Advanced Nuclear Technology

Commissioning and Plant Information Turnover

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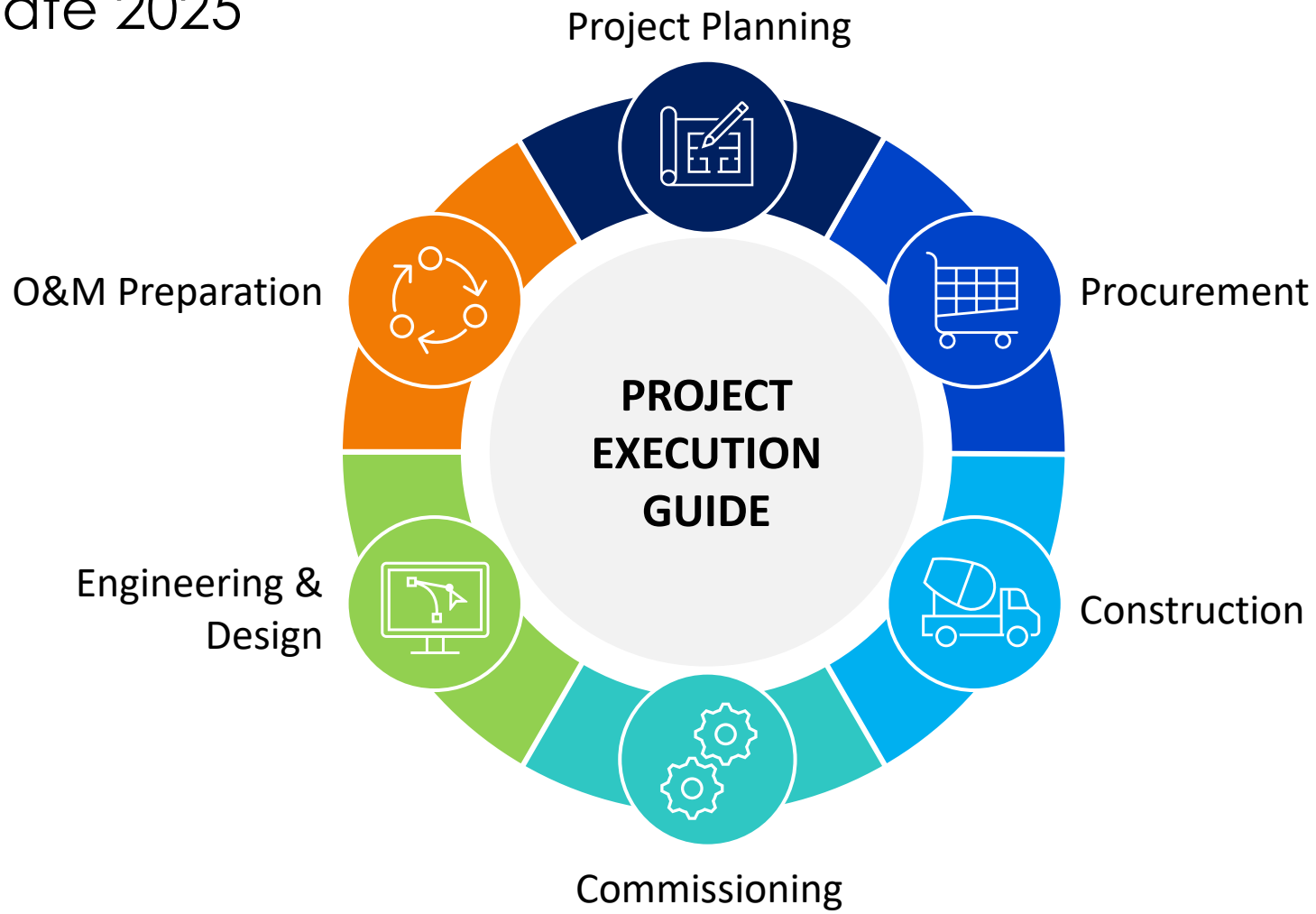
June 12, 2025

