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Role of the OWNER'S ENGINEER in Project Development and Management

Leadership and Management for Introducing and Expanding Nuclear Power Programmes
IAEA/ANL, USA

- Sargent & Lundy
- Owner's Engineer
  - Why Owner's Engineer?
  - Owners Engineer Roles/Tasks
- Selecting an Owners Engineer
- Summary

Profile

- 123 years of leading global power industry experience
- Headquartered in Chicago, USA
- Exclusive focus on power industry
- Nuclear Quality Assurance Program
  - Topical Report which has been reviewed and accepted by the USNRC.
- ISO 9001:2008 Certified Quality System
- 2,600+ staff members

Client Base

- Over 600 clients
  - 150 fossil power clients
  - 120 nuclear power clients
  - 40 power delivery service clients
  - 340 consulting clients

Areas of Expertise Include:

-- Project Concept Development

-- Preliminary Financial Evaluation/Capital Cost Estimating

-- Site Selection, Feasibility studies

-- Transmission Impact Studies

-- Environmental Evaluation

-- Licensing, Permitting, and Document Preparation

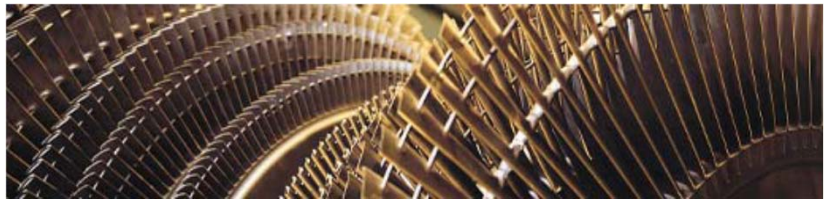
-- Detailed Design/EPC Implementation

-- Procurement/Quality Control

-- Construction Management

-- Preparation and System Startup Testing

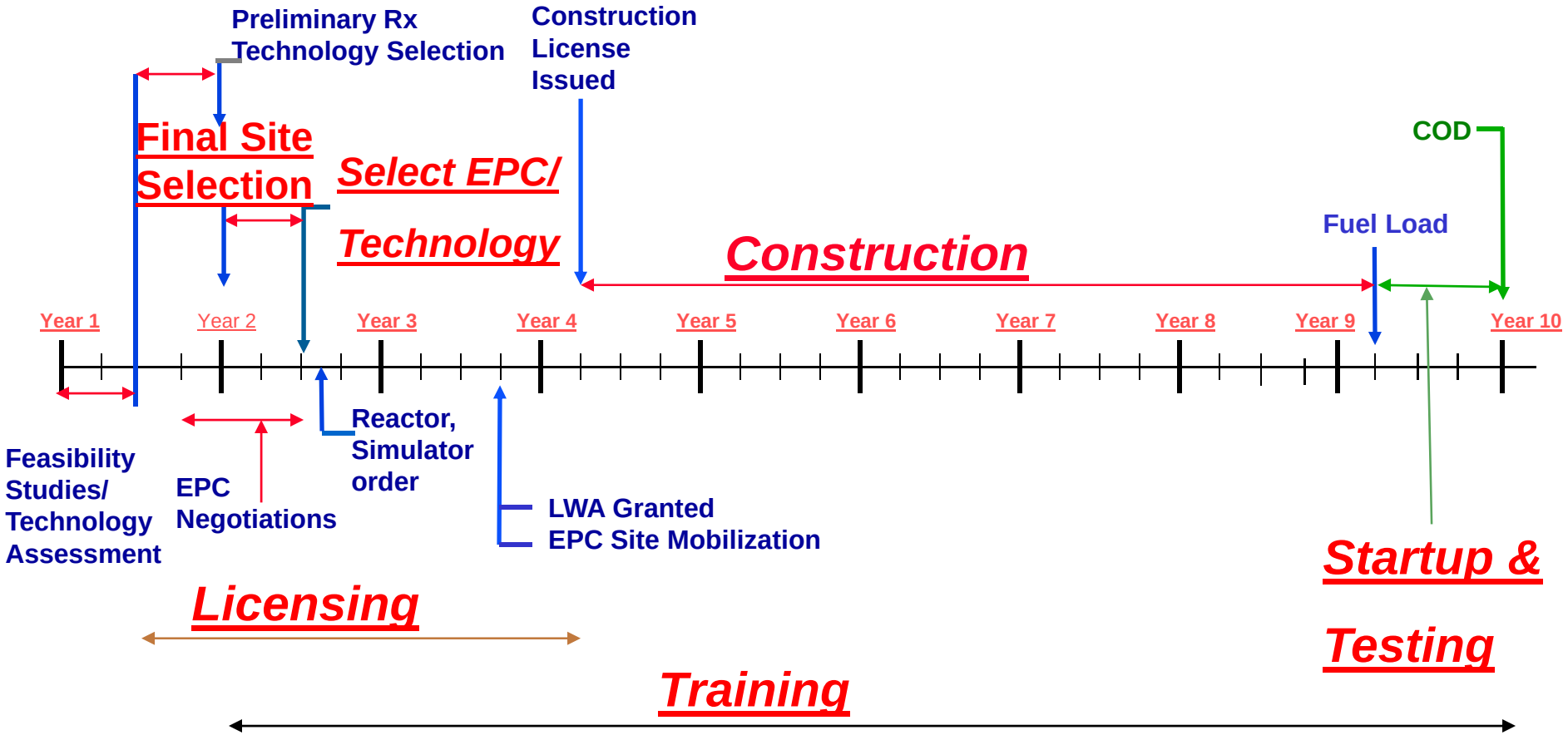
-- Operations & Maintenance Consulting



Owner's Engineer

Owner's Engineer is a term given to an independent party representative of the OWNER of a construction or engineering project.

