Criticality Safety Refinement at the MOX Fuel Fabrication Facility

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What is the MOX Project?

- **Mission**
  - Convert 34 metric tons of surplus weapons-grade plutonium to mixed oxide (MOX) fuel for use in U.S. commercial power reactors
  - Once irradiated, plutonium will meet the spent fuel standard –making it as inaccessible and unattractive for use in weapons
- **Impact**
  - Total lifetime cost $4.8 billion plus $200-300 million/year to operate
  - Removes about 10,000 warheads from the nuclear arsenal
  - Eliminates $500 million/year in security costs
  - Provides clean, carbon free energy that offsets over $21 billion in imported oil costs at $48/barrel (or $60 billion at $140/barrel)

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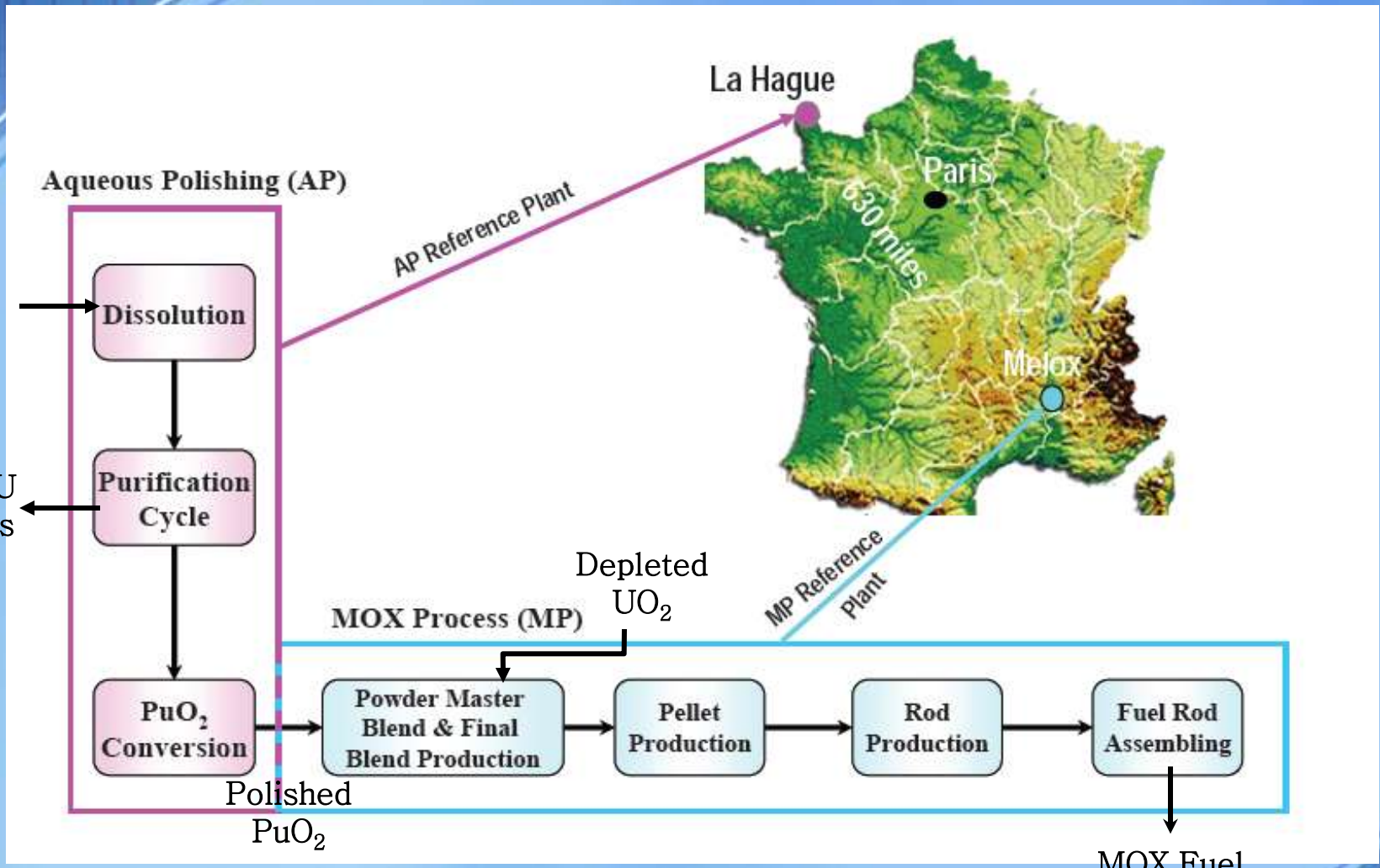

