

**International Atomic Energy Agency**

# **NPP Project Management**

**Craig Lambert – Exelon Nuclear**

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# Project Management Considerations

- Objectives
- Project Management Process
- Organizational Structure
- Project Schedules
- Project Control



# Objectives of this lecture

- **Successful nuclear deployment work requires the development, standardization and repeated application of specialized skills and methods to create a quantifiable deliverable. This lecture will provide recommendations on approaches and considerations that may be utilized to achieve this goal.**

# Project Management Process

- **The formulation and development of a nuclear power program, followed by deployment of a new nuclear power plant constitute a massive undertaking requiring a highly proficient organization, able to perform it's function in progressive and predictable increments that are tied to benchmarks, milestones and completion dates.**
- **A project management process must be utilized for an undertaking of this magnitude.**
- **The primary challenge of project management is to achieve the goal of the project charter, while at the same time meeting the constraints of scope, schedule, cost and quality.**
- **Project management involves definition, planning, scheduling, integration, coordination, problem resolution and control of project activities.**



# Project Management Process

- **Each project is broken into different phases. For a new nuclear development program the following phases are proposed:**
  - **Pre Project phase**
  - **Plant Acquisition phase**
  - **Project Construction phase**
  - **Project Operations phase**

# Project Management Process

- **Each project will need to make a decision whether other discrete phases are required to properly control the project.**
- **For a current United States new nuclear power plant project the following phases have been defined:**
  - **Project study and site early development phase**
  - **Combined License Application (COL) phase**
  - **COL approval and early construction phase**
  - **Construction phase**
  - **Start-up and Operation phase**



# Project Management Process

## Pre Project phase

- **In the introduction of nuclear power plants in a country, the majority of tasks are program oriented, usually carried out by a governmental organization, such as the Nuclear Energy Commission.**
  - **This work involves the establishment of the legal framework and international agreements required to implement a NPP.**
  - **Other elements include establishing the national nuclear regulatory body, national participation plan and surveying sites for future nuclear power plants.**
  - **Preparation of a national participation strategic plan**



# Project Management Process

## Pre Project phase

- **As the national program is being finalized, each utility considering a new nuclear power plant will need to develop their plan for proceeding with this type of project. Activities that should be considered at this phase include:**
  - **Establish an initial owner's organization and project management team**
  - **Establish a project budget**
  - **Establish the project management processes that will be used to carry out the project**
  - **Select external partners and experienced contractors to support the project**
  - **Perform initial power system planning reviews**
  - **Start the survey of candidate sites**
  - **Begin the assessment of available technologies**



# Project Management Process

## Plant Acquisition phase

- **Once the planning, program elements and pre project activities have been completed, and it has been determined that nuclear power is a viable alternative source of electricity generation for the country, the next phase should begin.**
- **Plant Acquisition phase activities should include the following:**
  - **Expand the project team to include all organizational units**
  - **Application for Preliminary Project Authorization (if required)**
  - **Technology Assessment (feasibility study)**
  - **Select technology planned to be utilized**
  - **Detailed site studies for the selected plant site**



# Project Management Process

## Plant Acquisition phase

- **Plant Acquisition phase activities continued:**
  - Electrical grid study
  - Environmental Impact Report
  - Preparation of the QA policy / program for the project
  - National regulatory agency technology approval (may extend into construction phase)
  - Preparation of Bid Invitation Specifications (BIS)
  - Technical and economic evaluation of bids submitted by Bidders
  - Technology transfer arrangements
  - Negotiation of financing arrangements
  - Contract negotiations and award
  - Refine cost, operating costs and economics of the project

## Project Management Process Plant Construction phase

- **The owner's organization and project scope during this phase will depend on the contract model selected for the project. Several approaches are available for this size project:**
  - **Turnkey contract**
  - **Non-turnkey contract managed by the owner**
  - **Non-turnkey contract managed by a third party**
- **The owner must retain direct project management responsibility for overall monitoring and control of the project.**

# Project Management Process

## Plant Construction phase

- **Major activities included in the plant construction phase:**
  - **Engineering and design (validation and modification of reactor vendor standard plant design required for the specific site and regulatory requirements)**
  - **Licensing**
  - **Site preparation**
  - **Procurement of equipment and materials (some critical long lead components should be initiated during the acquisition phase)**
  - **Equipment manufacturing and delivery to site**



# Project Management Process

## Plant Construction phase

- **Plant construction phase activities continued -**
  - **Civil work**
  - **Mechanical, electrical and I&C work**
  - **Hiring of personnel for the permanent plant operating staff**
  - **Training of plant operation and maintenance personnel**
  - **Completion of all required plant operating and maintenance programs and procedures**
  - **Nuclear fuel receipt and first fuel loading**
  - **Preoperational testing and startup**
  - **Plant acceptance testing**



