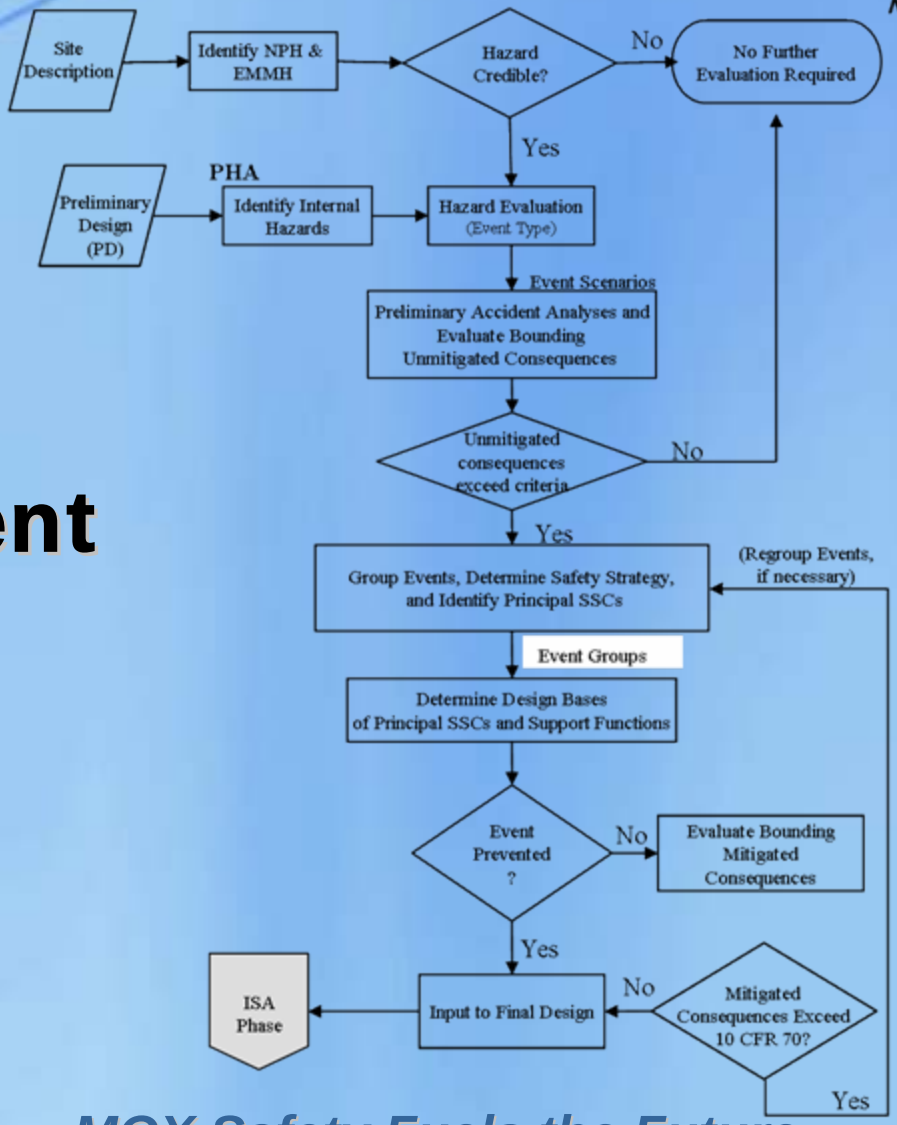
Safety Assessment Phase



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ISA Methodology

- ISA Phase
  - Identify IROFS at component level
  - Demonstrate IROFS are adequate to ensure the performance requirements of 10 CFR 70.61 are satisfied
  - Ensure IROFS reliability & availability via supporting management measures and QA

