New Reactor Construction Lessons Learned

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Key Insights

• The importance of supply chain/vendor quality and oversight

• Achieving early alignment on seldom used consensus standards

• Improved regulatory approach for initial licensing of operators and other regulatory program areas

• Balancing level of detail and change control for 10 CFR Part 52 applications to ensure both safety and reasonable flexibility
Supply Chain and Vendor Performance

• Licensee identified some discrepancies for Safety Related items after receipt or at vendor facilities
  o Volume of primary system component
  o Fabrication details of civil engineering “modules”

• NRC identified some discrepancies – “modules”, rebar bend radius

• NRC investigation concluded Nuclear Safety Culture concern at “module” fabrication facility
Lifting over 1,200 tons, the heavy lift derrick places the CA01 module inside the Vogtle Unit 3 containment vessel.
Supply Chain and Vendor Lessons

• Importance of prior experience working under stringent QA requirements (whether Nuclear Safety Related or other)

• Importance of having design details and fabrication drawings fully finalized prior to commencement of fabrication

• Need for effective interface between NRC construction inspection and vendor inspection programs and staff.
Consensus Standard for Nuclear Concrete

• American Concrete Institute (ACI), Code Requirements for Nuclear Safety Related Structures, ACI-349-01
  o NRC staff/Industry disagreement over detail for anchoring walls to basemat
  o Departure from “typical” detail in design control document
  o Violation resulted in construction delay

• American Concrete Institute (ACI), Building Code Requirements for Structural Concrete and Commentary, ACI-318-19
  o Includes provisions not yet adopted into ACI-349
  o Industry and staff found its use acceptable for specific issues in subsequent license amendments
ACI Lessons

• Designers should push for Consensus Standards to be as current and unambiguous as possible.

• Fabricators/constructors should be judicious in departing from representations in the design control document/safety analysis report

• Licensees should monitor for differences between their safety analysis report and fabrication/construction drawings and push for communication with the regulator prior to the start of construction
10 CFR Part 55 Operator Licensing

• Historically, NRC oversaw “cold” licensing – no plant to gain experience on or computer-based simulators to operate

• Current regulation reflect a mature industry
  o “Simulators” that reflect the current plant
  o Practical exams that take place in the plant

• Extensive work between NRC and industry to plan for new construction operator licensing

• NRC late-identified concerns impacted operator-trainees and licensee
  o Acceptable “simulators”
  o Delays in construction impacting NRC guidance on timing of exams
Operator Licensing Lessons

- Issues resolved at Vogtle 3 & 4 through NRC approval of alternative simulator and departure from “guidance” on timing of licensing exams
- Rulemaking underway to fix 10 CFR Part 55 to recognize new construction
- Timing of licensing under Part 55 interesting logistical challenge/opportunity for vendors/licensees/operators
- Similar challenges/opportunities in other program areas: Emergency Planning, Security, Transportation, Fuel Cycle, etc.
Balancing Licensing Detail and Flexibility

• Existing reactors licensed to 10 CFR Part 50
  o Construction Permit w/ limited detail
  o Operating License after construction completed
    • Allows flexibility during construction
  o Advisory Committee review, Hearings, and Court challenges based on as plant as constructed

• New reactors to date licensed under 10 CFR Part 52
  o Design Certification of a reactor is done as Rule Making
    • Opportunity for Public comment at this stage
    • Finality for certified design
  o Combined License prior to construction
Resultant Challenge

• Providing sufficient information and detail prior to construction
  o Support development of the Safety Evaluation Report by NRC staff
  o Support independent assessment by the Advisory Committee on Reactor Safeguards
  o Support right for public meaningful participation in Rulemaking/Hearing/Court

• Allowing reasonable flexibility to deal with changes in supply chain, siting conditions, and the evolution of technology

• Key – Basis for confidence that reasonable flexibility doesn’t undercut the findings of Reasonable Assurance of Adequate Protection
Prior to Gaining Construction Experience

• Design Certification Control Documents get increasingly large

• The amount of information in the designs that required prior NRC approval to change grew

• In consequence, the cost to both the applicant and the NRC staff to do the reviews continued to grow, as did the duration of reviews to some extent
Construction Experience

• Details and lack of flexibility drove licensees to have to submit and NRC staff to review and approve numerous license amendments that were not safety significant

• NRC team went back to find the underlying causes of the increase in detail and rigid control
  o Standard Review Plan (NUREG 0800) requirement in Part 52
  o Inadequate understanding of all administrative tools, integrated safety from test programs, and lack of training in “Reasonable Assurance” fundamentals

• NRC and Vendors engaged more effectively on alternative ways to achieve appropriate control without forgoing reasonable flexibility
Actions to Rebalance

• Guidance to staff on licensing New Reactors. [Memo to New Reactor Business Line from F. Brown, NRO re: Expectations for New Reactor Reviews.](nrc.gov)

• New approach to content of Design Certification documents. [SECY-19-0034: Improving Design Certification Content](nrc.gov)

• Rule Making to align licensing regulations to address lessons described here, and others. [2021-01860.pdf](govinfo.gov)

• Rule Making for non-light water reactor licensing approach (10 CFR Part 53)
Thank You!

Questions?