# Project Management Process

## Project Operations phase

- **Near completion of the construction phase of the project, the project operations phase will be initiated. There will be some overlap of activities, as a result of fully staffing the operating organization during the construction phase, and then transitioning personnel from construction and start up roles into the operating organization.**
- **All training, processes and procedures required to operate the plant should be completed.**
- **The organization and facilities utilized during construction should be demobilized, except for possibly a small staff that would remain to address issues identified during initial operation.**
- **The project management organization is now ready to move to the next big project.**

# Organizational Structure

- **The initiation of a NPP project requires the establishment of a project management organization. As the project progresses, the organization will change to support the increasing scope of the work and the additional functions involved.**
- **The selection of personnel assigned to the organization is important through all phases of the project, but is extremely critical during the early stages of the work. During the formation of the project, at the Pre – Project phase, the selection of the core team must include very experienced personnel, with recognized expertise in new plant development.**



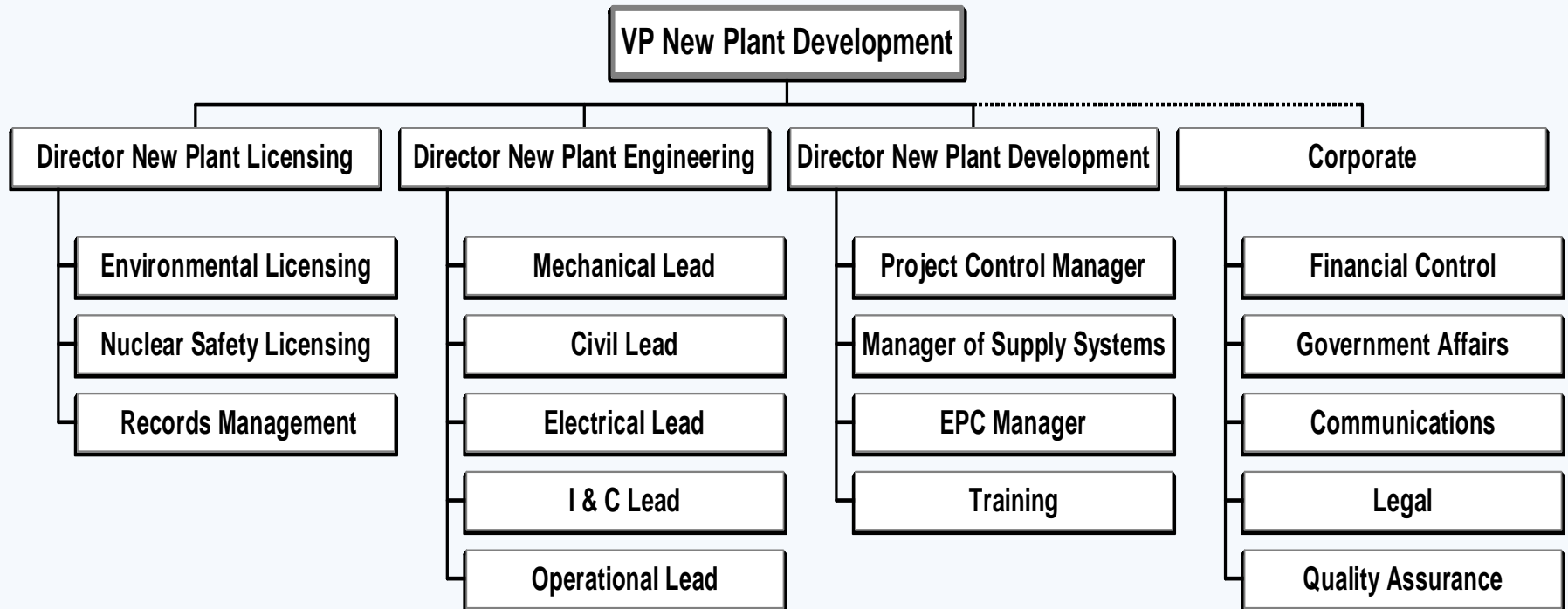
# Organizational Structure

- **The core team of project management personnel should be capable of assuming broader and greater areas of responsibility as the project moves from phase to phase.**
- **The owner's executive team must have confidence in the project management core team, based on the significance of a project of this magnitude.**
- **A representative organization chart is provided for a project that is in the early stages of the Plant Acquisition phase. Followed by construction and operation phase charts.**