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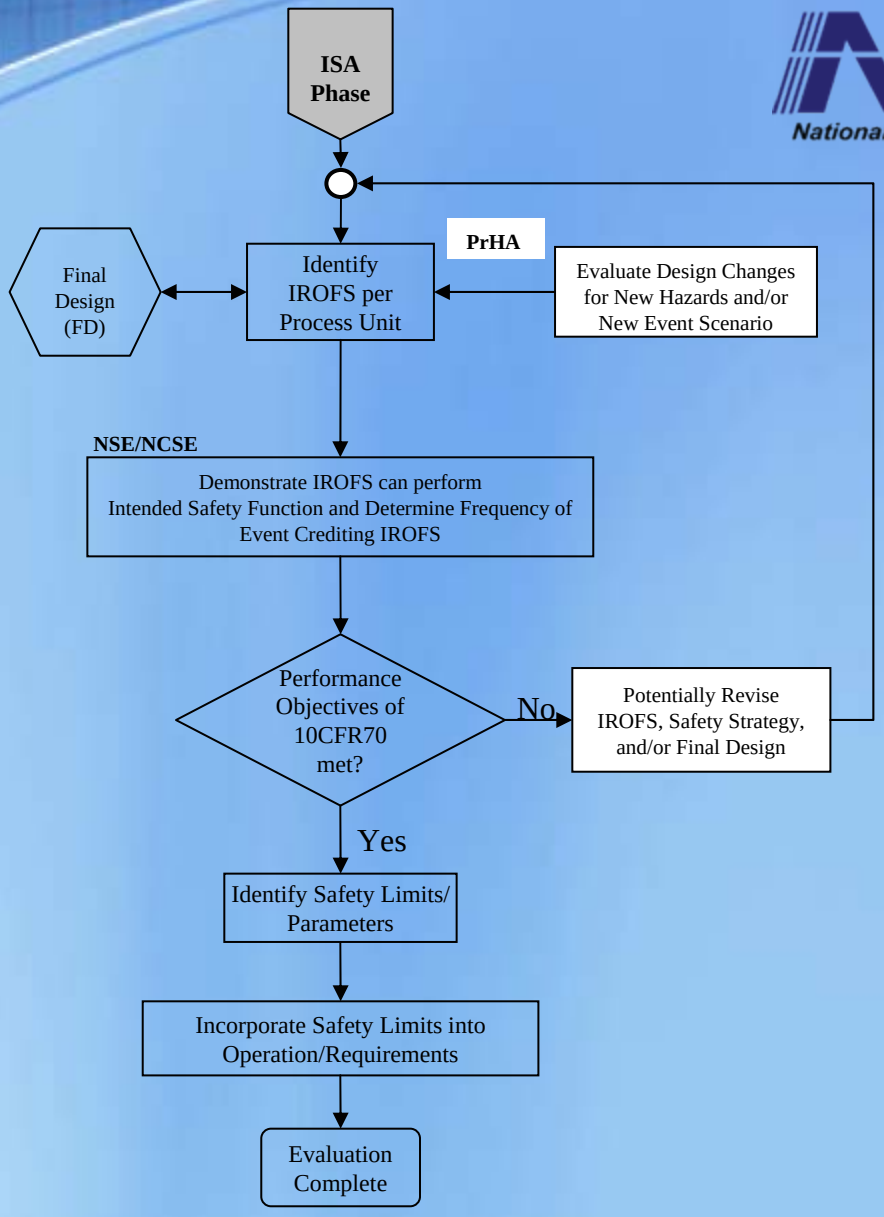
ISA Phase



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ISA Methodology

- ISA Phase
  - Process Hazards Analyses (PrHAs)
    - Hazop/What-If for each unit/area
  - Nuclear Safety Evaluations
    - Demonstrates that 10 CFR 70.61 performance criteria are satisfied for non-criticality events (fire, loss of confinement, explosion, etc)
  - Nuclear Criticality Safety Evaluations
    - Demonstrates that 10 CFR 70.61 performance criteria are satisfied for criticality events
    - Demonstrate compliance with double contingency requirements

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ISA Methodology

- Process Hazards Analyses (PrHAs)
  - Detailed evaluations performed for each process unit/area to identify specific event scenarios, including causes of the events, and associated prevention and mitigation features (IROFS)
  - All modes of operation are considered: startup, normal operation, shutdown, and maintenance
  - Software malfunctions, including communication and common mode malfunctions, are considered
  - Event causes include personnel actions and in-actions (e.g., operator error) that could result in adverse consequences

ISA Methodology

- Nuclear Safety Evaluations
  - Integrate results of the PHA, PrHAs and other safety analyses to demonstrate that the performance requirements of 10 CFR 70.61 are satisfied
  - NSE for each event type: explosion, loss of confinement, fire, load handling, & NPH/EMMH
  - Identifies the selected safety strategy for each hazard event scenario and the IROFS required to implement the safety strategy
  - Describes each IROFS to show that the IROFS is capable of reliably performing its safety function

Integrated Safety Analysis

- Conclusion
  - Robust and systematic approach to analyzing MFFF hazards and potential accident sequences
  - IROFS identified to protect the public and workers
  - Demonstrates compliance with 10 CFR 70.61 requirements

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