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Good Practice Guide
GPG-FM-001

Project Management Overview

March 1996

Department of Energy
Office of Field Management
Office of Project and Fixed Asset Management

1. INTRODUCTION

The following sections present an overview of the Department's project management system. Project management can be a powerful tool that is particularly useful in terms of the management of the many interfaces within a project. However, despite the power of the concept, project management is not presented here as a model to solve all problems. Rather, it is a tool which, when properly used under appropriate circumstances, can aid an organization in the achievement of its major goals.

1.1 Why Use This Guide?

Project management is a means to effectively and efficiently organize, plan, execute, control, and review projects in the Department. The use of a systematic approach to project management provides a consistent structure for managing projects from the earliest idea for a project through the final closeout. A structured project management system helps ensure that projects are:

- clearly in support of Departmental missions and strategic plans,
- defined adequately to commit Departmental resources, and
- successfully completed according to technical objectives, on schedule, and within cost.

This Guide describes the broad concepts for a structured project management system to effectively manage projects in the Department. It defines the basic processes, products, and decision points across the life cycle of a project. The Project Managements System Flow Diagram (Figure 1) shows how each of those elements is integrated to form one consistent project management system.

1.2 Where To Use This Guide?

Departmental Elements may apply this Guide to any project. A project in this context is a unique effort that supports a program mission having distinct start and end points with planned interdependent activities undertaken to create a unique product, facility, system, or environmental condition. It may also apply to any category of project such as Strategic Systems, Line Item Projects, Operating Expense-Funded Projects, or General Plant Projects. Efforts may include construction, renovation, modification, environmental restoration, and decontamination and decommissioning. Tasks such as basic research, grants, and the operations and maintenance of facilities are usually excluded from being defined as a project.

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2. GRADED APPROACH

For cost-effective project management, all Departmental organizations should apply a graded approach to managing their projects. An important part of successful project management is to ensure that project requirements are commensurate with the dollar value, complexity, visibility, and risk of the project. These grading factors should be the basis for determining the degree to which the elements of the project management system are to be applied.

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3. PROJECT PHASES

Every project has certain phases of development. A clear understanding of these phases permits better control of Departmental resources in achieving its goals. Because of the complex nature and diversity of projects within the Department, the terminology may differ across organizational elements. From a fundamental standpoint, the project management system consists of preconceptual activities, a conceptual phase, and an execution phase, that includes acceptance and turnover. Generally these phases will occur in sequence, which is the way the following sections have been organized. However, this Guide recognizes that efforts within each phase may overlap significantly due to the complexity of projects. In cases where subprojects exist under one project, the phases may also occur simultaneously.

3.1 Preconceptual Activities

This phase leads to the formal start of a project through the identification of a need and development of mission need documentation. The program manager will then use this documentation to evaluate the proposal and determine if the need supports the missions, goals, and objectives of the Department and program. Cost accrued for activities in this phase are not part of the total project cost or the life-cycle cost for the project.

3.1.1 Program Sponsor

A need or opportunity for a project may originate from any office within the Department. Once a need has been identified, the originating office typically informs the appropriate program office of the proposed need to gain their initial support. Determining which organization(s) will develop the preconceptual documentation should be part of the preconceptual planning. Program offices may want to assign program managers early to assist in integrating a proposed need with the program's needs to ensure it supports the program's mission and objectives.

3.1.2 Mission Need Documentation

The program office, in partnership with the originating office, should define the approach for the project by developing mission need documentation. The mission need documentation provides sufficient information to allow the development of more detailed functions and requirements during the conceptual and execution phases. The documentation should contain short, qualitative information with primary focus on mission need.

The proposed mission need typically has clearly stated goals that the project will achieve. If the project objectives are required by Congress or some other outside authority, the documentation should describe how the project will meet the requirements. The mission need should include a description of the anticipated results and benefits to be gained from the project.

The project mission need should always correlate to the Departmental Strategic Plan and program mission, including integration with other projects and activities. The documentation should demonstrate that the project is an integral part of the program office's mission and objectives, and address organizational interfaces between the program and field participants.

The mission need documentation should include the technical functions, technical performance objectives, and technical interfaces with the project. The initial, high-level set of functional requirements should be used as the top-level functions for functional analysis in the conceptual and execution phases.

The preliminary schedule for the project, including the desired start date for fiscal year funding, should also be included. The initial master schedule should show the date for completion and proposed activity. It should include major milestones, including decision points, with sufficient detail to determine when funding will be required, by fiscal year, to meet the master schedule.

A rough order-of-magnitude estimate of the total project costs, including a detailed estimate of the costs for the conceptual phase, should be included.

The preliminary risk assessment for the project and the basis for the assessment should be included. Potential risk factors should be identified and the overall impact on the project estimated for each. Risk analysis is necessary for implementation of a risk-based graded approach. Evaluation of risks is crucial for effective use of the flexibility within the graded approach to formulate optimal control strategies. This should be input for development of the cost contingency.

A preliminary environmental strategy of the project including pollution prevention, waste management issues, and recommendations for the National Environmental Policy Act (NEPA) documentation determination should be included.