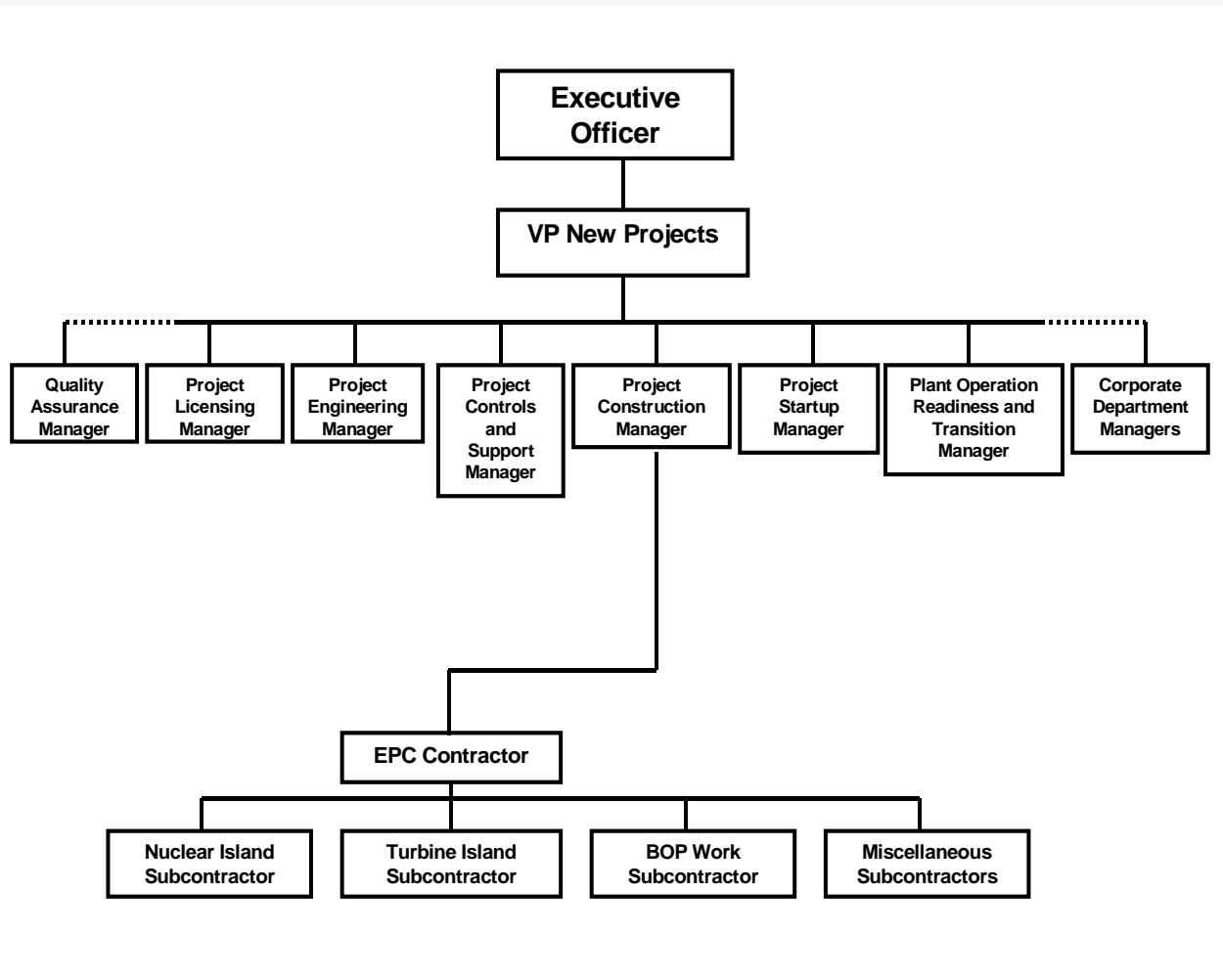
# Organizational Structure

Pre-project to early acquisition phase typical structure



# Organizational Structure