New Nuclear Plant Timeline
Greenfield Site



Why Owner's Engineer?

Why Owner's Engineer?

- Support the owner in a successful planning, oversight, execution and implementation of the project from inception through commissioning.
- Ensures deliverables are in-line with owner's expectations.
- Owner's engineer, involved from project inception can help with defining the project size, location, technology selection, contracting strategy, scope, DOR/interfaces, and schedule.
- Reduce a project's overall project cost (capital, operation and maintenance) and project risk
  - Design optimization that reduce the owner's lifecycle costs.

Why Owner's Engineer? (continued)

- Owner benefits from having a dedicated engineering advisor who is familiar with all aspects of the project and will help the owner identify opportunities that may otherwise be overlooked while avoiding or minimizing risks.
  - Preparation and/or review of equipment procurement specifications and ensure suppliers are in compliance with all contract requirements.
  - Support development of configuration management control that captures the plant design basis.
  - Develop of the training program and capacity building
  - Preparing integrated project schedules.
  - Preparing Technical Commercial Requirement Document.
  - Support with the licensing process, permitting and environmental
  - Support with EPC contract documents and negotiations, including RFP (request for proposal) and evaluations.
  - Provide design when necessary, project management, contract administration, and construction oversight.
  - Support plant commissioning (system turnover, start-up tests, punch lists, etc…).

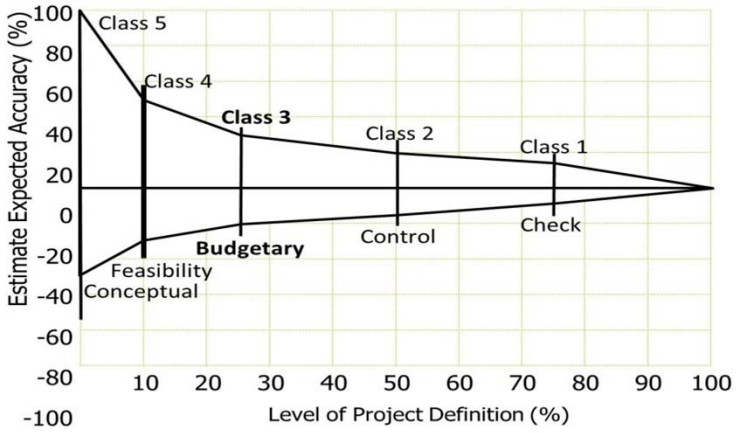
Owner's Engineer Roles and Tasks?

Owner's Engineer Roles/Tasks

- Site Selection
- Technology Assessment/Selection
- Licensing support
- Engineering, Procurement, Construction (EPC) Commercial Technical Specification and Bid Assistance
- Division Of Responsibilities (DOR)
- Contract negotiations support
- Develop overall project execution plan
- Develop an integrated master project schedule
- Identify and quantify project risks and develop a risk mitigation plan

Owner's Engineer Roles/Tasks (continued)

- Develop design for site specific activities and owners assigned activities
- Develop & update project cost estimate
  - EPC experience
  - Maturity of Design
  - Regulatory Environment
  - Procurement



- Perform audits on behalf of the Owner
- Review EPC contractor's procedures and related documents
- Represent Owner in EPC contractor's procurement activities

Owner's Engineer Roles/Tasks (continued)

- Perform design reviews on behalf of the Owner of vendor documents (e.g., drawings, calculations, specifications, constructor/vendor document submittals, etc…)
- Support Owner with reviewing EPC contractor costs, schedule, and progress
- Support the owner with plant testing and startup
- Provide construction support: oversight, engineering, licensing, procurement and commissioning.
- Support design activities/interface with operating units
- Independent engineer evaluation
- Training
- Miscellaneous support (Deployment, etc…)

Owner's Engineer Roles/Tasks (continued)

- ***Technology Assessment***
  - Suitability for available sites
  - Amount of power needed
  - Costs
    - » Capital
    - » O&M
  - Risks associated with each technology
    - » Technical (First-of-Kind, Passive vs, active, Design, etc…)
    - » Procurement
    - » Licensing
    - » Schedule
    - » Reliability / Availability