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Unique Aspects

- DOE funded with DOE oversight
  - **BUT** NRC licensed and regulated
- Weapon-Grade Pu versus Reactor-Grade
- DCP/HU Tables summarize NCSEs instead of NUREG-1718/1520-type Risk Scoring
- Highly automated process
  - 40,000 Control Inputs/Outputs
  - 80 non-safety PLCs
  - 36 safety PLCs

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Timeline Overview

- March 1999 – MOX Contract Awarded
- February 2001 – Construction Authorization Request Submitted
- March 2005 - NRC Issues Construction Authorization
- September 2006 - License Application and Integrated Safety Analysis Summary Submitted
- August 2007 - Construction Starts
- March 2009 – Response to NRC's First Round of Request for Additional Information
- December 2010 – NRC to complete SER and issue License
- June 2015 - Cold Start-Up
- September 2016 - Hot Start-Up

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September 12, 2008

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Construction Statistics (as of May 31, 2008)

- **Office Space** (of 600,000 square feet)
  - **Completed** 262,500 square feet
  - **In Process** 78,000 square feet
- **Concrete**
  - **Structural** 51,434 cubic yards (of 170,000)
  - **Unreinforced** 47,238 cubic yards (of 55,800)
- **Rebar** 9,697 tons (of 35,000 tons)
- **Embedded Plates** 10,331 plates
- **Conduit** ~0 (of 500,000 linear feet)
- **Cable tray** ~0 (of 47,000 linear feet)
- **Power/control cable** ~0 (of 3,000,000 linear feet)
- **Process piping** limited (of >80 miles)
- **MOX Project Employment** 1,523

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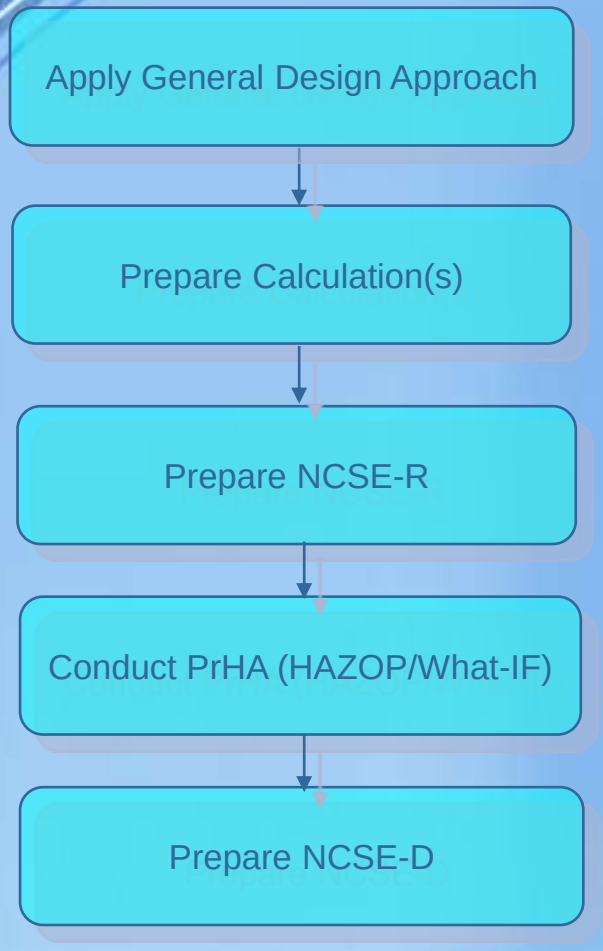
Current MOX Challenges

- Finding NQA-1 Vendors
- Obtaining Commercial Grade Dedication of non-NQA-1 Vendor Equipment
- Graded Approach to IROFS in identifying Safety Function
- Workforce Revival
  - Revival of Manufacturing Base
  - Finding expertise (replacing retiring workforce)
  - Developing off-site training to build pool of qualified individuals for operations