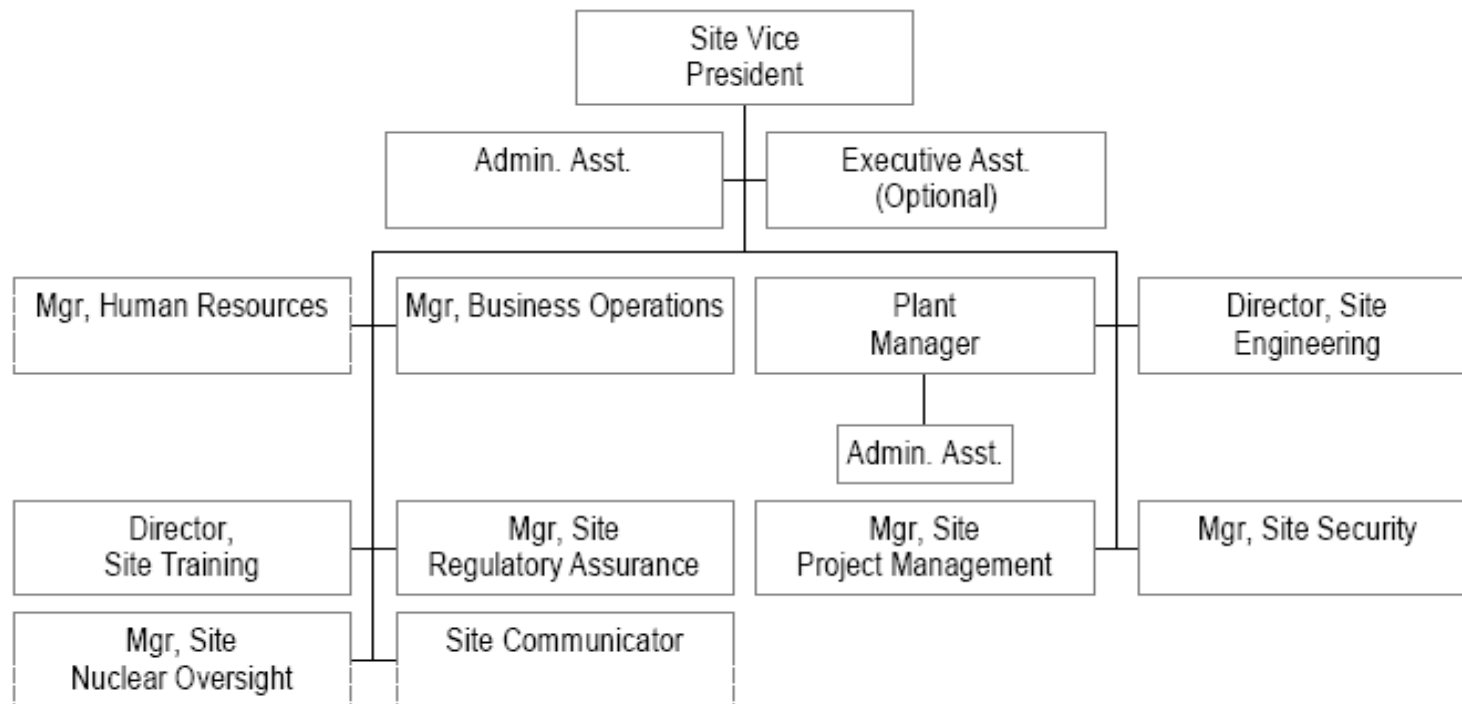
## Project Construction phase



# Organizational Structure

## Project Operations phase

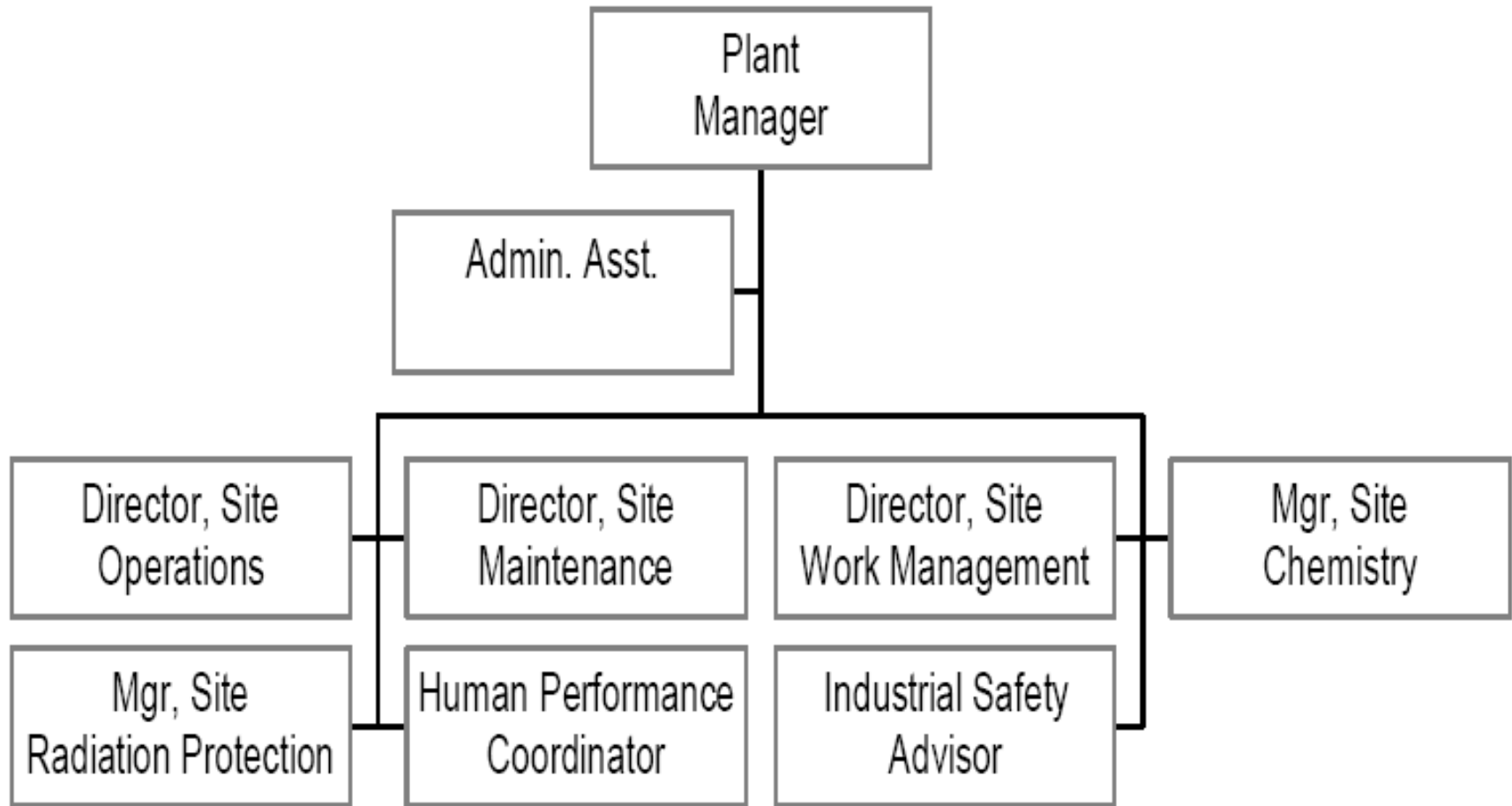
