



Recent Exelon Experience and Observations with Regulatory Oversight of Dry Cask Storage Implementation and Operations

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Dry Cask Storage Requirements

- ✓ Work involves fuel selection, inspection, movement to canisters, storage in overpacks, emergent equipment repairs (contingencies)
- ✓ Scope:

| | <u>2008</u> | <u>2009</u> | <u>2010</u> | <u>2011</u> |
|----------------|-------------|-------------|-------------|-------------|
| • Peach Bottom | 4 | 3 | 5 | 5 |
| • Oyster Creek | 0 | 0 | 4 | 0 |
| • LaSalle | 0 | 0 | 10 | 12 |
| • Quad Cities | 5 | 6 | 10 | 0 |
| • Dresden | 4 | 8 | 4 | 8 |
| • Limerick | 2 | 5 | 5 | 5 |
| • Byron | 0 | 0 | 8 | 0 |
| • Braidwood | <u>0</u> | <u>0</u> | <u>0</u> | <u>6</u> |
| Total | 15 | 22 | 46 | 36 |

Measuring Dry Cask Storage Success

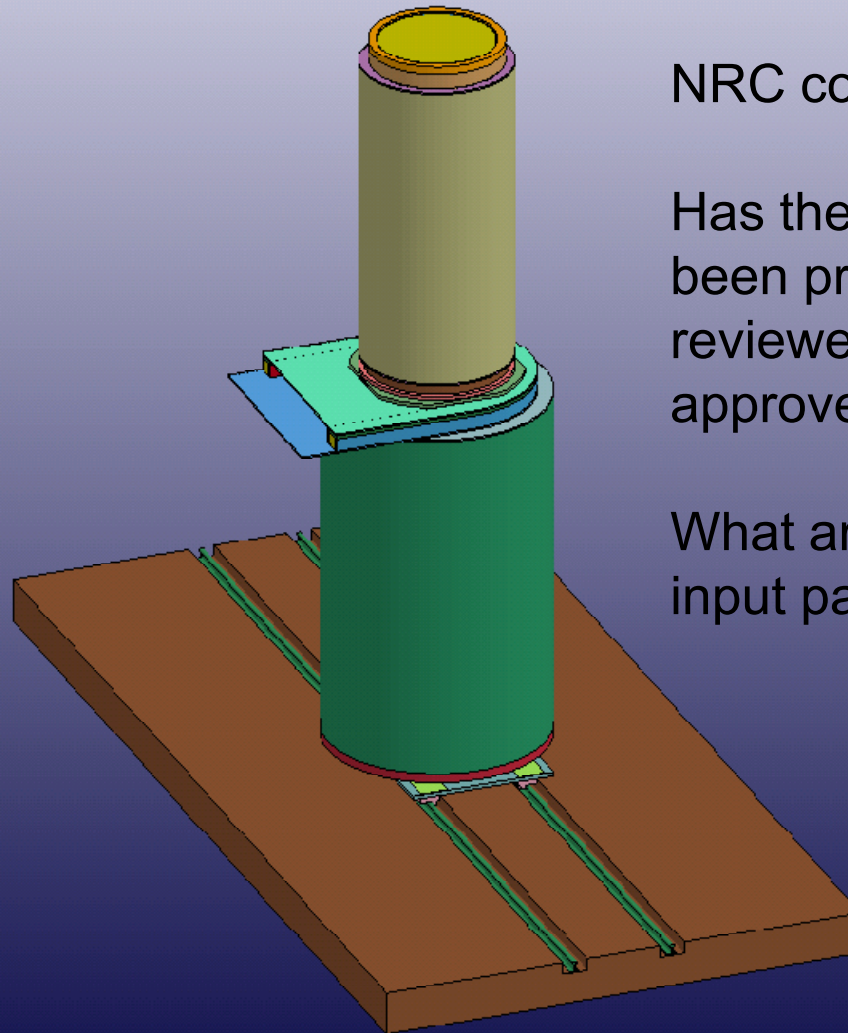
- ✓ Safe storage of spent nuclear fuel
- ✓ Ensure program compliance with applicable regulations
- ✓ Maintain sufficient room in spent fuel pools for plant operations
- ✓ However, NRC's additional focus on dry cask storage activities in the past two years has created substantial, unanticipated delays in initial ISFSI implementation and ongoing dry cask storage operations