3.1.3 Approval of Mission Need

The mission need documentation is given to the decision maker responsible for the Approval of Mission Need Critical Decision. This decision should occur before beginning the conceptual phase and the decision maker should focus on mission need. Approval by the decision maker confirms that a proposed need supports a Departmental mission, initiates "formal" start of the project, and authorizes development of the conceptual design and supporting studies to adequately define the project.

The decision maker may approve the mission need documentation, request modification, or terminate efforts. In any event, a traceable record of the decision should be kept on file. Documentation supporting the decision should include a preliminary analysis of risk, including technical, schedule, and cost together with the potential impact on Departmental resources. The preliminary analysis usually serves to identify issues and opportunities to address during the conceptual phase.

3.2 Conceptual Phase

This is the initial formal project phase. Activities in this phase are dedicated to development of a design concept and basis for initiation of effective preliminary physical design, and establishment of a project baseline. The project baseline, including mutually dependent technical, schedule, and cost components should be reviewed and approved at the Approve Baseline Critical Decision prior to initiation of the execution phase.

This phase also marks the initial formation of the project team with the appointment of the project manager. During this phase the project team identifies the specific resources that will be required to accomplish project objectives and establish the scope, schedule, and cost for the project. During this phase the project management team develops the initial project planning documentation for execution of the project. For an environmental restoration project, the assessment phase is usually equivalent to this phase.

3.2.1 Project Team and Functions

A project is a joint venture where success depends on the involvement of all project participants. After receiving Approval of the Mission Need, the Operations Office normally appoints a project manager to lead and coordinate project efforts. It is at this point that the emphasis for management responsibility will usually shift from the program office to the project manager in the field. Although all participants work as a team, the project manager should be responsible for ensuring the successful completion of the project and managing the project team.

Sufficient planning activities and detailed studies are conducted to define the scope, schedule, and total project cost to provide a baseline for the project from which to measure performance. The information should be sufficiently detailed and reliable to support the Approval of Baseline Critical Decision.

One of the initial functions that is done during this phase is establishing an adequate design basis. It should identify the project's acceptance criteria and performance capability. The design should characterize an approach to satisfy the customer's needs and requirements.

The design basis leads to the development of schedule and cost estimates. It should include contingencies for managing risks that could jeopardize the successful completion of the project.

Preliminary functional requirements are transformed into a preferred configuration using system engineering principles. The end result usually means tradeoff studies have been completed, functional and operational requirements have been identified and developed into the final design criteria, and the configuration baseline has been established. As a note, the conceptual activities will usually develop roughly 20% of the completed design, but will form Congressional and public expectations for 100% of the total project cost.

Contract performance measures are developed to assess the physical, technical, schedule, and cost progress of the project. This is the basis for defining how the status of the project is determined to identify potential problems, assess their impact, and recommend alternative courses of action.

3.2.2 Status Reporting

Baseline reporting does not start until the execution phase begins. However, the project manager may chose to communicate progress or status at any time during this phase.

3.2.3 Conceptual Design Documentation

Typically, the conceptual phase produces conceptual design documentation leading to project execution planning that provides a comprehensive analysis and detailed assessment of the project. The conceptual design documentation typically addresses the following areas.

- Technical objectives.
- Project Schedule.

- Cost estimates, including total estimated cost and related other project costs that together represent the total project cost.
- Funding requirements and consideration of life-cycle costs.
- Specific risk assessment.
- Alternative studies, including Life-Cycle Cost Analysis.
- Preliminary safety assessment.
- Determination of NEPA documentation and initiation of NEPA analysis.
- Socioeconomic evaluations.
- Public and/or stakeholder input.
- Value Engineering assessment.

3.2.4 Project Planning Documentation

The project manager should use the information above to develop, in partnership with the program manager, project planning documentation which defines the specific requirements for the project. The planning documentation is the primary tool to Guide the execution and subsequent phases of a project and will form the project baseline once approved. Project planning documents may take different names, from a project execution plan, to cleanup planning documents for environmental restoration, to a program agreement for research and development. Over the course of a project, the project planning documentation normally addresses the following topics as a minimum. The project manager should establish the content for the initial project planning documentation and use a graded approach to match the management of risk to the planning elements.

Mission Need Justification. This should be considered the "anchor" of the planning documentation, as this section should not have to be updated after the mission need has been approved. General plant projects do not normally require a Justification of Mission Need. The justification may simply be a brief narrative contained on a data sheet (or similar) form which requests project funding.

Organization Structure. Identify all the project participants, and provide a high-level summary of their responsibilities and the role that each performs on the project.

Project Baseline.

Scope. Describe the structure of the project's technical work and clearly define objectives that are to be achieved. It should also identify, in measurable technical and economic terms, the project's design criteria and performance capability.

Schedule. Identify the known time related requirements and restraints affecting the project. Schedule should integrate with the work breakdown structure and cost estimate, and represent all technical work scope regardless of the funding source.

Cost. Present the costs and budgets for labor, services, and materials that have been or will be established. Identify the proper levels at which costs are collected and time phased in accordance with the project schedule.

Project Controls. Project Performance and Analysis is accomplished by establishing risk-based project controls that provide a description of the means to assess project technical, schedule, and cost performance with respect to established baselines. Include the circumstances or time table for identifying significant difference between planned and actual technical, schedule and cost accomplishments, and revising project forecasts as appropriate.

