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Nuclear Power Plant Site – Early Development Key Considerations

Ed Shyloski

**UN IAEA Nuclear Advanced Construction
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Preliminary Site-Specific Engineering

- Required to define layout, quantities, sizes and costs for the site and add to a nuclear plant construction schedule and estimate to develop an overall project-specific schedule and price. This work would include:
 - Evaluation of the site or review of existing evaluations for development of design criteria for site-specific systems, structures and components including those that contain undergrounds (circ. water, fire loop, underground duct banks, storm drains, wastewater, potable water, tanks with underground piping)
 - Preparation of conceptual designs
 - Development of dimensioned layout drawings and preliminary foundation cross-sections
 - System and component sizing calculations which support conceptual designs
 - Equipment and component technical specifications for conceptual designs
 - Preparation of P&IDs which support conceptual designs
 - Preparation of preliminary structural drawing information to define structural commodities
 - Preparation of preliminary piping drawings for large bore piping for quantity assessments
 - Electrical 1-line drawings for conceptual designs
 - Control logics
 - Preparation of Bid packages for components
 - Bid evaluations and vendor selection for components
 - Review of vendor design packages

Detailed Site-Specific Engineering

- Perform that portion of the site-specific engineering that is required to be complete before the start of Phase 2 to support the start of pre-construction and construction activities. This would include:
 - Completion of site preparation plans and initial site excavation/grading plans
 - Completion of engineering for underground systems and systems required to support construction
 - Completion of engineering to support module development based on the module and procurement lead times
 - Completion of engineering for equipment and commodities that need to be done to support procurement of long lead time items as needed to support installation schedule requirements
 - Site heavy haul load evaluations, engineering of haul foundations, hardstands for cranes , module erection pad foundations
 - Site infrastructure design including roads, rail, barge facilities, construction water, construction fire protection and construction power
 - Development of specifications and procurement of systems and commodities to support construction: Underground commodities for undergrounds; batch plant; temporary electrical power design and components and other items identified in the Construction Plan

Nuclear Power Plant Envelope Evaluation

- Perform a scope assessment of site-specific parameters to define any work scope impacts associated with siting the standard design at the site establishing the design criteria for the site-specific design. This will include:
 - Site meteorological parameters
 - Site SSE and design response spectra
 - Site soil and rock properties
 - Site groundwater conditions
 - Water supplies properties
 - State and local requirements; permits required
 - Impacts of nearby facilities/utilities
 - Site flood history
 - Soil stabilization techniques

Site Geotechnical Review – Design Assessment

- Perform a scope assessment of the site-specific geotechnical parameters based on data collected by the client to define the impacts on the standard design and the design criteria for the site-specific design. This will include:
 - Site soil and rock properties, including dynamic properties and load bearing capacities
 - Site seismic analyses: Safe Shutdown Earthquake (SSE) and design response spectra and soil structure interaction validation, liquefaction potential, stability of excavations, slopes and dam embankments
 - Site groundwater conditions: design bases for hydrostatic pressure and dewatering of excavations
 - Assessment of the adequacy of existing information and identification of needed additional information
 - Definition of soil stabilization approach
 - Development of related construction requirements, guidelines, plans and estimate inputs

Regional Infrastructure Assessment

- Perform a scope assessment of the infrastructure required to support the construction of any type of power plant and define the impacts on construction, modularization and the ability to transport fabrications to the site. This will include:
 - Rail Road access
 - Highway Road access
 - Water/Barge access
 - Available Utilities (Water/Sewage/Power)
 - Medical facilities
 - Fire fighting facilities
 - Available Housing
 - Schools
 - Financial facilities
 - Regional communications
 - Local governments
 - News outlets

Project-Specific Equipment & Material Logistics Deployment Model

- Identify the scope of attributes to be evaluated and develop plans for the transportation of heavy equipment and modules to the site. Input includes the results of the evaluations performed as part of the Regional Assessment. This task defines the following:
 - Module/large components shipping routes
 - Highway capability (material/module shipments)
 - Waterway/barge availability (material/module shipments)
 - Bridge capacities (material/module shipments)
 - Overhead electrical (shipping routes)
 - Heavy haulers/cranes
 - Railroad capabilities

Site-Specific Procurement Plan

- Investigate and develop site-specific standard inserts and changes to the standards specifications that are needed to reflect special site and client-specific requirements for the purchase of equipment and commodities and to tailor procedures to reflect these requirements. This would include:
 - Site description
 - Site transportation information
 - Client specific contract requirements
 - Site security restrictions
 - Site access restrictions
 - Site prohibitions
 - Special environmental requirements
 - Special state and local requirements

