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UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Regulatory Perspectives on New Plant Construction

2008 Nuclear Quality Oversight Conference
Omaha, Nebraska

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July 8, 2008

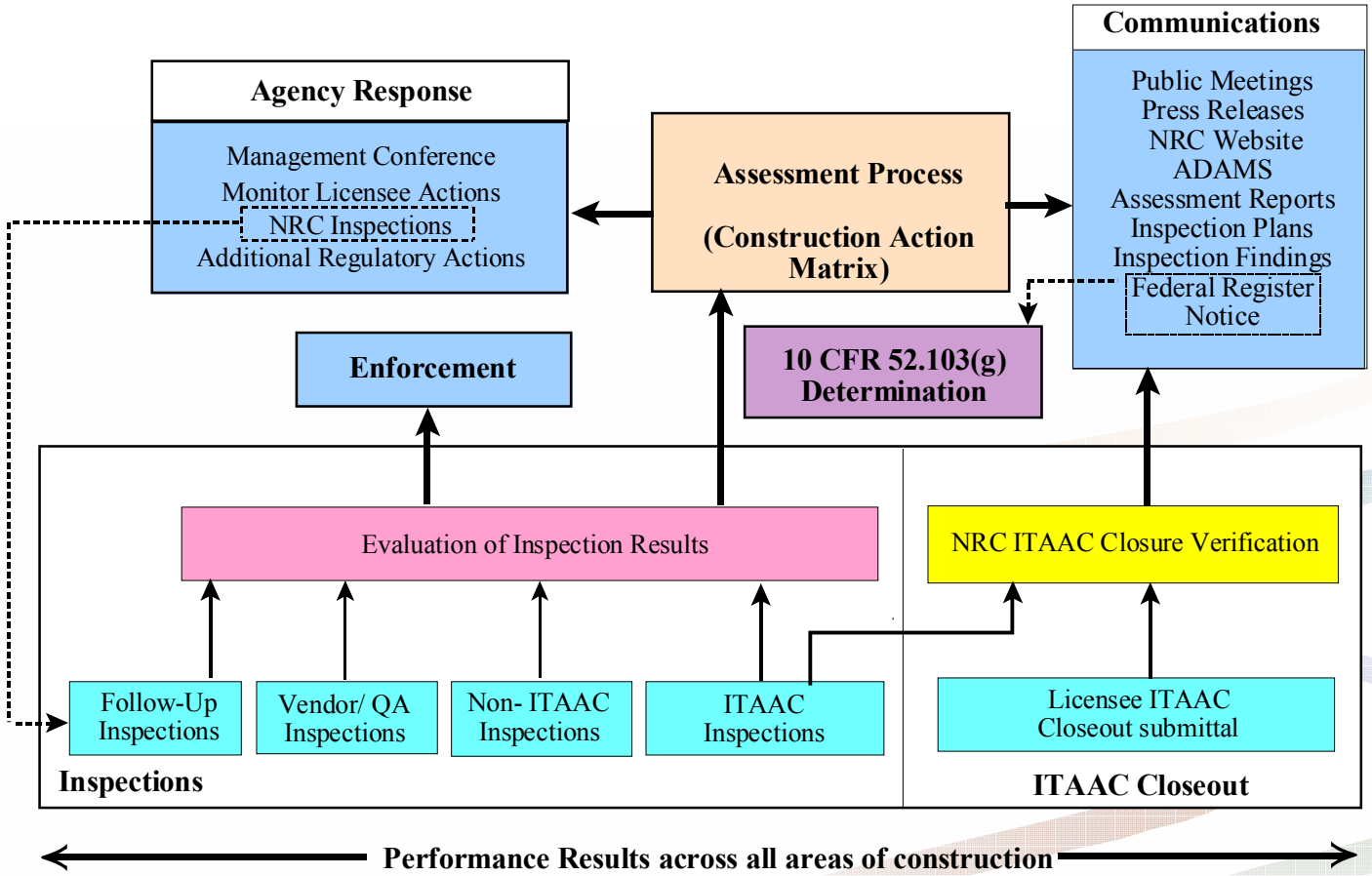
Purpose & Topics

- Purpose
  - To share insights on NRC's Construction Inspection Program and regulatory requirements for NRC oversight of construction activities
- Topics
  - Overall Construction Inspection Program (CIP) requirements and guidance
  - Early Site Permit (ESP), Pre-Combined License (Pre-COL), and Design Certification (DC) requirements and guidance
  - Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) and Operational Readiness (Non-ITAAC) requirements and guidance