### Typical top level structure



# Organizational Structure

## Project Operations phase

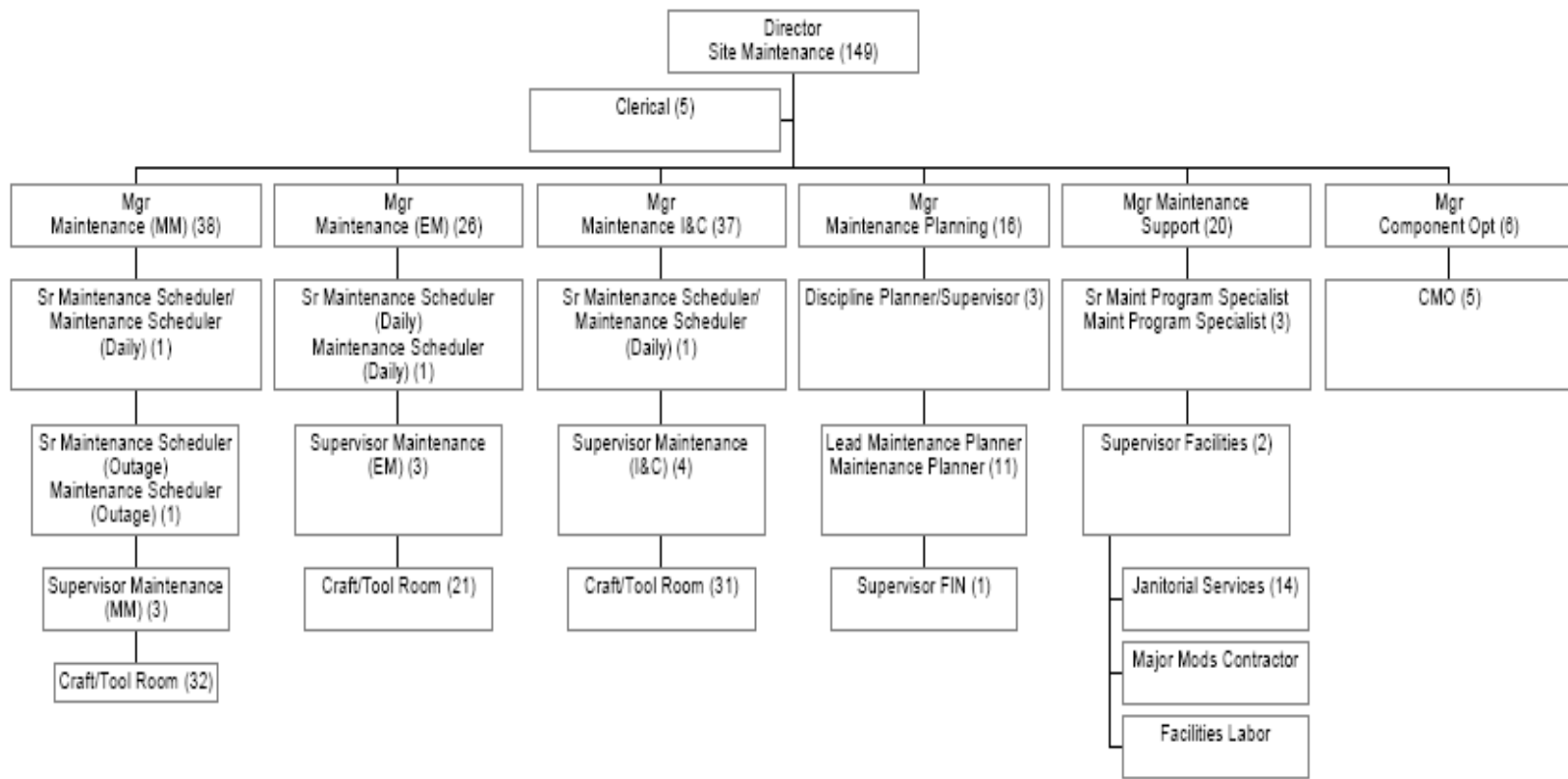
### Typical structure at the Plant Manager level