Regional/Local Labor Survey

- Perform an assessment of craft availability and training requirement needed to support the construction of nuclear power plant(s)
 - Evaluate Craft availability all crafts)
 - Dedicate staffing team to focus on nuclear talent
 - Establish initial resource profile by discipline
 - Survey labor sources with advertisements and direct and indirect mailings to open and closed shops by craft discipline in the effected geographic radius
 - Decide with Owners the formal Project Labor Approach considering completion and safety incentives to draw and keep labor
 - Evaluate Craft training/qualifications
 - Formulate a skill resource draw plan with various resources, e.g. employment agencies, trade schools, specialty contractors, construction manpower entities
 - Monitor plan performance a minimum of 24,18, 6, and 3 months before site mobilization
 - Start early, i.e. training programs on specifications/procedures/craft skills mock-up testing materials
 - Develop and certify craft skill development program
 - Test for reading drawing and installation skills by use of mockups
 - Test for basic skills, e.g. formwork, rigging, piping, electrical, etc.
 - Establish Adult Basic Education Survey Testing Level Required
 - Develop and test required skill sets by “show-for-hire-later-chits”

Local Subcontractor Evaluations and Agreements

- Identify specific needs as related to subcontractor requirements
 - Prefabrication
 - Modularization
 - Area and Specialty Contractors (e.g. Painting, HVAC, Fire Protection)
 - Emergency Health Care
 - Consumable Tools/Materials

Early Procurement/Vendor Commitments

- Identify the procurement support needed to support the placement of orders for Turbine Island and site-specific Tier 1, Tier 2 and selected Tier 3 components, the batch plant and commodities needed to support design development, estimate development and plant integrated schedule. This includes:
 - Vendor identification
 - Performance of needed surveys and reviews
 - Preparation of bid packages
 - Solicitation of bids
 - Bid evaluation and award
 - Vendor qualification and audit
 - Negotiation and contract placement
- Identify specific subcontractors and produce evaluations of their capabilities to perform. Contracts then may be negotiated with selected contractors who qualify to nuclear plant safety-related, important to safety, and non-safety related work as well as meeting specific thresholds of industrial safety.

Level 2+ Specific Schedule

- Develop the schedule for site-specific EPC activities and the integration of these activities into the construction schedule to yield a site-specific project schedule.
 - Integrate site-specific requirements into standard construction schedule (i.e., excavation, yard layout, etc.)
 - Insure underground, module laydowns, and site infrastructure completion prior to First Nuclear Concrete Placement

Project-Specific Construction Plan

- Develop an integrated site-specific construction plan and schedule.
 - Locate and define requirements for construction facilities (temporary and permanent) to optimize efficiencies
 - Time alley/brass houses
 - Craft change facilities
 - Safety facilities
 - Tool rooms
 - Warehouses
 - Fabrication shops
 - Equipment maintenance (heavy equipment truck)
 - Construction offices (management/engineering/supervision)
 - Material laydown yards (avoiding heavy foot traffic pathways)
 - Site heavy haul load paths (engineered roadway keeping underground utilities in mind)
 - Relocation/heavy lift crane (scheduling to minimize the need for heavy lift crane movement)
 - Parking lots
 - Batch plant
 - Spoils areas

Project-Specific Construction Plan (cont.)

- Utility corridors layout
 - Optimization of routing (strategies, maintainability, heavy haul paths)
 - Temporary power requirements (sizing and layout)
 - Relocation of existing services
 - Fire protection header interfaces with provisions for construction and transition to permanent plant configuration
 - Construction water
 - Bulk service gas facilities temporary and permanent
- Batch plant qualification and erection plan
- Construction security plan
- Cut and fill plan
- Site module fabrication and sequencing plan
 - Delivery (access roads, rail spurs, barge slips)
 - Offloading
 - Laydown (strategically locate and size to maximize efficiencies)
 - Module assembly platens locations
- Site waterproofing plan
- Integrate site-specific requirements into standard construction schedule (i.e., excavation, yard layout, etc.)

Site Temporary Construction Facilities Consideration as Permanent

- Identify the scope for temporary construction structures/facilities for a standard nuclear plant site that may remain as permanent scope. This will include:
 - Engineering facilities
 - Management facilities
 - Craft facilities
 - Safety facilities
 - Construction tool rooms
 - Construction material warehouses
 - Mechanical/electrical fabrication shop
 - Warehouses

Excavation Plans and Yard Early Construction Before Power Island

- Perform an assessment of the site-specific soil conditions and address any existing or new underground facilities existing that have potential impacts on the standard design. This will include:
 - Soil stabilization process
 - “Waterproofing” the site process/technique(s)
 - 100% engineering for underground facilities
 - Locate existing underground facilities
 - Install new underground facilities
 - Excavation complete and utilities installed prior to start of construction
 - Rock investigation i.e. blasting, removal and disposal

Importance of Nuclear Site Development

- Remember DO NOT ignore setting the stage for success on any new nuclear site “development”, i.e. development is not just site preparation! It is much more. It is the “launching pad” completed for power island construction take-off.
- Focused attention to nuclear site development is much more important to launch a nuclear project and is commonly misunderstood for its estimate at completion, schedule, cost, and length of preparation.
- Having full site development underway at the time of First Nuclear Concrete lowers the overall site population, provides the infrastructure for power island focus planning teams, and completes the site to grade around the power island such that there are no major or minor interferences to the nuclear critical path construction schedule for personnel, cranes, and all equipment.