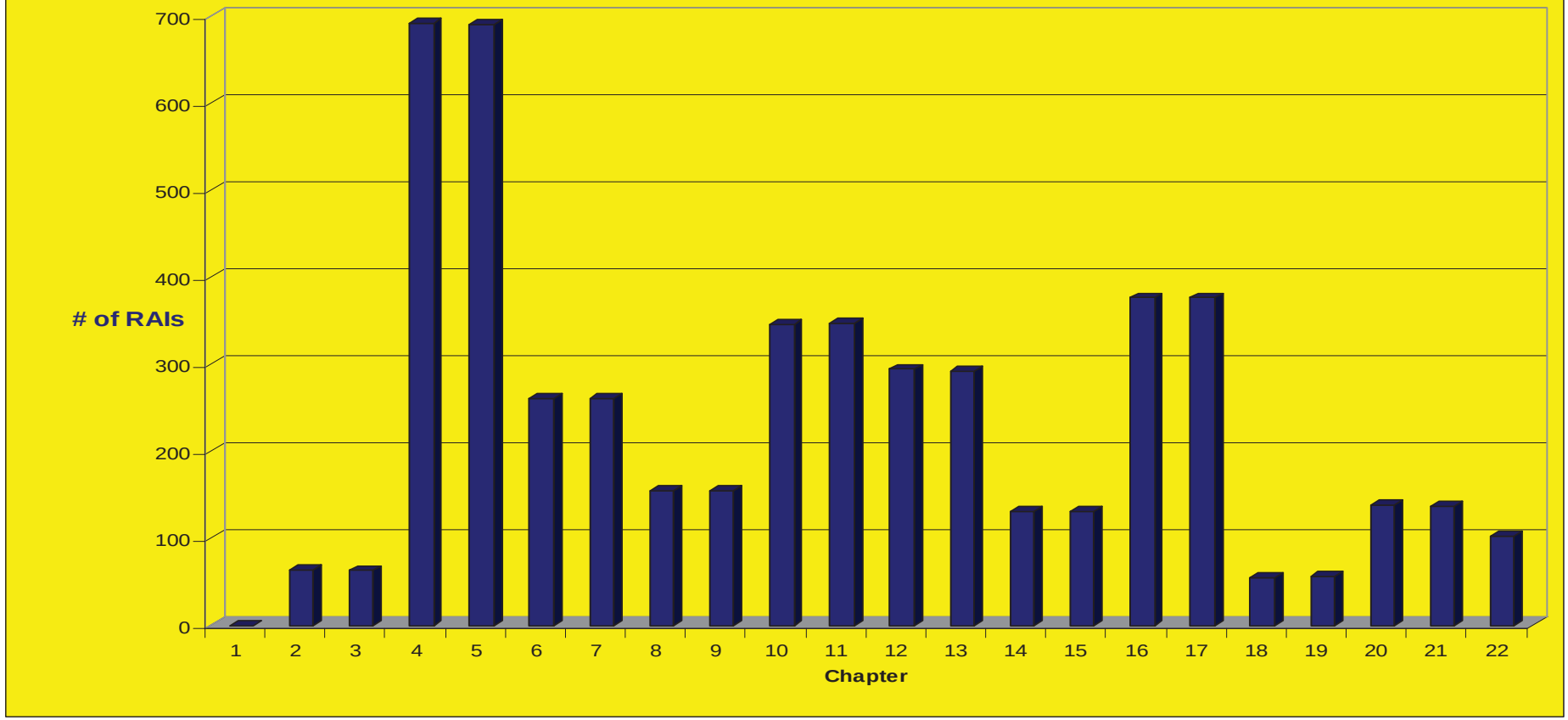
Owner's Engineer Roles/Tasks (continued)

- ***Technology Assessment (continued)***
  - Risks associated with each technology (continued)
    - » No reliance on AC power for safety systems
    - » Reduced reliance on operator actions
    - » Large margin to safety limits
    - » Fewer Active components - less capital / O&M Costs
    - » Modular construction
    - » Better predictability of cost and schedule
    - » Etc…

Owner's Engineer Roles/Tasks (continued)

- ***Licensing***
  - IAEA General Guidance for the Licensing Process
    - » Pre-Construction SAR (PCSAR)
    - » Pre-Operation SAR (POSAR)
    - » Station SAR (SSAR)
  - US NRC (10 CFR 50 and 52)
    - » 10 CFR 52- Single process
      - Early Site Permit (ESP)
        - Approval to secure one or more sites for future use
      - Combined Construction and Operating License (COL)
        - ITAAC unchartered
      - 10 CFR 50- Two step process
      - Separate construction and operating license
  - OE support: License application, RAI's, etc…

New Technology RAI Review Experience



EPC Commercial Technical Requirement Document

EPC Commercial Technical Requirements Overview

- Relationship to EPC Contract
  - Supplement to EPC contract
  - Includes technical requirements
    - » Owners requirements
    - » Country local and regional requirements
    - » Industry Lessons Learned
    - » Regulatory requirements

EPC Commercial Technical Requirements Overview (Cont'd)

- Goal = Issue Commercial Technical Specification that delivers a State of the Art Plant to the owner
  - Emphasis on nuclear industry Lessons Learned to date
    - » 60 year design life
    - » Industry requirements (EUR/URD)
    - » Specific operating experience
    - » INPO/WANO operating experience
    - » S&L design experience
  - Augment the Proven Technology (DCD)
  - Specify critical design and procurement requirements