Construction Inspection Program

- Ensure that plants are constructed in accordance with approved designs and safety regulations
- Determine operational readiness
- Communicate results to all stakeholders
- Ensure effective transition to operating reactor oversight program

Construction Oversight Process



Construction and Operational Experience Program

- Program Goals
  - Utilize construction experience gained from both international and domestic projects
  - Provide insights in support of NRC reviews and inspections
  - Improve safety and security

Historical Lessons Learned

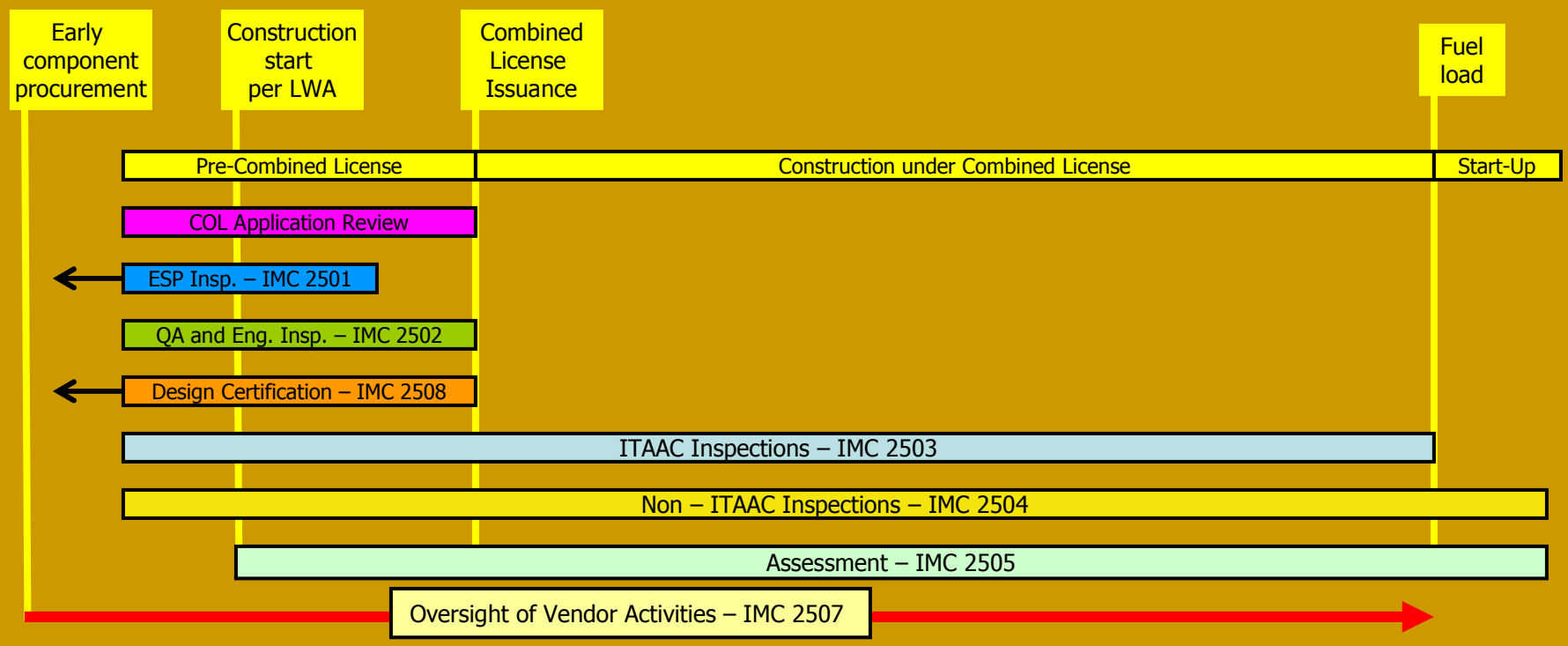
- Significant quality-related concerns identified in Information Notice 2007-04:
  - Inability of utility management to adequately control all aspects of the construction project
  - Inexperience with nuclear plant construction
  - False sense of security based on prior successes
  - Failure to encourage problem reporting and resolution
  - Failure to appropriately delegate authority
  - Failure to have clear communication pathways

Current Construction Insights

- Causal factors related to construction problems described in IN 2007-04:
  - Poor communication between design and construction organizations
  - Overconfidence in personnel
  - Ineffective problem ID, reporting and corrective action
  - Unrealistic and aggressive schedules
  - Inadequate assignment of responsibilities and authority
  - Vendor shortcomings
  - Subcontractor issues

NRC CONSTRUCTION OVERSIGHT HAS MULTIPLE COMPONENTS

Oversight will assure plants are constructed as designed.



