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FUEL FABRICATION FACILITY

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Integration of Safety in Design in MOX Fuel Fabrication Facility
Sue King

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Sue King

- B.S. degree in Chemical Engineering from Virginia Tech
- Started her career working at the Charleston Naval Yard refueling nuclear submarines.
- Worked for the Department of Energy for about a decade in various positions at SRS and Pantex.
- Worked for the SRS M&O contractor for about a decade.
- Since 2006, she has worked for Shaw AREVA MOX Services on the MOX project. Her current position is VP of Projects.

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U.S. Pu Disposition Program

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Plutonium Pits

Weapons Dismantlement at Pantex

Interim Storage at Pantex

Pit Disassembly & Conversion at Savannah River

MOX Fuel Fabrication

Burn in Existing, Domestic Commercial Reactors

Aqueous Purification

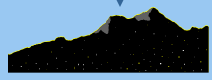
Non-Pit Plutonium

Clean Metal

Impure Plutonium Oxide

Interim Storage at SRS

Spent fuel is unsuitable and unattractive for use in nuclear weapons



Geologic Repository

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Regulatory Regime

- U.S. Congress mandated (Public Law 105-261, 17 October 1998, Section 3134) the MOX Fuel Fabrication Facility will be:
  - Licensed and regulated by the NRC
  - Comply with Occupational Safety and Health Administration Act of 1970
- DOE and NRC requirements met for Physical security
- NRC requirements for MC&A
- MOX Services is the licensee

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Applicable Regulations

- 10 CFR 70, Domestic Licensing of Special Nuclear Material
- 10 CFR 20, Standards for Protection Against Radiation
- 10 CFR73, Physical Protection of Plants and Materials
- 10 CFR 74, Material Control and Accounting for Special Nuclear Material
- 10 CFR 50 Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.

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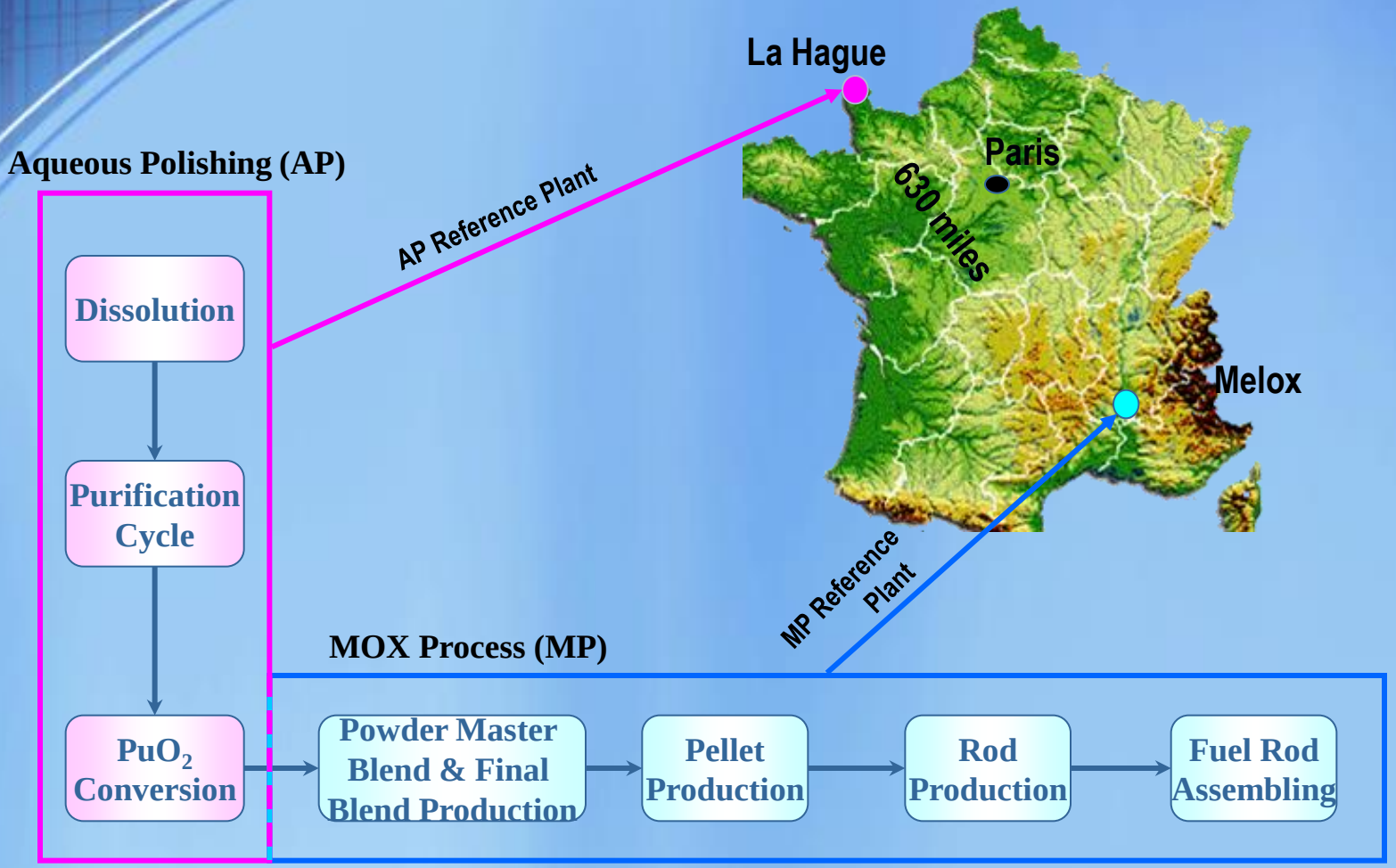
Reference Plants