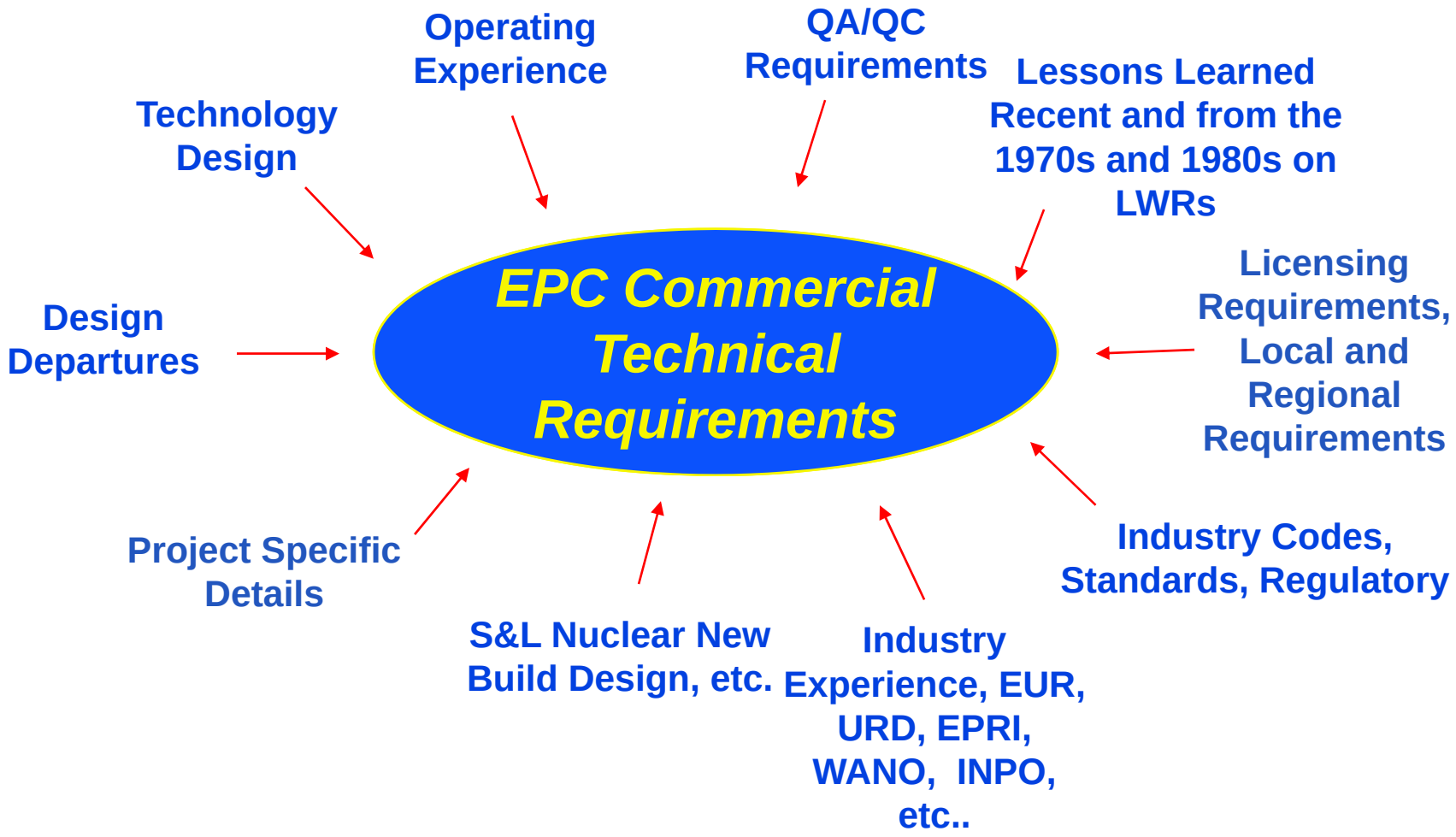
EPC Commercial Technical Requirements Overview (Cont'd)

- Adds value relative to requirements affecting:
  - » Plant operations
  - » Reliability
  - » Availability
  - » Maintenance
  - » ISI/IST
  - » ALARA
  - » Design philosophy
  - » Design margin
  - » Construction and transition from construction to operation
  - » Outage optimization

Technical Requirements Overview (Cont'd)

- EPC Commercial Technical Specification Structure
  - Parallels US NRC NUREG-0800 (Standard Review Plans)
  - Additional sections added for:
    - » Regulatory (Country specific)
    - » Cooling Media
    - » Site Infrastructure - Barge Facility, Haul Road, etc…
    - » Initial Site Development
    - » Final Site Development
    - » Fukushima Impact/Requirements
    - » Misc. Sections

Inputs to EPC Commercial Technical Requirement



Technical Requirements (Cont'd)

CONTENTS of the

EPC Commercial Technical

Requirements Document

Technical Requirements (Cont'd)

1. General Plant Description and Design Philosophy
2. Site Characteristics
3. Design of Systems, Structures, and Components
4. Reactor
5. Reactor Coolant System and Connected Systems
6. Engineered Safety Features
7. Instrumentation and Controls
8. Electrical Systems and Equipment
9. Auxiliary Systems
10. Steam and Power Conversion

Technical Requirements (Cont'd)

11. General Radwaste Protection
12. Radiation Protection
13. Conduct of Operations
14. Initial Test Program
15. Accident Analysis
16. Technical Specification
17. Quality Assurance
18. Human Factors Engineering

Technical Requirements (Cont'd)

19. Severe Accidents
20. Cooling media and Related Facilities
21. Site Infrastructure- Barge Facility, Haul Road, etc…
22. Initial Site Development
23. Final Site Development
24. Unit 1 Transition from Construction to Operation
25. Items Critical to Quality

Technical Requirements (Cont'd)