Abbreviations

ESP – Early Site Permit
IMC – Inspection Manual Chapter
ITAAC – Inspections, Tests, Analyses, and Acceptance Criteria
LWA – Limited Work Authorization

IMC 2501

-ESP QA controls on integrity & reliability of data collected for site characterization.
-ESP controls for application preparation

IMC 2502

-QA for design, procurement, & construction
-Translation of certified design into design details
-COL controls for application preparation

IMC 2503

Verification of successful performance of ITAAC-related activities

IMC 2504

-QA for construction & operations
-Problem identification, reporting, & corrective action
-Work planning/control over work & contractors
-Translation of certified design into design details
-Design change process
-Pre-operational & startup testing
-Operational programs & operational readiness

IMC 2505

-Guides inspection planning

IMC 2507

- Verification of QA program implementation, compliance, reporting and corrective action

IMC 2508

- Verification of QA program implementation for the preparation of a Certified Design.

IMC 2501 – Early Site Permit (ESP)

- Objectives
  - Verify information in ESP application meets Subpart A of 10 CFR Part 52
  - Verify implementation of the quality assurance (QA) program described in the ESP application
  - Provides guidance for audit of geotechnical and foundation activities to verify that data and test activities are governed by adequate QA controls

IMC 2501 – Early Site Permit (ESP)

- Oversight begins when the NRC is formally notified that an applicant is preparing an application for an ESP
- Inspection Procedures (IPs)
  - **IP35005:** Quality Assurance (QA) Audit
  - **IP35017**: QA Implementation Inspection for Design Activities
  - **IP36100**: Inspection of 10 CFR Parts 21 and 50.55(e) Programs for Reporting Defects and Noncompliance
  - **IP45051:** Geo-Technical/Foundation Activities

IMC 2501 – Early Site Permit (ESP)

- Used to verify that an adequate QA program governs the data and test activities supporting the ESP application.

- IMC 2501 oversight continues during the review process until the NRC issues an ESP.

IMC 2502 – Pre-Combined License (Pre-COL)

- Objectives
  - Verify information in the COLA is accurate and complete
  - Verify technical, quality, and administrative requirements are implemented during design and construction
  - Verify implementation of the QA program described in the COLA

IMC 2502 – Pre-COL

- Objectives (con't)
  - Provides guidance for review of licensee engineering activities not covered as part of design certification
    - First-of-a-Kind Engineering (FOAKE)
    - Site Specific Design Engineering
    - Design Engineering for Deviations from Certified Designs

IMC 2502 – Pre-COL

- Inspection Procedures (1st 4 same as IMC 2501)
  - **IP35005:** QA Audit
  - **IP35017**: QA Implementation Inspection for Design Activities
  - **IP36100**: Inspection of 10 CFR Parts 21 and 50.55(e) Programs for Reporting Defects and Noncompliance
  - **IP45051:** Geo-Technical/Foundation Activities
  - **IP37802:** First-of-a-Kind Engineering (FOAKE)

IMC 2502 – Pre-COL

- IPs focus on QA, FOAKE, and Part 21 programs
- Oversight will continue through the receipt and review of COLA and will end when the NRC decides whether to issue a license.
- FOAKE inspection may occur during the inspections conducted under IMC 2504 instead of IMC 2502.