NCS Approach and Products



- Established Validation (5 AOAs in 3 reports with NRC concurrence)
- Established ~100 separate Nuclear Criticality Safety Calculations
- Generated 48 separate NCSEs that
  - Identify Criticality Safety Controlled Parameters
  - Establish Controls on Credible Events
    - Inherently Highly Unlikely Event Controls
    - Double Contingency Events
      - Explicitly show two legs of DCP
      - Provide additional control properties (Redundancy/Diversity/Margin/Failure Detection)
  - Demonstration that likelihood of all credible events is "Highly Unlikely"

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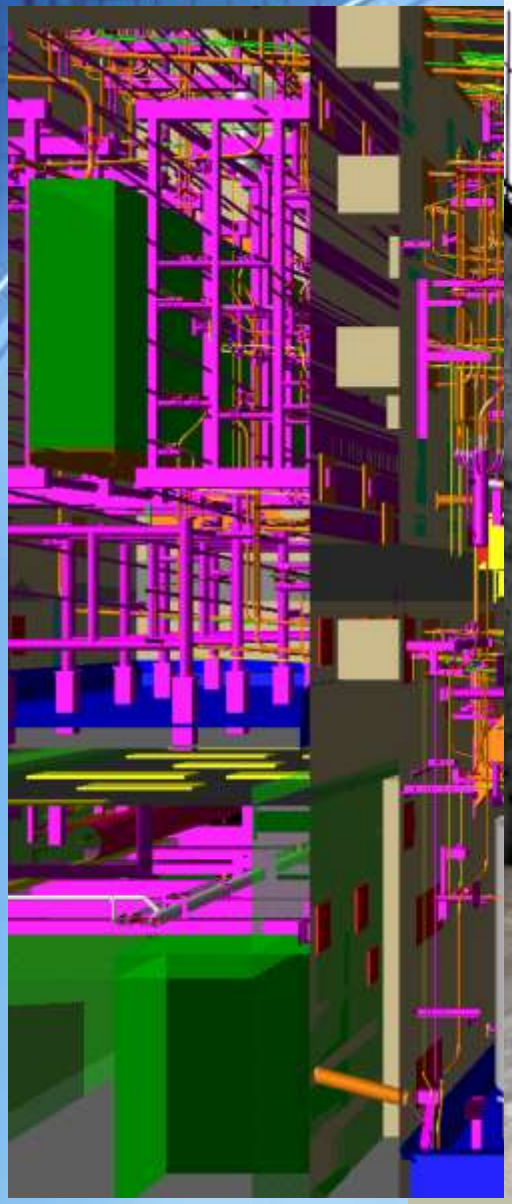
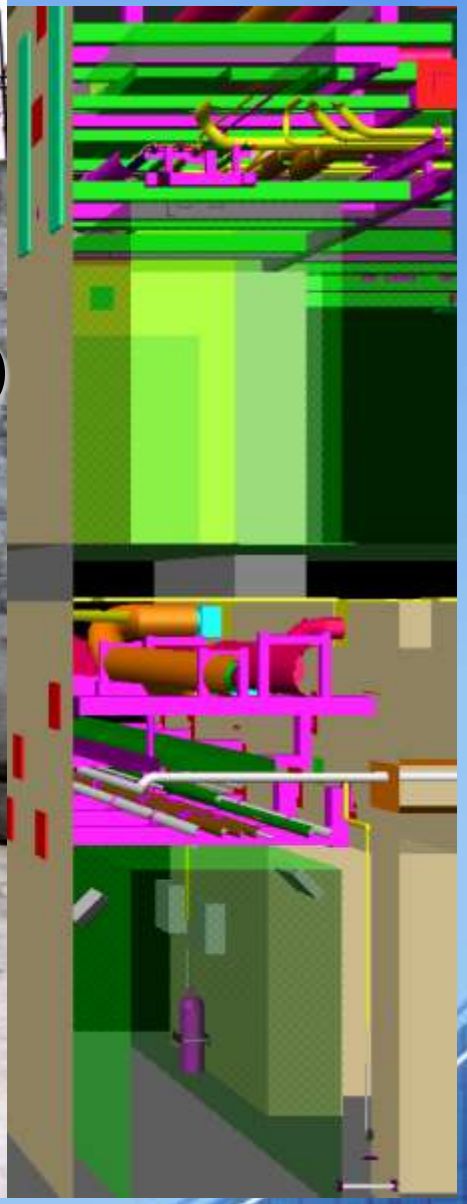


Actual Cell (Before Tank Placement)



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NCS Program & NCSE Evolution