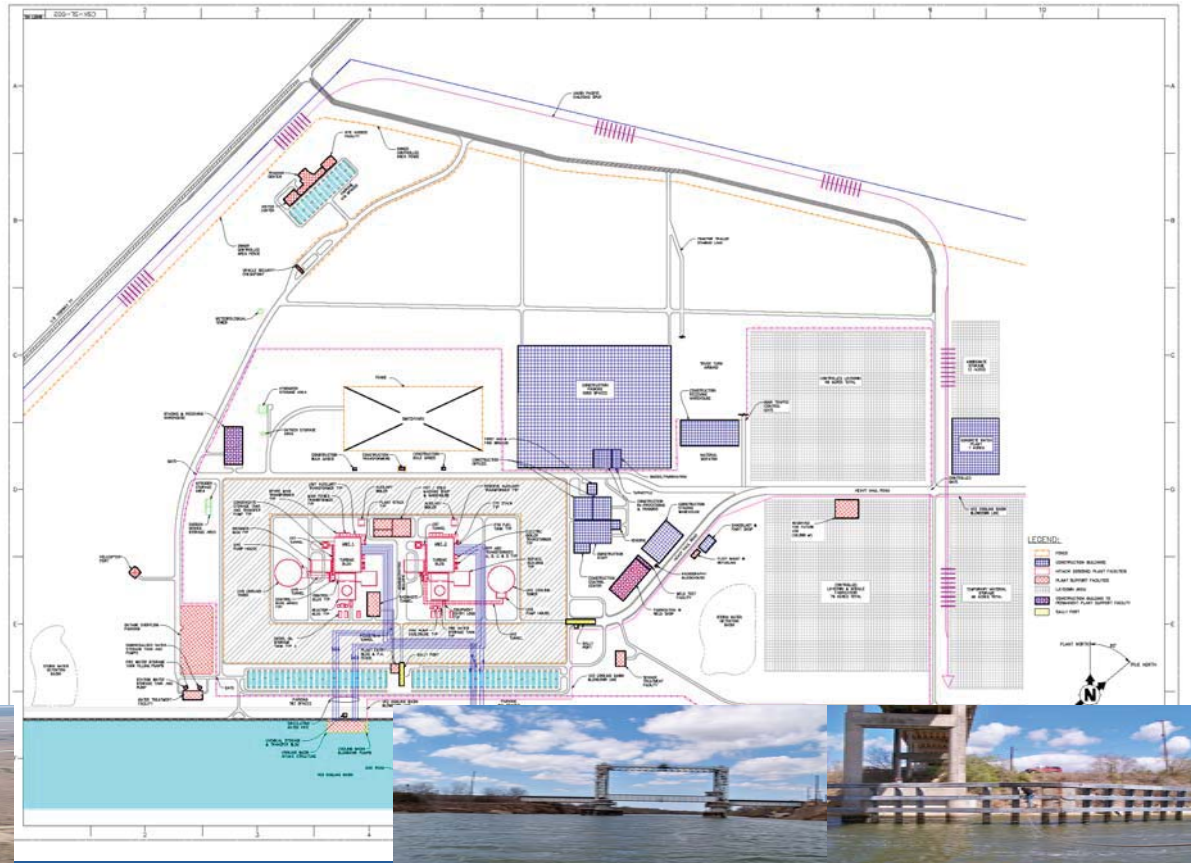
26. Construction Oversight, Construction Optimization Including Construction Command Center
27. Procurement Plan, Requirements and Oversight
28. Risk Analysis and Mitigation
29. Fukushima Impact/Requirements
    - Hazards (Flooding and Seismic)
    - Mitigating Strategies for Beyond Design Basis Events
    - Etc…
30. Training and Training Facilities

Division of Responsibilities

Sargent & Lundy LLC

DOR

- Site Infrastructure
- Power Block
- Licensing
- Permitting
- Security
- Fire Protection
- Etc…



Quality Assurance/Vendor Oversight

Quality Assurance/ Vendor Oversight

- Quality Assurance/Quality Control
  - **Develop and Implement QA/QC Program for an independent assessment of the effectiveness** of programs and processes related to design, procurement, construction, maintenance and operation activities, as well as the effectiveness of human performance in implementing program and process requirements
  - **Objective:**
    - » Ensure that the programs and processes deliver high quality project work. This should account for safety culture, including the establishment of a safety-conscious work environment, QA, industrial safety, and problem identification and resolution

Quality Assurance/ Vendor Oversight

- Quality Assurance/Quality Control **Approach**
  - QA/QC is integrated in design, construction and procurement
  - Utilize Commercial Grade Dedication requirements
    - » Technical requirements
    - » Quality requirements
    - » Acceptance Method
  - Verify each level of the procurement chain - audit suppliers often
  - Establish an inspection frequency and scope
  - Emphasize QA and technical requirements through performance-based inspections

Quality Assurance/ Vendor Oversight

- Quality Assurance/Quality Control **Approach** (continued)
  - Assess effective implementation of manufacturing and fabrication processes to provide assurance of product quality
  - Establish and maintain document control and records management systems early
  - Establish a corrective action program
  - Emphasize root cause analysis and/or extent of condition as required to ensure that any proposed corrective action addresses the underlying QA performance drivers