Acquisition Strategy. Briefly summarize the acquisition strategy developed for the project. Describe the approach that will be used for acquiring the products or services that support the technical objectives and work scope described in the planning documentation.

3.2.5 Systems Engineering

While not all projects will have a formal systems engineering process or system at work on a project, the basic assurance that the project as designed will meet the requirements should be established. The basic systems engineering process functional flow is shown in Figure 2, Typical Systems Engineering Process. The figure illustrates that, for each phase of the life-cycle, it is a good practice to:

- define what must be done,
- define how well it must be done,
- evaluate alternative solutions to getting it done,
- select a solution, and
- verify the solution meets the requirements.

The systems engineering process shown in the figure illustrates general steps to define the system configuration for the end-product(s). The process may require several iterations before the final functions, requirements, and architecture are identified.

3.2.6 Funds Management

Funds management is a process that assures budget formulation and financial controls are integrated with other management elements and ensures that funding impacts are reflected in contract or project baselines as is appropriate.

3.2.7 Change Management

Change management is the means to manage changes to approved scope, schedule, and cost baselines for all DOE projects. Change authority is established at the different management levels by using thresholds that limit the amount of control organizational elements have in managing changes on a project. A threshold is a range within which measures of actual occurrences against the baseline must stay to avoid the need for a baseline change control action. Thresholds correspond to the scope, schedule, and cost baseline of a project and should be developed with the baselines. Change management should delineate the authority and responsibilities for approval of baseline changes and thresholds.

3.2.8 Statusing

Status information appropriate for the project should be identified. The project team usually produces reports for both external and internal use. Reports provide information to assist in review and oversight of the project. The importance of reports in not simply to communicate progress and status, but to get feedback to the project team to enable them to make changes and take any necessary corrective actions.

3.2.9 Approval of Baseline

The project manager should present the project planning documentation to the appropriate decision maker for the Approval of Mission Need Critical Decision. This decision should occur before beginning the execution phase. Approval by the decision maker, which is usually the program office, sets the scope, schedule and cost elements of the project baseline, and indicates that the project has been adequately defined to allow the execution phase to begin. The project manager and project team should use this initial baseline as the basis for measuring the progress of the project and evaluating the effectiveness of the management system.

3.3 Execution Phase

After obtaining approval to proceed, the project manager should initiate execution of the project in accordance with the project planning documentation. During this phase, the project progresses from a conceptual design as defined by the planning documentation into a detailed design. The project will continue through design execution and conclude with final completion or acceptance of the project. Activities such as preliminary design, detailed design or remedial design, construction, or remedial actions will typically take place during this phase.

3.3.1 Congressional Funding

As described, the project manager typically develops planning documentation that describes the project baseline during the conceptual phase. The documents should be such that fiscal year budgets can be prepared by program managers to support the project and ensure establishment of an adequate design basis. The product is usually a project activity data sheet and associated documentation containing validated baseline information which the DOE submits for Congressional authorization and appropriation.

3.3.2 Preliminary Design

The preliminary stage of the project design utilizes the conceptual design and/or design criteria that have been prepared for the project as the design basis. Sufficient design should be performed to firmly fix the project scope and further develop schedules and costs. Preliminary design generally includes preliminary tradeoff studies, including evaluation of alternative design approaches; definition of the project design criteria and establishment of quality levels for systems and components to be applied in the detailed design stage; and specifications for equipment procurement.

3.3.3 NEPA Documentation

Proper environmental planning is critical to project management. The project manager should carefully integrate the requirements of NEPA with the appropriate stage of the project development. The development of an environmental analysis will depend on the availability of an appropriate level of engineering detail. Compliance with the NEPA process allows public participation and requires consideration of alternatives and mitigating measures. Most importantly in this process, the project manager should complete the required NEPA documentation prior to alternative so subsequent project planning and project decisions will reflect environmental values.

3.3.4 Detailed Design

The detailed deign effort usually begins after NEPA documentation and preliminary design have been approved and, if appropriate, a preliminary design is selected from multiple alternatives. Details are developed during this stage transforming the preliminary design framework into a complete design for the project. The detailed design usually ends with the detailed design review and Approval to Start Construction/Remedial Action Critical Decision.

3.3.5 Design Reviews

As a vital part of the overall management of the project, periodic design reviews should be performed during preliminary and detailed design. The reviews assure that project development and design are proceeding in an orderly manner and that the project will satisfy program objectives. (See *Projects Review* GPG-FM-015.)

3.3.6 Safety Assessment

The hazards associated with facilities, operations, or end-product(s) should be assessed concurrently with the inception of the execution phase of projects. In this context, hazards imply threats to safety, and safety implies freedom from harm to persons, equipment, facilities, and insults to the environment. For certain nuclear facility projects, it may be necessary to prepare preliminary safety documentation early in the execution phase. With whatever preliminary information exists, the preliminary safety documentation identifies hazards, proposes scenarios of accidents that would trigger the hazards, and analyzes the accidents for the severity of potential consequences and the probability of their occurrence. This preliminary safety documentation is a basis for Safety Analysis Reports for nuclear facilities. The Preliminary Safety Analysis Report is usually completed prior to the Approval to Start Construction Critical Decision, and the Final Safety Analysis Report is required prior to the Project Completion Critical Decision.