NRC Additional Focus on DCS

- ✓ NRC questions vendor discontinuing factory weld helium leak test – technically valid, however NRC concluded that 72.48 supporting documentation was inadequate
 - Significant technical work to provide response
 - Extensive field work to leak test deployed systems in order to demonstrate no safety concern
- ✓ NRC regional inspectors' questions regarding “freestanding stackup” and other “freestanding” configurations in Part 50 facility
 - Does 50.59 adequately demonstrate prior NRC review and approval was not required? Was methodology previously reviewed and approved by NRC?
 - In light of NRC’s outstanding questions on Exelon’s existing 50.59 evaluation, NRC concluded there was a basic safety concern with the freestanding stackup (heavy load issue)
 - Exelon installing seismic restraints to satisfy the safety concern
 - Exelon revising 50.59 to demonstrate that the freestanding stackup is acceptable

Dresden Stack-up - dstack_matrix1-1 - SI Time-Hist 1, Bolts, UB Friction

Assembly 1
Geom Parts



NRC concerns:

Has the methodology
been previously
reviewed and
approved?

What are you using for
input parameters?

NRC Additional Focus on DCS (cont.)

- ✓ Overhead crane and reactor building modifications
 - Crane vendors used ASME NOG-1 to seismically qualify new single-failure-proof trolley, bridge and end trucks at Byron and LaSalle
 - NRC inspectors questioned the use of trolley-to-rail friction coefficients that permit sliding along rails – NOG-1 rules are silent about the use of friction
 - NRC considered the use of friction a deviation from an approved methodology that required prior NRC review and approval
 - New seismic analyses for crane supporting structure performed, using FEA model boundary conditions from original design basis
 - Original design basis equally applied crane horizontal seismic loadings on both sides of building
 - NOG-1 rules require application of seismic loading on one side only
 - NRC considered this deviation to require prior NRC review and approval

NRC Additional Focus on DCS (cont.)

- NRC inspectors question use of damping coefficients from NOG-1
 - Existing design basis had more restrictive values
 - NRC position is to use the more conservative values from existing design basis or NOG-1 rules
- To avoid further delays, final crane and building seismic design and analyses were redone to comply fully with NOG-1 rules and to use more conservative damping values
- At LaSalle, in particular, major modifications to both the reactor building structural steel and the overhead crane were required
 - Extensive addition of structural steel to reactor building
 - Addition of vertical seismic restraints on crane end trucks

NRC Additional Focus on DCS (cont.)

- ✓ ISFSI Concrete Pad Soil-Structure Interaction (SSI) Analysis
 - NRC questioned the use of NUREG-6865 in SSI analyses at Byron, Braidwood and LaSalle (among other concerns regarding the analysis)
 - NRC's position is that the NUREG was intended to assist inspectors in performing their review, and not intended to be used for design input w/out regard to analyzing site specific response at a higher confidence level, i.e. 95%.
 - Standard SSI analyses for all three sites were redone and submitted to NRC for review and acceptance of the analysis methodology and results.
 - The ISFSI Pad is considered to be Not-Important-To-Safety
 - The cask is designed to protect the fuel in the event of non-mechanistic tipover on the pad
 - There is currently no regulatory guidance on the required dynamic analysis for the ISFSI Pad