# Organizational Structure

## Project Operations phase

### Typical structure – Maintenance Department



# Project Schedule

- **The successful introduction of the first nuclear plant in a country spans a long period of time and involves the execution of a large number of activities.**
- **Thorough planning of these activities is essential and includes the following considerations:**
  - **Identification and listing of activities**
  - **Preparation of the description and definition of the objectives and scope of each activity**
  - **Assignment of responsibility for each activity**
  - **Prioritization and determination of activity relationships**
  - **Time allocation (when to start and duration) to complete each activity**



# Project Schedule

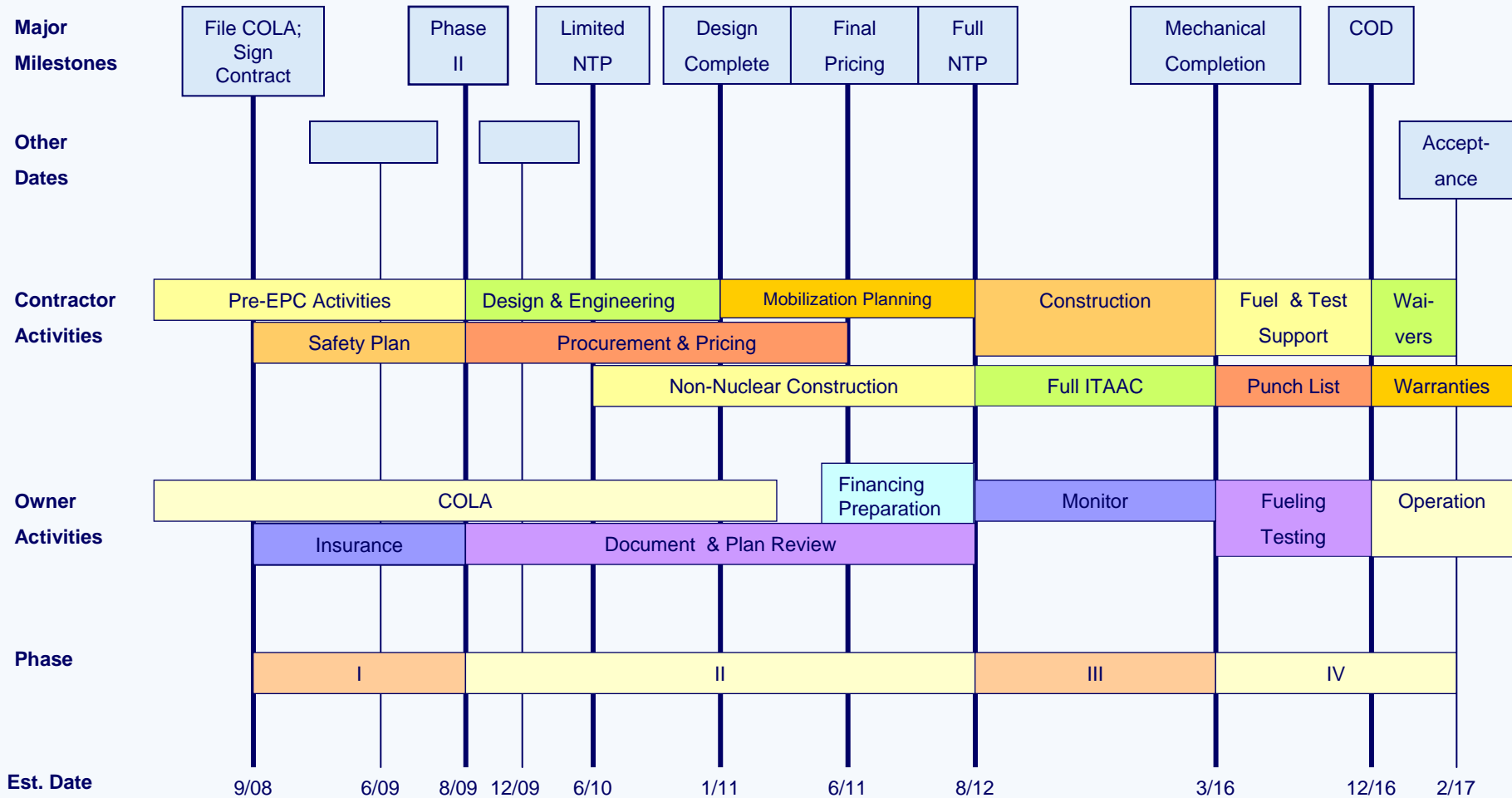
- **A level 1 master project schedule must be prepared to cover all key activities and milestones, from the decision to start a new nuclear program to the commercial operation date for each nuclear unit under consideration.**
- **As the project advances, more detailed schedules (level 2, 3 or 4) will be developed for specific project phases, areas and disciplines.**
- **The schedule is a key project management tool, and is critical to good project control.**