3.3.7 Configuration Management Documentation

The configuration management planning documentation is developed typically in the conceptual phase and is used in the execution phase as the means to implement a configuration management process, i.e., system. The configuration management system and its requirements should be tailored to the specific project and implemented with consideration given to:

- configuration identification, including the technical baseline.
- configuration control, including waivers and deviations procedures.
- configuration recording and reporting.

Configuration management is used as the means to verify that the end-product has been completed according to the technical specifications at the Completion/Acceptance Critical Decision at the end of the project.

3.3.8 Baseline Change Control Documentation

After the planning process in the conceptual phase has established scope, schedule and cost baselines, they should be carefully controlled through a formal, disciplined management process. Baselines are usually derived from the conceptual design documentation, or some other comparable documentation (see *Project Execution and Engineering Management Planning Guide*, GPG-FM-010, for additional information). Change authority is established at the different management levels by using thresholds which limit the amount of control organizational elements have in managing changes on a project. A threshold is a range within which measures of actual occurrences against the baseline must stay to avoid the need for a baseline change control action. Thresholds correspond to the scope, schedule, and cost baseline of a project and should be developed with the baselines.

Each Field Element (i.e., Operations/Area/Project Office) should maintain oversight of contractor tasks relative to DOE change control processes for all DOE projects to ensure changes are appropriately implemented by requiring their contractors submit appropriate deliverables.

3.3.9 Funds Management Documentation

A funds management process provides for the input of scope, cost and schedule baseline information into the Federal budget cycle, and facilitates the management of fiscal year disbursements to the project. Beginning in the preconceptual activities, the project uses either a project/activity data sheet or activity data sheet that is submitted as the project's first input to the budget cycle. In the conceptual phase, the project/activity data sheet and associated documentation contains detailed baseline information that is submitted for Congressional authorization and appropriation. Thereafter, the product is the various documents related to appropriations, disbursements and management actions necessary to fund the project activities on a fiscal year basis.

The project cost estimate, after approval of the cost baseline, is the basis for funds requests from DOE to Congress and for the budget authority to execute the project's work scope. The project manager typically uses a time-phased cost plan based on the cost estimate to serve as the basis for any subsequent Congressional funding requests as part of the ongoing annual budget process. The funds management process is the system that is used for managing the capital and expense funds that have been authorized and made available for use on a contract or project. The budgeted cost for one fiscal year will normally form the basis for that fiscal year's funding request through the budget call and development process.

During the normal course of a project, the availability of funding may have an impact on any or all of the project contracts. When funding changes interrupt a project or contract's planned effort, a timely impact analysis will allow the project manager to develop project impact and completion scenarios. When the impact of a funding change is significant enough to warrant a corresponding change in the cost and schedule baseline, a baseline change action is warranted.

3.3.10 Risk Analysis and Management Documentation

One of the earliest actions in the risk analysis process should be to determine at which points (if any) in the project life-cycle risk analyses are appropriate. Reviews, revisions, or updates should be performed at least once during each project phase (i.e., conceptual, execution, and acceptance), preferably at the beginning of the phase. A risk analysis should be performed if conditions warrant (i.e., a major risk is realized, the potential of a high-risk item is eliminated, the potential for new risks is identified, etc.). The complexity and size of the project are the key factors in determining when the risk analyses will benefit the project manager, how often it should be reviewed and/or updated during the project, and which elements will be reviewed and to what depth.

Risk analysis will assist in identifying significant risk factors and their consequences on project objectives and or baselines (see *Risk Analysis and Management Guide*, GPG-FM-007). Project risk analysis should be considered an ongoing, integrated process that addresses the risk. Managing or mitigating a risk should cost far less than realizing the risk itself. The following are some examples of risk mitigation strategies.

- Specific design features/redundancies to control the risk.
- Prototype testing.
- Alternative/value engineering studies.
- Formal design reviews.
- Analytical modeling.

- Operating adjustments.
- Life accelerating testing.
- Functional testing.
- Expert design review and redesign.
- Financial incentives to vendors/contractors.
- Strategic milestone.
- Hold points.
- Additional resources.
- Selective use of contingency.
- Overtime/multiple shifts.
- Application of project controls to appropriate level.

In addition to the development of a risk management strategy, the results of the risk analysis are also used by the project manager to develop performance objectives and measures and specify status report formats. When risk management planning is completed, the project team should implement the plan and periodically evaluate performance against performance objectives and measures to ensure that risks are mitigated.

3.3.11 Project Control and Reporting

Project control and baseline management processes are implemented at the inception of the execution phase. The project baseline is the standard against which project technical, work scope, schedule, and cost progress and performance are measured. Configuration management of the technical baseline and specifications is integrated with project controls for the cost and schedule baselines to ensure a consistent process. The project control process includes continuous determinations, analysis, and reporting of performance and trends against the project baseline. The analysis includes problem identification, forecasting based on performance trends, and development of alternative solutions to cost and scheduling problems. The project control process and its associated work scope, schedule, and cost reporting is maintained through each stage of the project including preliminary design, detailed design, construction, and acceptance (see *Performance Analysis and Reporting*, GPG-FM-006).