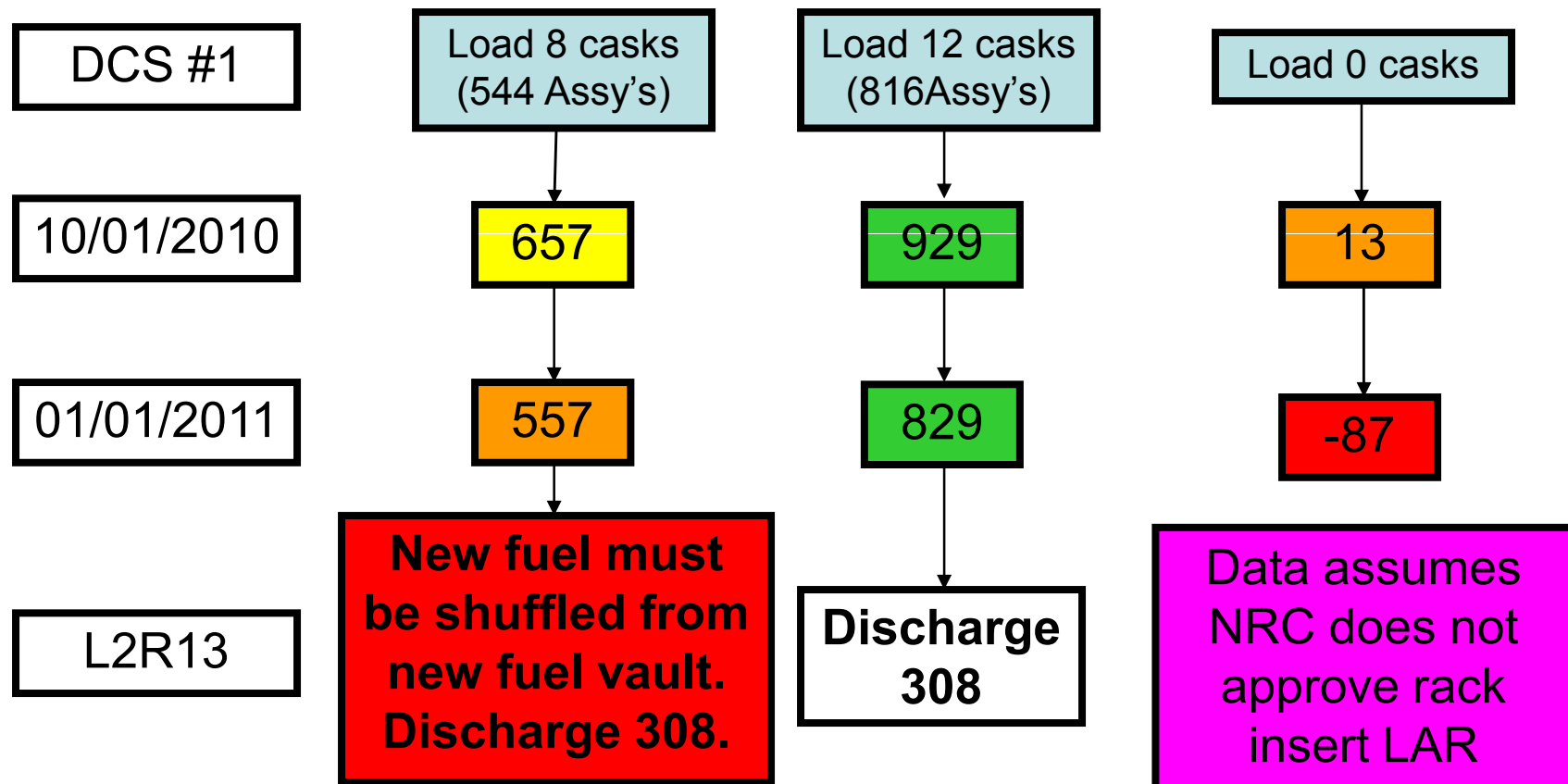
DCS Delays Severely Impact Operations - LaSalle SFP Capacity Case Study

- ✓ Boraflex[™] degradation in Unit 2 spent fuel pool continues to reduce available fuel storage locations
- ✓ Revised criticality analysis for spent fuel pool, assuming 3-of-4 storage and no credit for Boraflex[™] – 4th cell physically blocked
 - Submitted December 2007
 - Review delays encountered due to other NRC priorities and insufficient resources
 - Withdrawn June 2009 – NRC did not agree with Exelon's assertion that removing a cell-blocking device and inserting an assembly, was NOT a credible event

DCS Delays Severely Impact Operations - LaSalle SFP Capacity Case Study (cont.)