# Project Schedule

- Together with the project schedule, a comprehensive project plan must be developed to define the project scope, identify major project activities, including assigned responsibilities, a summary of resources required, and an estimate of project costs.
- A typical level 1 master schedule should include the major activities defined in the project phases previously listed in the project management section of this lecture.
- The following slide provides an example timeline for the development of a new nuclear plant. A level 1 master schedule will provide more detail than shown on this slide.

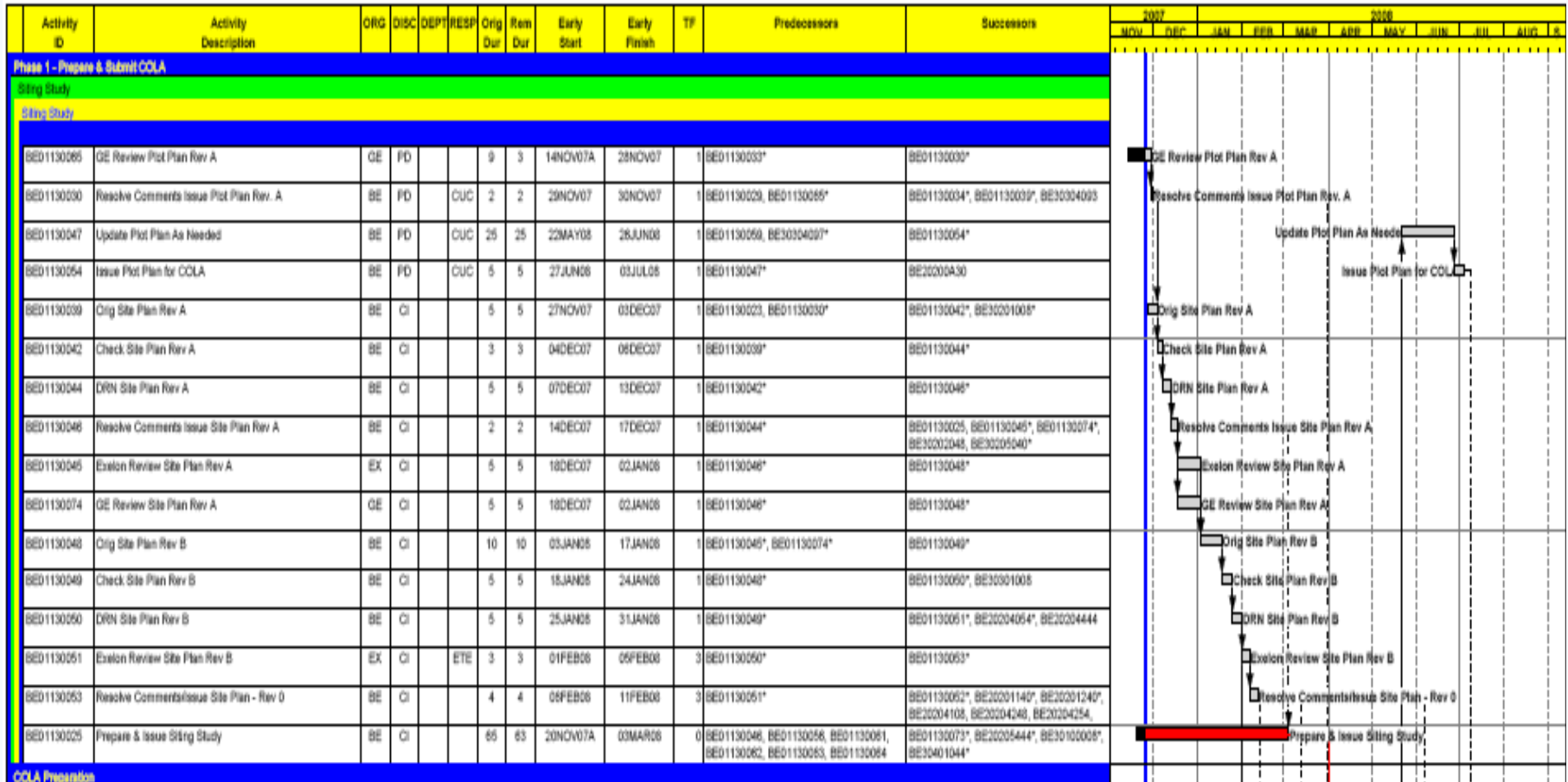
# Project Management Process

## Example timeline for the development of a new nuclear plant



# Project Schedules

## Example of a level 3 schedule



# Project Control

- Project Control - The process of implementing cost and schedule controls to achieve project objectives throughout the life of the project. It includes planning, scheduling, estimating, budget and cash flow preparation, monitoring actual cost expenditures and schedule accomplishments, cost and schedule variance analysis, recommendations for corrective action and integrated cost and schedule reporting.

# Project Control

- **During project implementation the Project Manager's primary responsibility is project control. Project control is the process used in accomplishing the following project objectives as defined in the approved project plan by minimizing the impact of change:**
  - **Scope**
  - **Quality**
  - **Cost**
  - **Schedule**

# Project Control

- **The project control function consists of applying project control fundamentals, identifying current and potential problems, analyzing impacts to established plans, deriving alternative solutions, and implementing preventive and corrective measures.**
- **Project Control enables the Project Manager to:**
  - **focus management attention on potential problems in a timely fashion**
  - **keep the project management team and executive management aware of project performance**
  - **create an atmosphere of project awareness among all project participants and project team members.**

# Project Control

- To be effective, project control should be based on the project cost forecast, relying on the approved budget as a baseline and staying within authorized limits.