3.3.12 Approval to Start Construction

This decision should occur before construction begins. It indicates that the detailed design for the project has been adequately defined to continue with the project in accordance with the design requirements and project planning documentation.

Construction, in this sense, is a generic term which may refer to engineering development, physical construction, remedial actions, etc.

3.3.13 Transition Plan

As early in the execution phase as feasible, the project manager should initiate planning for and development of the documentation for transition to operations. Transition documents may include development of operations and maintenance manuals, generation of as-built drawings, procurement of materials needed for initial operations, etc. The plan should also address staffing during this stage. The project manager should ensure that the operators that are responsible for operations of the facility develop operating procedures, and, if necessary, a training program to ensure safe, compliant, and successful transition.

3.3.14 Closeout Plan

The planning process for a project should also include a closeout plan. This brings the project to an orderly close. The closeout plan should include the following.

- Roles, responsibilities and authority of the personnel responsible for safe closeout of the project.
- Alternative use studies or approvals.
- Decommissioning planning, if required. (This should also be a consideration in design planning.)
- Closeout approvals.
- Permits, licenses, and/or other environmental documentation.
- Relocation of resources.
- Post-project reviews.
- Termination or closeout of contracts.
- Lessons learned.
- Submission of final closeout reporting and any adjustment to obligations and costs.

3.3.15 Construction/Remediation Complete

At the end of the construction/remediation stage of a project, the project manager should focus on transition activities, which require strong coordination with the operating organizations. All the roles and responsibilities, acceptance testing, and start-up planning for transition should be addressed in the project planning documentation. Not all projects will undergo transition activities but may proceed directly to closeout as prescribed by the project planning documentation.

3.3.16 Acceptance Documentation

The project manager should submit acceptance/completion documentation to support the Acceptance/Completion Critical Decision. This decision typically occurs before beginning operations. It indicates that the technical performance has been demonstrated as acceptable and that no further transition activities are necessary. During the transition, the project manger should work closely with operating organizations to complete acceptance testing and start-up in accordance with the project planning documentation. At certain times during the transition, the operations organizations may take beneficial occupancy and take ownership of all documents.

3.3.17 Final Acceptance

Acceptance testing and development of related documentation typically lead to the Completion/Acceptance Critical Decision. The operations and project organizations generally perform tests and evaluations to ensure that the project, as designed and built, can be safely operated. Transition of the project to operations usually concludes with final acceptance of the facility by the operations organizations.

3.3.18 Closeout

After the operations organizations approve final acceptance, the project manager, usually at the direction of the Head of the Field Element, should closeout the project. This phase brings the project to an orderly close. Depending on the project, this phase may follow final acceptance by the operations organizations, or termination of an incomplete project.

4. MEASURING FOR RESULTS

Performance measures for project management are under development as part of the Departmental training curriculum for Life-Cycle Asset Management.

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5. SUGGESTED READING

- Office of Management and Budget (OMB) Bulletin No. 94-08, PLANNING AND BUDGETING FOR THE ACQUISITION OF FIXED ASSETS.
- OMB Circular A-109, MAJOR SYSTEM ACQUISITIONS.
- 31 U.S. Code, ANTIDEFICIENCY ACT (Sections 1514, 1517, 1518, and 1519).
- DOE O 130.1, CONGRESSIONAL BUDGET REVIEW.
- DOE O 451.1, NATIONAL ENVIRONMENTAL POLICY ACT COMPLIANCE PROGRAM.

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6. DEFINITIONS

For a complete listing of the definitions for major terms used in this Guide see the Department's Consolidated Glossary.

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7. ASSISTANCE

Questions concerning this Guide may be referred to the Office of Field Management in Washington, D.C. at (202) 586-4041.

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8. RELATED TRAINING

Refer to list of available Departmental training courses on project management through the Office of Human Resources.