- ✓ Exelon issues revised criticality analysis for spent fuel pool, using NETCO SNAP-IN™ rack inserts
 - Submitted October 2009, requested June 2010 final response
 - Due to lack of resources and impending work load, NRC hired Oak Ridge to perform review
 - Initial RAIs received April 2010, Exelon response in June 2010
 - Informed by NRC that earliest response date is August 2010
 - In the interim, Exelon is installing inserts, at risk, into cells which have been declared inoperable due to Boraflex™ degradation
 - Based upon the extent of RAIs from NRC, Exelon is uncertain LAR will be approved
 - Due to lack of space in spent fuel pool, Exelon moving forward with DCS as a contingency – large loading campaign required

DCS Delays Severely Impact Operations - LaSalle SFP Capacity Case Study (cont.)



Essential Support from Vendors and Supporting Parties

- ✓ Nuclear utilities depend upon their primary and supporting vendors to be responsible for, and to understand, a wide variety of spent fuel storage issues
 - Validated seismic analysis – this means the methodology has been previously reviewed and approved by NRC in an SER
 - Regional inspectors' questions and concerns of vendor product quality required technical assistance from NRC Headquarters – which raised more questions and concerns, and significantly delayed project timelines at Byron, Braidwood and LaSalle
 - These actions jeopardized schedules, added costs, and result in uncertainty by NRC about the strength of licensee reviews of vendor work products.
- ✓ Licensees must participate by performing more aggressive in-house and independent third-party reviews
 - Ensure compliance with codes/standards and smooth NRC review process

Essential Support from NRC

- ✓ Nuclear utilities depend upon NRC regional inspectors to understand and stay current with applicable technology / models / analyses submitted to NRC for review
 - Durable guidance of sufficient engineering detail must be available in regulatory space to NRC field inspectors to assist them in the timely review of complex licensee engineering work products
 - Staff / inspector turnover challenges ability of licensees to provide “what we think they need” to perform inspection
 - Makes communication difficult between regulator and licensee when analytical assumptions accepted in previous inspections are no longer considered valid
 - Potentially leads to extensive – and sometimes unnecessary and very costly – rework
- ✓ Exelon’s recent experiences were highlighted by a number of occasions where NRC inspectors and Exelon staff could not agree on the interpretation of regulatory guidance or industry standards

Essential Support from NRC (cont.)

- ✓ Regions should have the ability to solicit rapid response from Headquarters, to assist in the local inspection process when required
 - When local inspectors must rely upon submitting analyses to NRC Headquarters for review, severely impacts licensee project schedules
- ✓ Licensees must participate by providing NRC Regions with sufficient detail regarding schedule and level of complexity of upcoming products to be reviewed during NRC's inspection process

A Path Forward in the New Environment

- ✓ Work aggressively to establish in advance, a schedule of milestones and deliverables – not just in house, but also with your NRC regional office
 - Identify all deliverables, and anticipated complexity of products
 - Include in your schedule, agreed-upon milestones for completion of NRC reviews
 - Help the regulators to be proactive in providing the appropriate resources for engineering product reviews
 - Exelon's recent experience with Region III, and their support of Exelon's needs, has been very positive using this approach
- ✓ Understand, and fully appreciate, the regulatory distinctions between the Part 50 and Part 72 licenses
- ✓ Do not hesitate elevating concerns or asking questions when clarity from the regulator is required

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