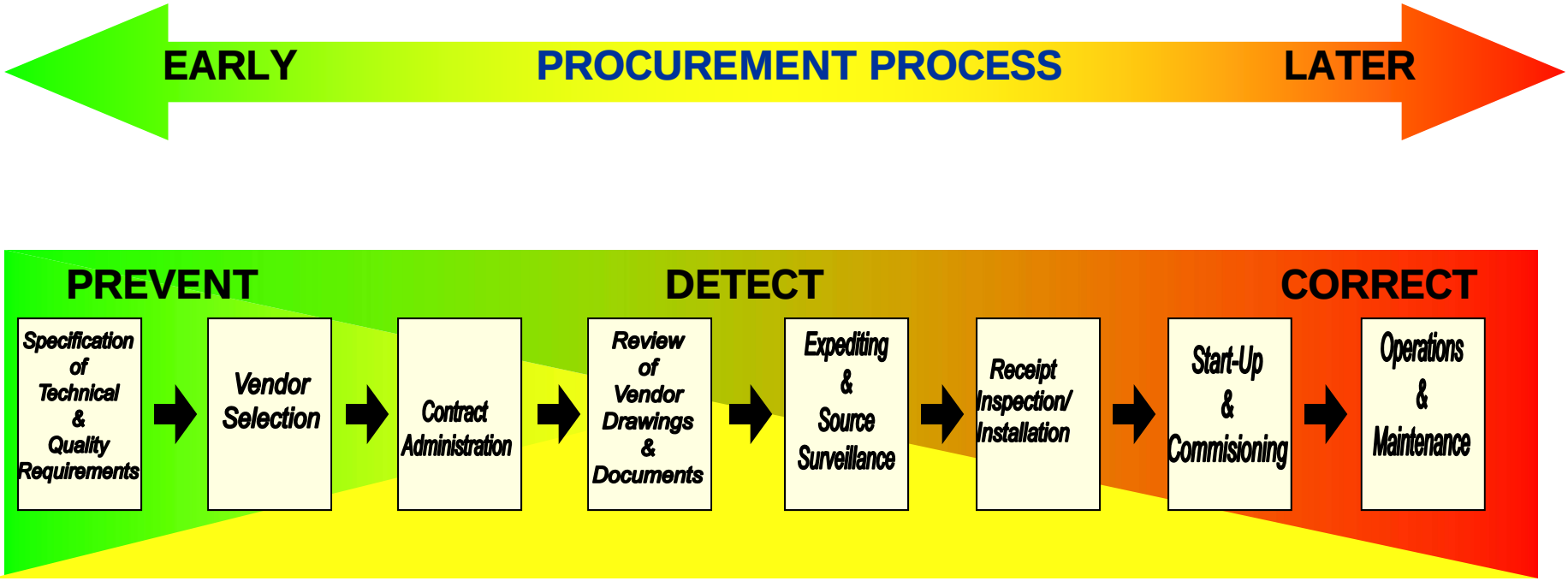
Quality Assurance/ Vendor Oversight

- Quality Assurance/Quality Control **Approach** (continued)
  - Inspection and test process verifies that the completed project meets specified design basis attributes, including performance features and characteristic
  - Historical records of calibrations, audits, testing, maintenance, certifications, etc… need to be maintained as part of the permanent plant records
  - Ensure installed material/components meet intended function and operability requirements
  - Oversight and inspections of suppliers' facilities

Quality Assurance/ Vendor Oversight

- Quality Assurance/Quality Control **Approach** (continued)
  - Counterfeit material can compromise safety related components/systems/structures
    - » Establish a process to quickly identify counterfeit material
      - Qualified suppliers
      - Oversight and inspections of supplier facilities
      - Proper material documentation and traceability
      - Material that cannot be traced back to the original source should be considered suspect
      - Corrective action program