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Key Statistics

- Total Project Cost $4.86 B
- Concrete: 170,000 cubic yard
- Reinforcing Steel: 35,000 tons
- Cable Tray: 47,000 linear feet
- Power/control Cable: 3,600,000 linear feet
- Process piping: 85 miles
- Gloveboxes: ~ 200
- Cells: 24
- Analytical Lab: ~85 gloveboxes
  >30,000 analyses/year

Key Milestones

• Submit Construction Authorization Request (CAR) to NRC	2/2001
• SER and NRC authorization to start construction	3/2005
• DOE authorization to start construction (CD 3)	4/2007
• Start MFFF Construction	8/2007
• End of Construction	6/2015
• Begin Hot Startup (Pu in plant)	10/2016*

*The construction schedule includes 16 months of contingency. Hot Startup is currently tracking to begin in summer of 2015.

Construction Authorization Request

- Developed and submitted 2/2001
- ~2000 pages
- NRC issued ~250 Requests for Additional Information (RAIs)
- 4 years from time of submittal until NRC issuance of SER
  - Updated during NRC review
- Based on conceptual design and early preliminary design
- Defines safety systems at the system level

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Start of Construction August 1, 2007

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Operating License Application

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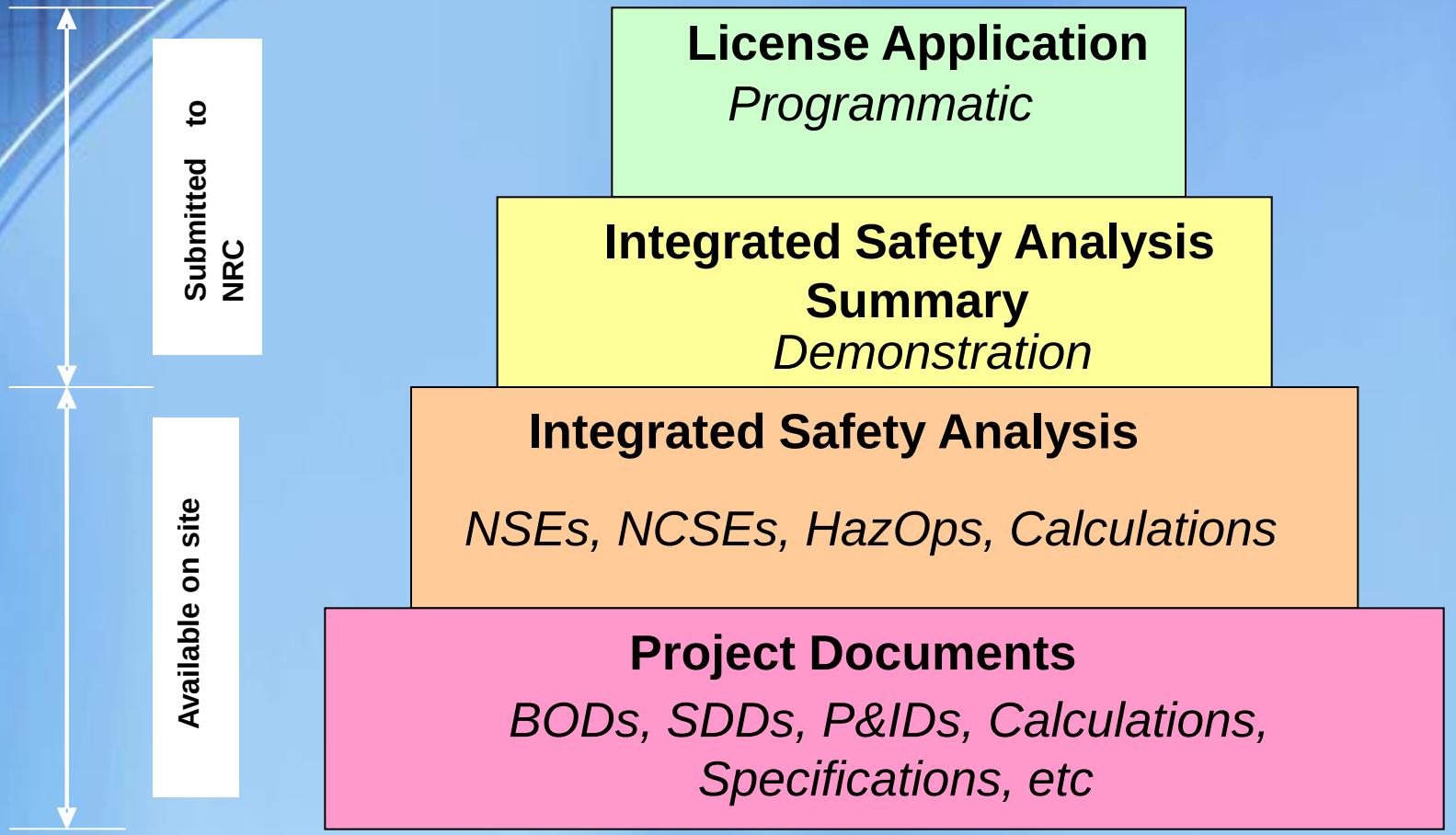
- Submitted to NRC 9/2006
- Document Set
  - License application (2000 pages)
  - Integrated Safety Analysis Summary (3800 pages)