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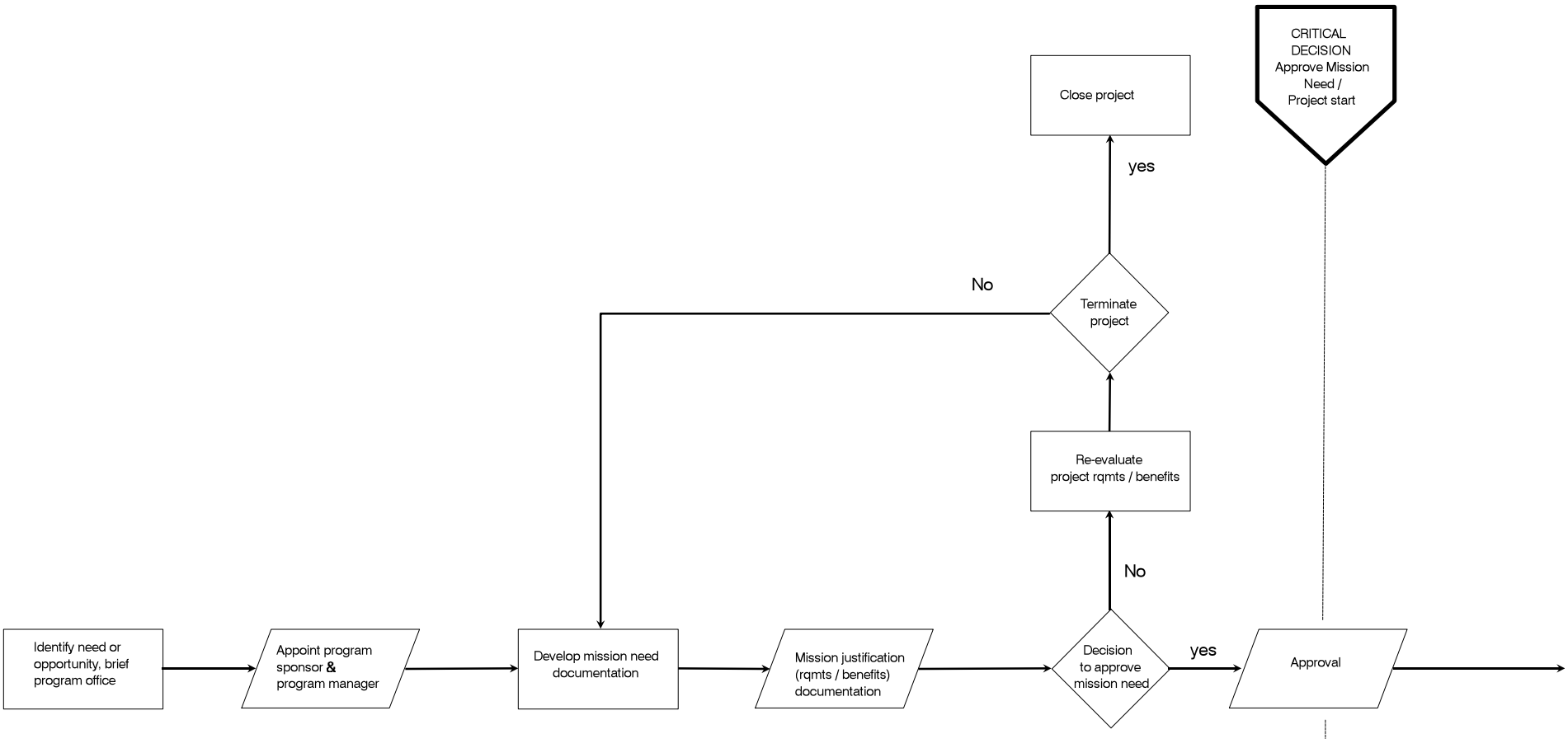
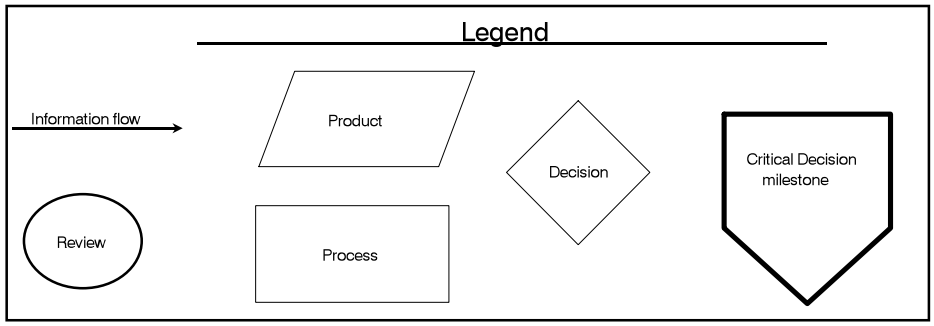
Figure 1: Project Management System Flow Diagram