- NCS Staffing
  - Originally near 100% French
  - Augmented mix of American and French expertise
  - Transitioning to In-plant base
  - Growing new NCS Engineers
- QA/QC inspection of NCS-controlled equipment leads to
  - dealing with contract/equip changes
  - dealing with non-conformances
- Continuous improvement of NCSEs to facilitate
  - improving safety function declaration through increased equipment detail knowledge

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NCS Challenges in Construction

- Application of a graded approach to quality level selection of subcomponents
  - gaskets and seals in powder QL-1 configuration-controlled components can be non-QL-1 and leak small gram quantities
  - certain structural subcomponents which do not contribute to structural and configuration-control qualification can be non-QL-1
- Commercial grade dedication when NQA-1 supplier not available
- Actual fabrication capabilities do not match idealized/modeled design and NCS calculations
  - Annular tank slight out of roundness accounted for in wall thickness tolerances
  - Cd poison sheets not continuous but rather separate sheets held in place by welding between SS covers resulting in unpoisoned dimples
  - Welding poison panels on slab tanks cause slight bulging, now accounted for in wall thickness tolerances


KPA-TK-


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Construction Continues…

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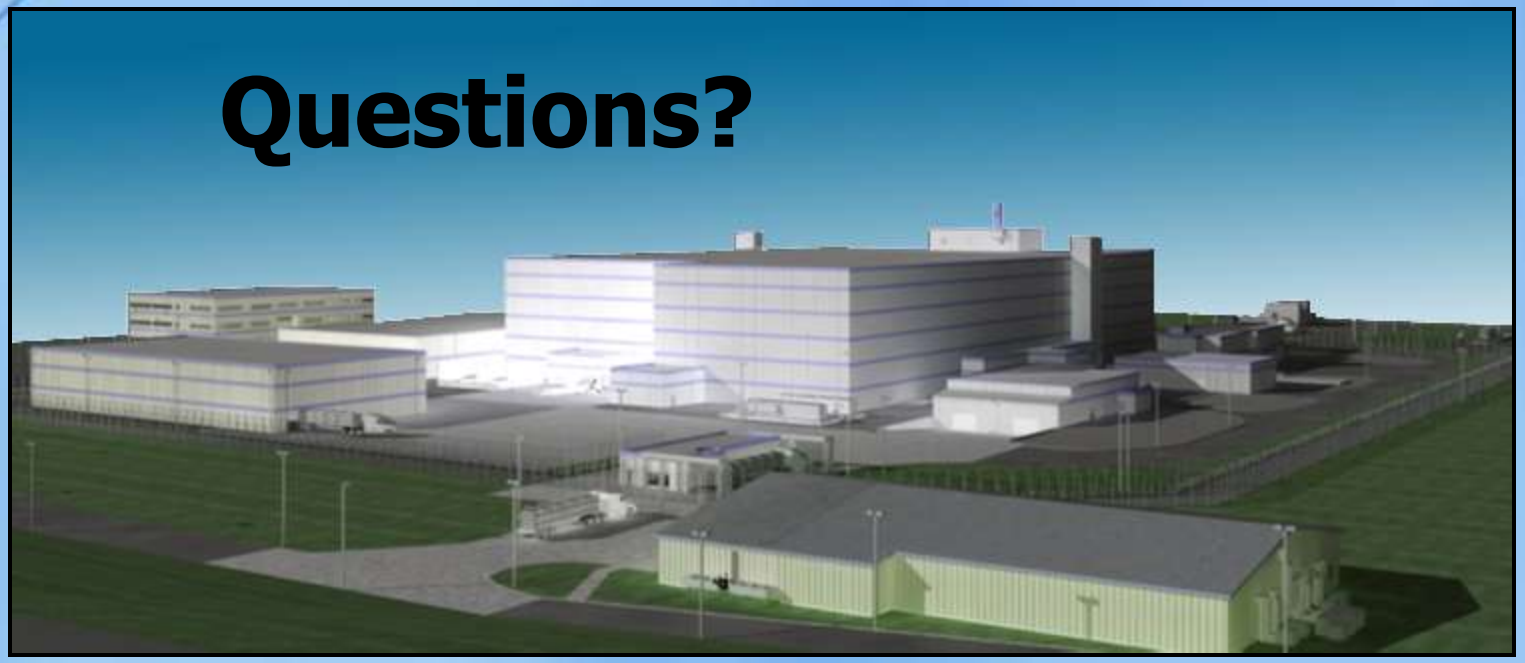
Questions?



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