Prevention, Detection, Correction



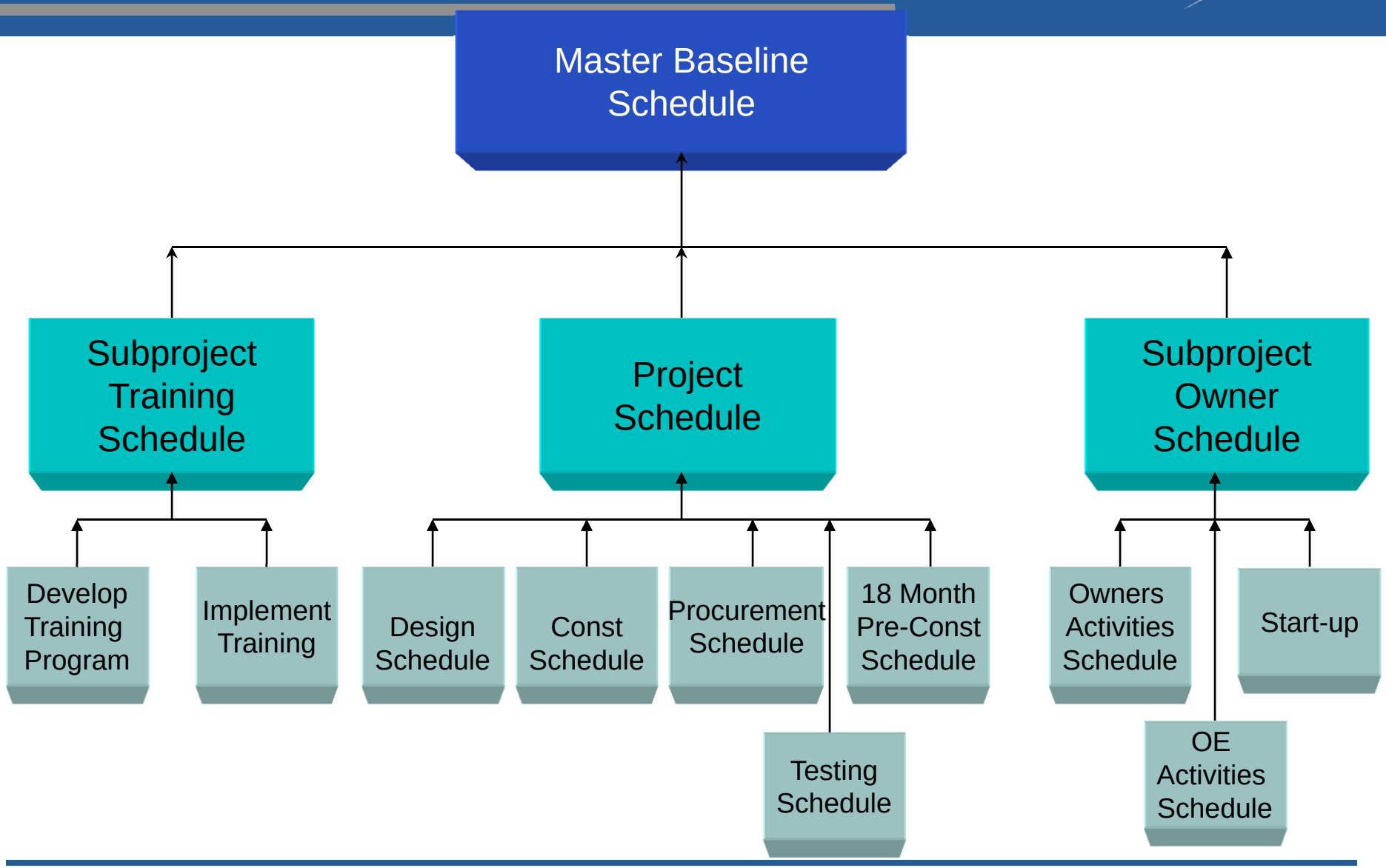
Manufacturing Oversight

- Develop a Manufacturing Quality Oversight Plan for successful overview of equipment and component fabrication

Manufacturing Oversight - Witness Point Trip Observations

- Equipment calibration documentation acceptable
- Work control documentation maintained current
- Procedure requirements correctly reflected in work control documents
- Heat analysis documents material specification compliance
- Shop quality control reviews completed as required
- Earthquakes occurred during the test.
  - Had no effect on operations but no procedure in place to mitigate

Integrated Project Schedule


Master Baseline Schedule
Subproject Training Schedule
Project Schedule
Subproject Owner Schedule
Develop Training Program
Implement Training
Design Schedule
Const Schedule
Procurement Schedule
18 Month Pre-Const Schedule
Testing Schedule
Owners Activities Schedule
Start-up
OE Activities Schedule

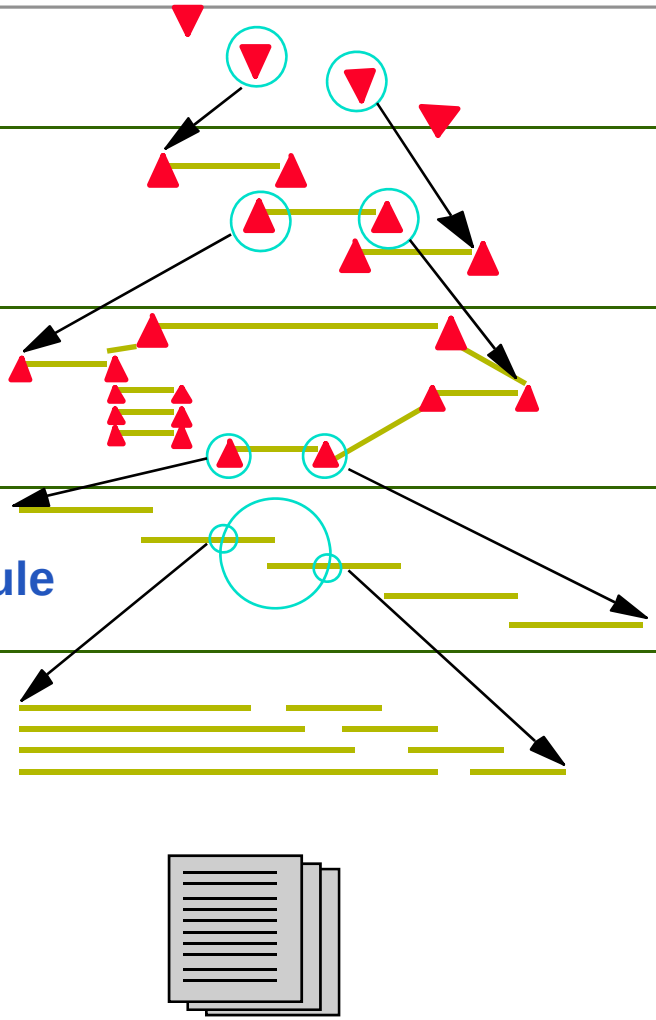
Level 0: Project Milestone Summary

Level I: Project Summary Schedule

Level II: Management Summary

Level III: Publication / Control Level Schedule

Level IV: Supporting Details
Schedule fragments or
Deliverable listings, quantity
data, etc..