  - Fundamental Nuclear Material Control Plan
  - Classified Matter Protection Plan
  - Physical Security
    - Physical Protection Plan
    - Training and Qualification Plan for Security Personnel
    - Safeguards Contingency Response Plan
  - Emergency Plan Evaluation

Document Hierarchy



Integrated Safety Analysis

- Systematic analysis to identify
  - Internal and external hazards
  - Potential event sequences
  - Likelihood and consequences (unmitigated)
  - Identify SSCs at the component level and activities of personnel relied on to mitigate or prevent event sequences
  - Demonstrate Items Relied on For Safety (IROFS) are effective, reliable, and available to meet specified performance criteria

ISA Continued

- Receptors
  - Facility worker (at location of hazard)
  - Site worker (100m from release point)
  - Individual Outside Controlled Area (IOC)
  - Environment
- Controlled Area boundary is about 160m from stack
- Both chemical and radiological hazards
- Must mitigate events with high consequences to "Highly Unlikely" and events with intermediate consequences to "Unlikely"

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Consequence Categories

Consequence Category	Facility and Site Worker	Individual Outside Controlled Area
High	TEDE $\geq$ 100 rem CC $\geq$ AEGL3, ERPG3, TEEL3	TEDE $\geq$ 25 rem CC $\geq$ AEGL2, ERPG2, TEEL2
Intermediate	100 rem > TEDE > 25 rem *3 > CC $\geq$ *2	25 rem > TEDE > 5 rem *2 > CC $\geq$ *1
Low	Less than above	Less than above