Pre-Conceptual Activities





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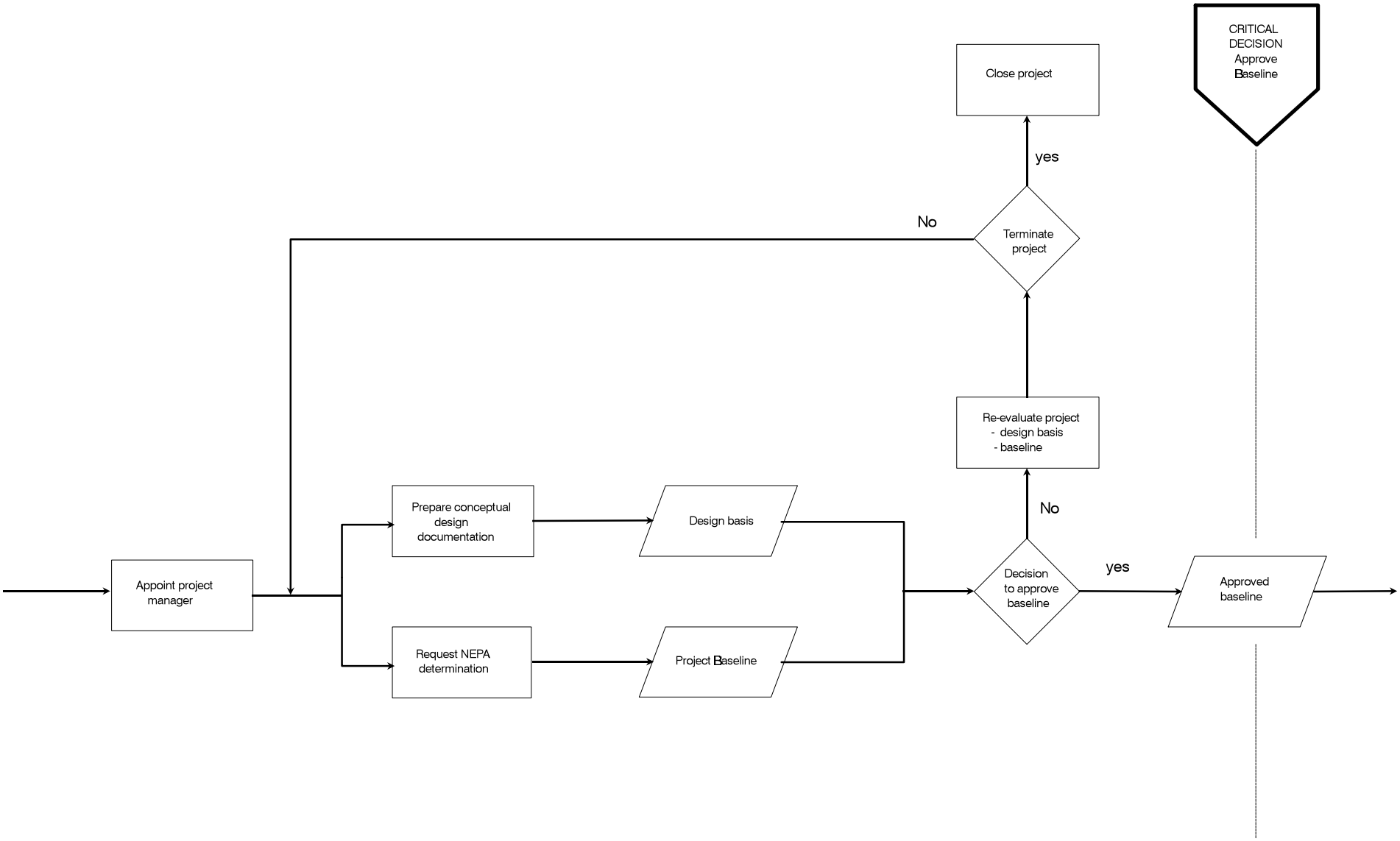
Conceptual Phase



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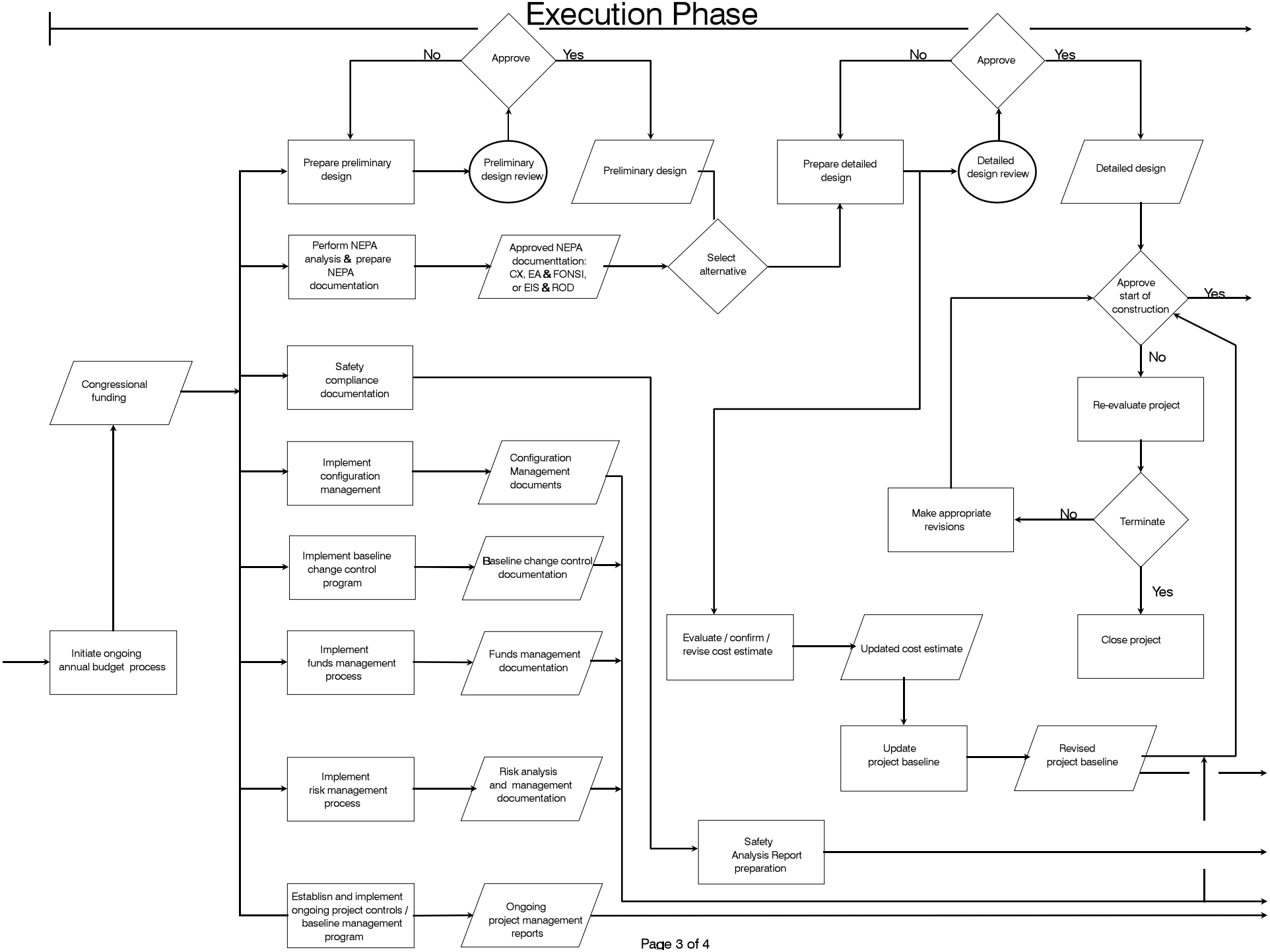
Execution Phase