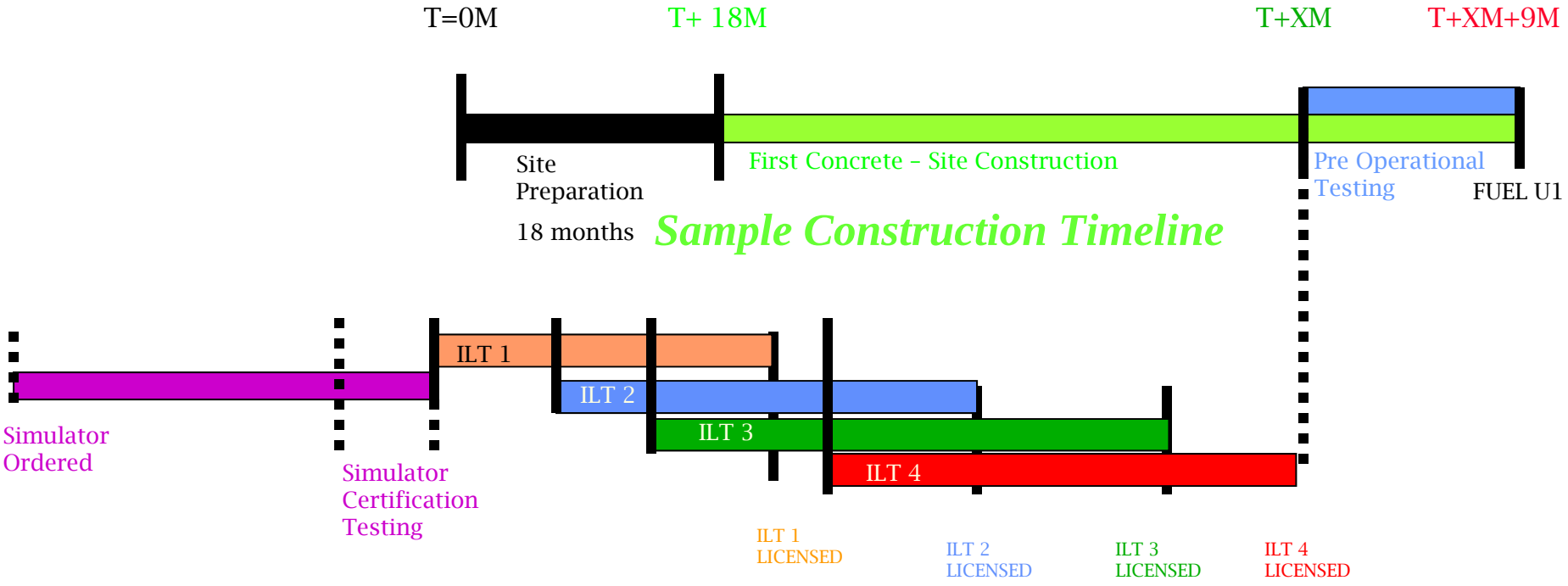


Integrated Project Schedule-Output (Continued)

- Around the clock critical path/near critical path to optimize the schedule
  - » Critical path
  - » Near critical path
- Parallel activities and resource management
  - » Parallel paths with manpower and equipment
  - » Use the largest of the large equipment/modules to optimize tasks
- Contingency planning

Training Activities/Plans

Sample Training Timeline



Sample Operator Training Timeline

Training Activities/Plans

1. Training Plans
   - » QA
   - » Construction
   - » Technical
   - » Security
   - » Operation
   - » Etc…
2. Training Material Development
   - » Systems, Maintenance, Construction, Radiation Protection, Engineering, etc…
3. Training Implementation

Deployment Plans

Deployment Plans (continued)

- DOR
- Project execution plan
- Site Infrastructure, layout
- Crane plan
- Dewatering plan
- Excavation plan
- Modular plan
- Procurement plan
- Design review and validation plan
- Permitting plan
- Labor plan
- Etc …

Selecting an Owner's Engineer?

- Prior experience:
  - » Design (NI, TI and BOP)
  - » Operation
  - » Licensing
  - » Procurement
  - » Quality
  - » NSSS (Technical Vendor) experience
  - » Oversight
  - » Project Management

Summary (continued)

- Planning through operation

Develop and Monitor an integrated plan that captures information and data for:

- Planning (Site selection, technology selection, **Material** reservation, etc…)
- Design (Systems, foundations, structures, component/**Material** specification, etc…)
- Procurement (Technical specifications, **Material** selection and management, etc…)
- Construction (Construction execution, oversight, **Material** availability, etc…)
  - Recent material issue at a construction site "Cable was not available, they used a bigger size cable"??
- Start-up (Training, testing, **Material** replacement/repair, fuel load, etc…)
- Operation (Maintenance & **Material** management, outages, etc…)

Summary

- Strategies for **SUCCESS**
  - » ***GET INVOLVED***
  - » Qualified Owners Engineer
  - » EPC commercial technical requirement document
  - » Integrated DOR
  - » Integrated project schedule
  - » Integrated plans (procurement, etc…)

Thank You

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