IMC 2503 – ITAAC Inspections

- Inspections, tests, analyses and acceptance criteria (ITAAC)

- ITAAC provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations [10 CFR 52.97(b)(1)]

IMC 2503 – ITAAC Inspections

- ITAAC required to be submitted with design certification and license applications
- Reviewed and approved by NRC in conjunction with approval of a certified design or issuance of a COL
- NRC inspection program provides oversight for the construction of structures, systems, and components

IMC 2503 – ITAAC Inspections

- Licensees perform ITAAC activities
- NRC directly inspects a sample of ITAAC
- Licensees complete ITAAC and submit a closure letter to the NRC

IMC 2503 – ITAAC Inspections

- NRC verifies the closure of all ITAAC through a review of licensee documentation and the inspection record
- NRC documents ITAAC closure verification
- Commission ensures inspections, tests, and analyses are performed and that the acceptance criteria are met prior to operation

Grouping ITAAC - Matrix

- Each certified reactor design has its own set of ITAAC including: piping, valves, welds, pumps, pipe supports, power supplies, cables, seismic qualification, etc.
  - The total number of ITAAC range from 500 to 1000.
- For the AP-1000 and ABWR designs, the NRC staff evaluated all ITAAC and developed a matrix organized by ITAAC common areas and programs applicable to those common areas.

Grouping ITAAC

- 19 matrix rows – processes
- 6 matrix columns – programs
- The intersection of each row and column are called ITAAC *families* which have common characteristics and use the same inspection procedure.
- Observing performance of construction, fabrication, and testing activities within an ITAAC family will provide insights that are applicable to the remainder of the family.

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THE AP1000 ITAAC MATRIX

	A)As-Built Inspection	B)Welding	C)Construction Testing	D) Operational Testing	E)Qualification Criteria	F)Design/Fabrication Requirements
01)Foundations & Buildings	14				1	4
02)Structural Concrete			1			
03)Piping	10	10	10	4		17
04)Pipe Supports & Restraints						8
05)RPV & Internals	7	2	1	2	1	4
06)Mechanical Components	28	5	6	22	4	22
07)Valves	8	4	6	27	12	20
08)Electrical Components & Systems	15		5	24	8	8
09)Electrical Cable	10		1			11
10)I&C Components & Systems	61		35	63	16	9
11)Containment Integrity & Penetrations	6			1	1	1
12)HVAC	11	3	3	14	2	10
13)Equipment Handling & Fuel Racks	6			5	3	3
14)Complex Systems w/ Multiple Components	25			4	4	6
15)Fire Protection	7		1	2		
16)Engineering	5				2	10
17)Security	3				1	
18)Emergency Planning						
19) Radiation Protection	5				1	1

ITAAC Sampling Attributes

- Propensity for Making Errors – The degree of propensity for making errors during fabrication, installation or testing. This may depend on complexity or inherent difficulty of the activity.

- Construction and Testing Experience – Relates to possible first-of-a-kind activity, or performed by company with little nuclear experience.

ITAAC Sampling Attributes

- Opportunity to Verify by Other Means – The extent to which the activity can be verified by observing other functional, pre-operational or performance tests.

- Licensee Oversight Attention – The effectiveness and extensiveness of licensee's oversight attention and QA efforts, including their contractors and suppliers.

- Safety Significance – The safety significance assigned to the system, component, or structure included in the ITAAC.

IMC 2504 – Operational Readiness (Non-ITAAC Inspections)

- Seven Construction programs:
  - Quality assurance
  - Problem identification and resolution
  - Reporting construction defects as required by 10 CFR 50.55(e)
  - Training and qualification
  - Planning
  - Oversight of contractors
  - Quality of ITAAC submittals

IMC 2504 – Operational Readiness (Non-ITAAC Inspections)

- 17 Operational programs: SECY-05-197

  http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2005/secy2005-0197/2005-0197scy.pdf
- Engineering design verification
- Construction and pre-operational testing
- Operational readiness (ORAT)
- Start-up testing and transition to ROP

IMC 2507 – Vendor Inspections

- SECY-07-0105: Enhancement to the Vendor Inspection Program Within the Office of New Reactors
  - To inform the Commission that the Office of New Reactors (NRO) is enhancing the Vendor Inspection Program (VIP) in support of new reactor licensing and construction.
  - To describe these enhancements, including the development of program guidance and an anticipated increase in audit and inspection activities.

IMC 2508 – Design Certification

- Oversight begins when NRC is formally notified that an applicant is preparing an application for a Design Certification (DC)
- Used to verify that an adequate QA program governs the data and test activities supporting the DC application

IMC 2508 – Design Certification

- Inspection Procedures
  - **IP35005:** QA Audit
  - **IP35017:** QA Implementation Inspection for Design Activities
  - **IP35035:** Qualification Testing
- IPs focus on QA
- IMC 2508 oversight will continue to be applied during the review process until the NRC completes review of the DC document

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QUESTIONS?