- Project Control is the application of general principles to solve specific problems by controlling expenditures within an authorized budget while providing a "product" of the desired quality within the time limit specified.
- In managing a project, the cost, schedule and technical performance should be controlled throughout the life cycle. Control of the project requires that adequate plans be formed, suitable standards be developed, and an information system be set up that will enable the project to be monitored through comparisons of planned performance with actual performance. When deviations of actual performance from planned performance occur, corrective action should be taken to realign the project resources in order to achieve cost and schedule goals and commitments.



# Project Control

- **The key features of a Project Control process include:**
  - **development of an overall project plan specifying activities and responsibilities**
  - **product/deliverable oriented Work Breakdown Structure (WBS) to facilitate project control reports at various levels and for performance measurement**
  - **emphasis on early identification of scope changes and change order control**
  - **emphasis on cost trending and budget variance analysis**
  - **interactive cost reporting software including modules for cost reporting, estimating and project accounting in a "real time" environment**
  - **cash flow management and control**
  - **regular project control and technical project review meetings and effective communication channels.**

# PROJECT CONTROL FUNCTIONS

## PROJECT PLANNING

- Project Scope
- Budget
- Resource plan & availability
- Material procurement
- Change control philosophy
- Work Breakdown Structure
- Schedules & Constraints
- Cost estimates
- Contingency management plan
- Installation & Testing considerations

## PERFORMANCE MEASUREMENT

- Actual Cost
- Actual Schedule
- Accomplishments

## ANALYSIS

- Earned Value
- Cost/Schedule
- Progress

## FORECAST

- Cash flow
- Schedule update

## CORRECTIVE ACTION

- Schedule adjustment
- Scope management
- PIF
- CPS revision

## FEEDBACK

- Project Team Meetings
- Project review meetings

## PROJECT REPORT

- Project Control Reports
- Post Project Report



# Questions ?