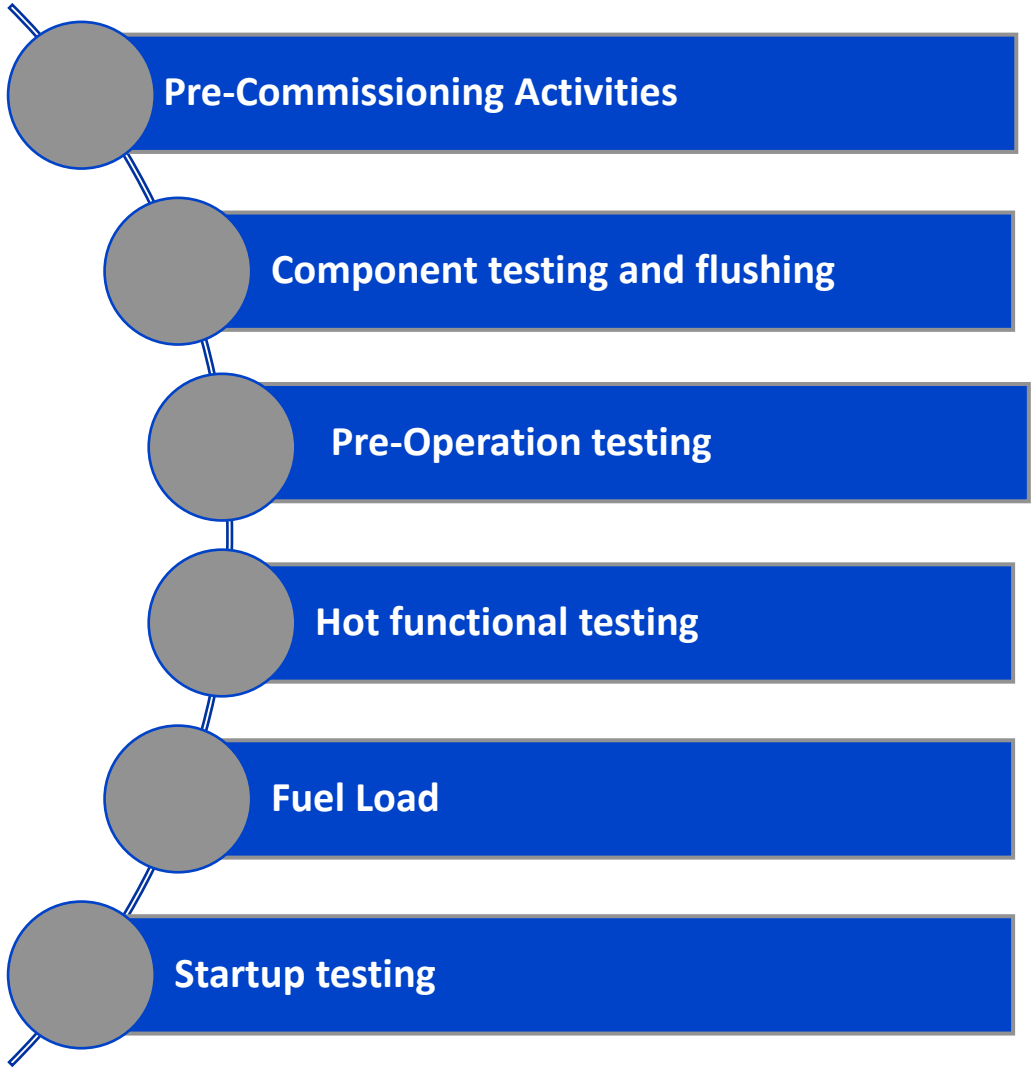
Project Execution Guides

Publication date 2025



Comprehensive Guides to Ensure Successful Project Execution!

Commissioning Execution Guidelines



- Structure of the Guidelines:
  - Includes practical tools, checklists, and templates to support implementation
  - Offers recommendations for managing the risk and problem-solving during commissioning
  - Partial system turnover, partial systems testing, passive systems testing,…
- Expected Outcomes:
  - Improved planning and execution of commissioning activities
  - Improved coordination among various stakeholders in the commissioning process
  - Reduced risks and potential delays in plant startup

Commissioning Phases

- Pre-construction Phase (~2 years prior to construction)
  - Developing commissioning strategy and master plan
  - Participating in design reviews
  - Creating staffing plans and initiating recruitment
  - Developing training programs and key procedures and templates

- Construction and Pre-Component Testing Phase:
  - Site mobilization and familiarization
  - System documentation review and preparation
  - Turnover package development
  - Construction interface management
  - Scheduling and work order development

Overview of the 7 Commissioning Phases

Commissioning Phases

- Component Testing Phase
  - Individual system and component testing
  - Calibration and functional checks
  - Data collection and analysis
  - Issue identification and resolution
- Pre-Operational Phase:
  - Integrated system testing
  - Performance verification and optimization
  - Preparation for subsequent phases

Overview of the 7 Commissioning Phases

Commissioning Phases

- Hot Functional Testing Phase
  - System heat-up to normal operating conditions
  - Testing at Normal Operating Pressure/Temperature (NOP/NOT)
  - Verification of system interactions and performance
  - Final adjustments and optimizations
- Fuel Load Phase:
  - Core monitoring system verification
  - Fuel handling equipment testing
  - Radiological controls implementation
  - Final safety system checks
- Startup Testing Phase:
  - Initial criticality and low power physics testing
  - Power ascension testing
  - Transient and integrated plant performance tests
  - Final system turnover to operations

Key considerations for each phase:

- ✓ Specific objectives and acceptance criteria
- ✓ Regulatory hold points and approvals
- ✓ Interface management between phases
- ✓ Documentation and reporting requirements

Overview of the 7 Commissioning Phases

Best Practices and Lessons Learned Implementation

- Early Integration:
  - Involve commissioning team in final design phase
    - Clear understanding of the system functions
    - Development of the acceptance criteria and test specifications BEFORE site relocation
  - Participate in vendor Factory Acceptance Tests for the I&C
- Planning:
  - Develop detailed, phase-specific test plans
  - Establish clear acceptance criteria for each test
  - Create contingency plans for critical tests (what-ifs)
- Risk Management:
  - Conduct regular risk assessments throughout commissioning
  - Develop and maintain a risk register with mitigation strategies
- Etc…

Best Practices across all phases

Lessons Learned from the recent projects

- Software Management:
  - Late software changes significantly impact schedules
- Interface Management:
  - Poor coordination between disciplines causes rework
- Training Effectiveness:
  - Lack of early training results in errors, poor performance and delays
- System Turnover Management:
  - Incomplete system turnovers cause delays and conflicts
- Etc…

Incorporation of the Lessons Learned

Plant Information Turnover- 3002007425

- The Life Cycle Information Turnover Strategy is a structured approach to managing and transferring critical plant information throughout the various phases of a nuclear power plant's development—from design to decommissioning. This strategy ensures that the right information is available, in the right format, to the right stakeholders, at the right time

Key Success Consideration for Turnover

- Early planning is critical
  - Defining the turnover strategy is at the inception of the project.
  - EPCs (Engineering, Procurement, and Construction contractors) should proactively engage with owner/operators early to align on information needs.
- Information: Structured, Listed, interoperable information has long-term value beyond construction—supporting operations, maintenance, life extension, and decommissioning.
- Fleet-Wide Efficiency: Standardized information models across multiple plants enable data sharing, trending, and predictive analytics.

Requirements

- Right information is delivered from the EPC (Engineering, Procurement, and Construction) contractor to the owner/operator of a new nuclear power plant
  - Turnover information must be tailored to its end user needs (Status, retention, regulation and system integration)
  - Develop a standard taxonomy document type, equipment type, Lifecycle properties
  - Structured data in standardized formats (e.g., XML, databases) that can be reused and integrated across systems

Priority should be given to structured data for high-frequency, high-value information

Information Turnover Plan (ITP)

- Owner/operators and EPCs should collaboratively plan and execute the turnover of information for new nuclear power plants (NNPPs)
  - Organized by plant area (Building, Elevation)
  - Package attributes (Status, type, retention, ….)
  - Progressive (Milestone driven: Initial Design, Design issued for construction,…)
  - Designated lead defined (system engineer)
  - Quality assurance and validation of requirements

The ITP is a living document that evolves with the project

Lessons Learned from Recent New Builds

- Information Turnover Must Be a Priority
  - Senior management must treat information turnover with the same importance as physical asset turnover.
  - The information turnover schedule should be integrated with the asset turnover schedule.
  - Missing or incomplete information should be considered a barrier to asset acceptance.
- Data-Centric Approach is Essential
  - Required data properties (e.g., for CMIS, work control, reliability).
  - Consolidation of data into a single validated source.
  - Delivery of as-built native files from analytical tools (e.g., stress analysis, load flow).

- Pilot Turnover Projects Are Invaluable
  - Conducted 2+ years before full turnover.
  - Validate processes.
  - Identify gaps.
  - Align expectations.

Bottom line!

- Start early: Define and document requirements during design.
- Collaborate: Engage EPCs, vendors, and internal stakeholders.
- Standardize: Use models like EPRI PIM
- Validate: Ensure data is accurate, complete, and traceable.
- Pilot: Test your processes before full-scale turnover.

EPRI Guide: 3002007425

Future EPRI Commissioning Projects

Project Title	Description	Priority Rankings
Test Specification and Procedure Development Guidelines	Develop standardized guidance for test specifications and procedures to ensure clarity and completeness, reducing errors and delays in SMR commissioning.	**2026**
FOAK and Passive Systems Lessons Learned	Analyze lessons from recent AP1000 projects to develop best practices for FOAK and passive system testing, mitigating delays in SMR commissioning.	**2026**
Risk Assessment and Management Program Study	Risks analysis from recent startups to recommend strategies for mitigating delays and supply chain issues in SMR projects.	**2027**
Test Engineer Qualification Standardization	Standardize test engineer qualifications through a best practices study, ensuring skills and training to handle FOAK tests and reduce errors in SMR commissioning.	**2027**
Dedicated Commissioning Oversight (CO) Group	Establish an independent CO group within the owner organization to oversee the entire commissioning lifecycle, addressing staffing shortages and challenges.	**2028**

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