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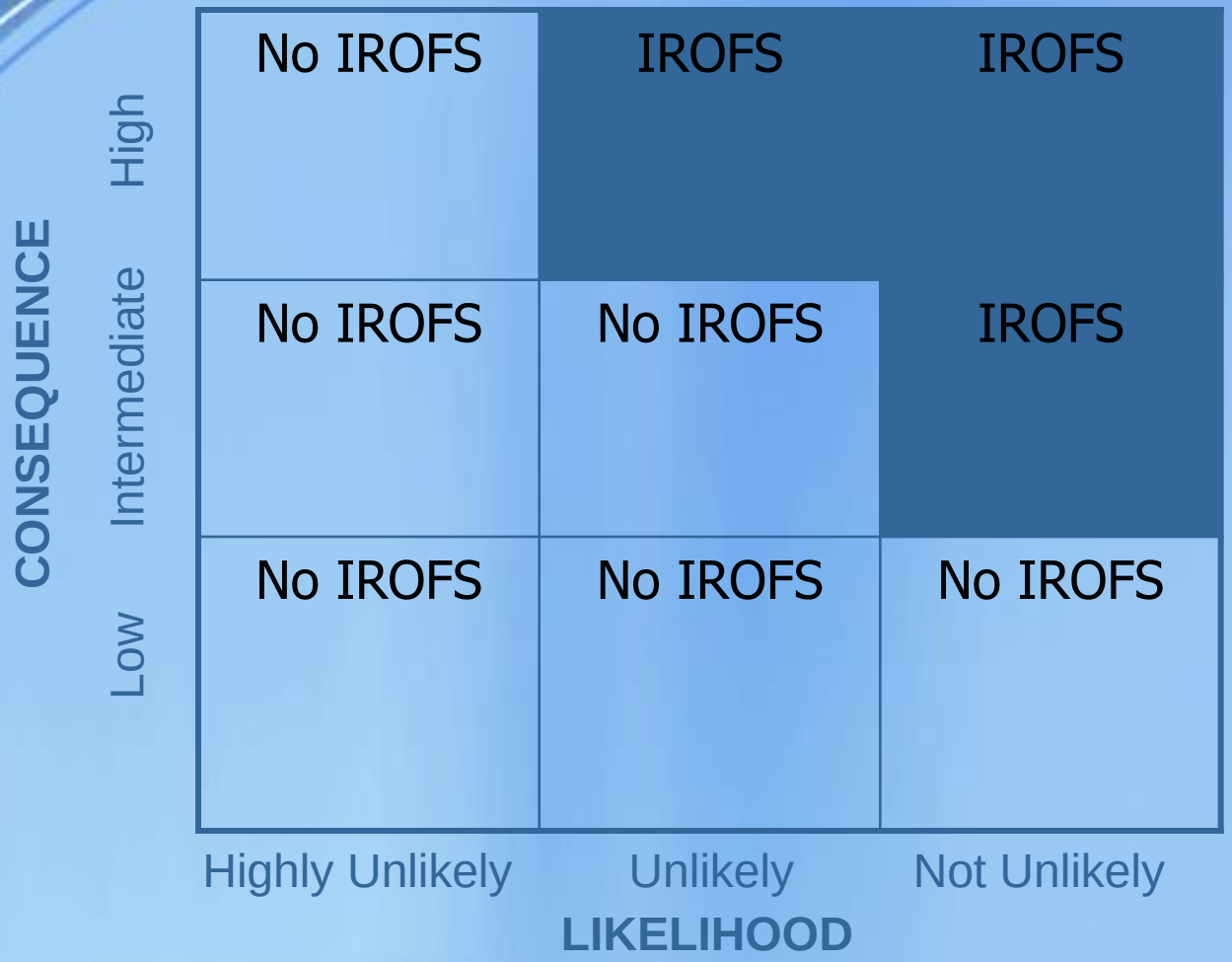
Risk Matrix



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Items Relied on For Safety Design Criteria

- Same criteria for systems protecting workers and public
- Robust design that is not susceptible to single-failure
- Consensus Codes and Standards
- Environmental qualification
- Failure detection

Additional Actions

- Perform design verification to ensure IROFS are appropriately incorporated into design
- Identify additional layers of controls for defense-in-depth
- Conduct Human Factors Engineering evaluations of administrative controls and human actions
- Update LA, ISA-S as needed during NRC review process
- Annual updates after NRC license received

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Status

- Overall Project is 37% complete
- Construction is 18% complete
- NRC Review of LA **to-date**
  - > 100 review meetings
  - ~ 600 RAIs
    - First round of RAIs complete
  - ~$10 million billed by NRC to pay for their review time
  - No significant design changes
- SER scheduled to be complete 2010

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June 11, 2009

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Conclusion

- Integration of safety into the design follows ISMS principles
  - Identify the hazard
  - Mitigate or prevent the hazard through design
  - Demonstrate that the public, workers, and environment are not adversely affected by the hazard
- Some differences from DOE regulated plutonium glovebox facility

http://www.moxproject.com