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Execution Phase

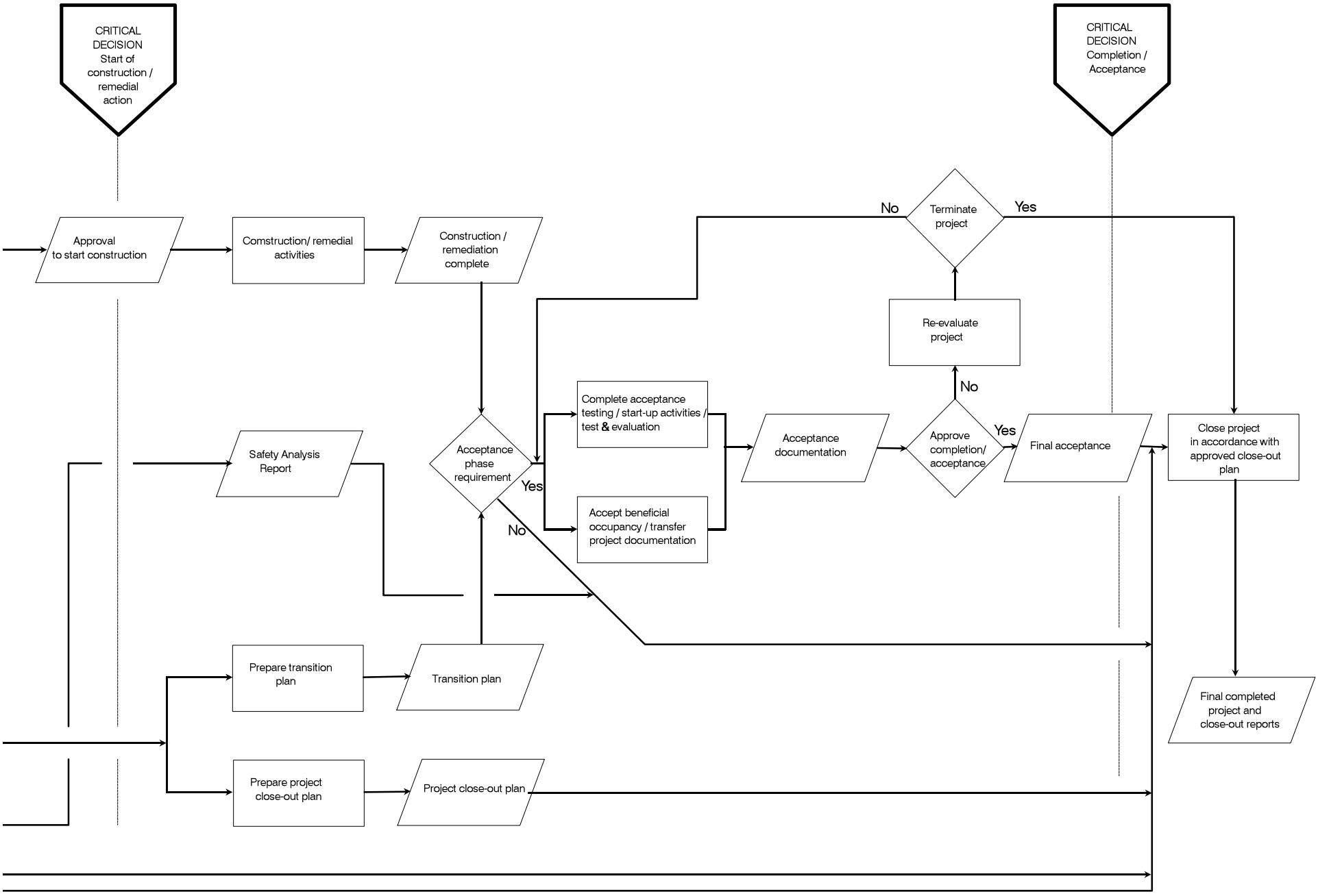

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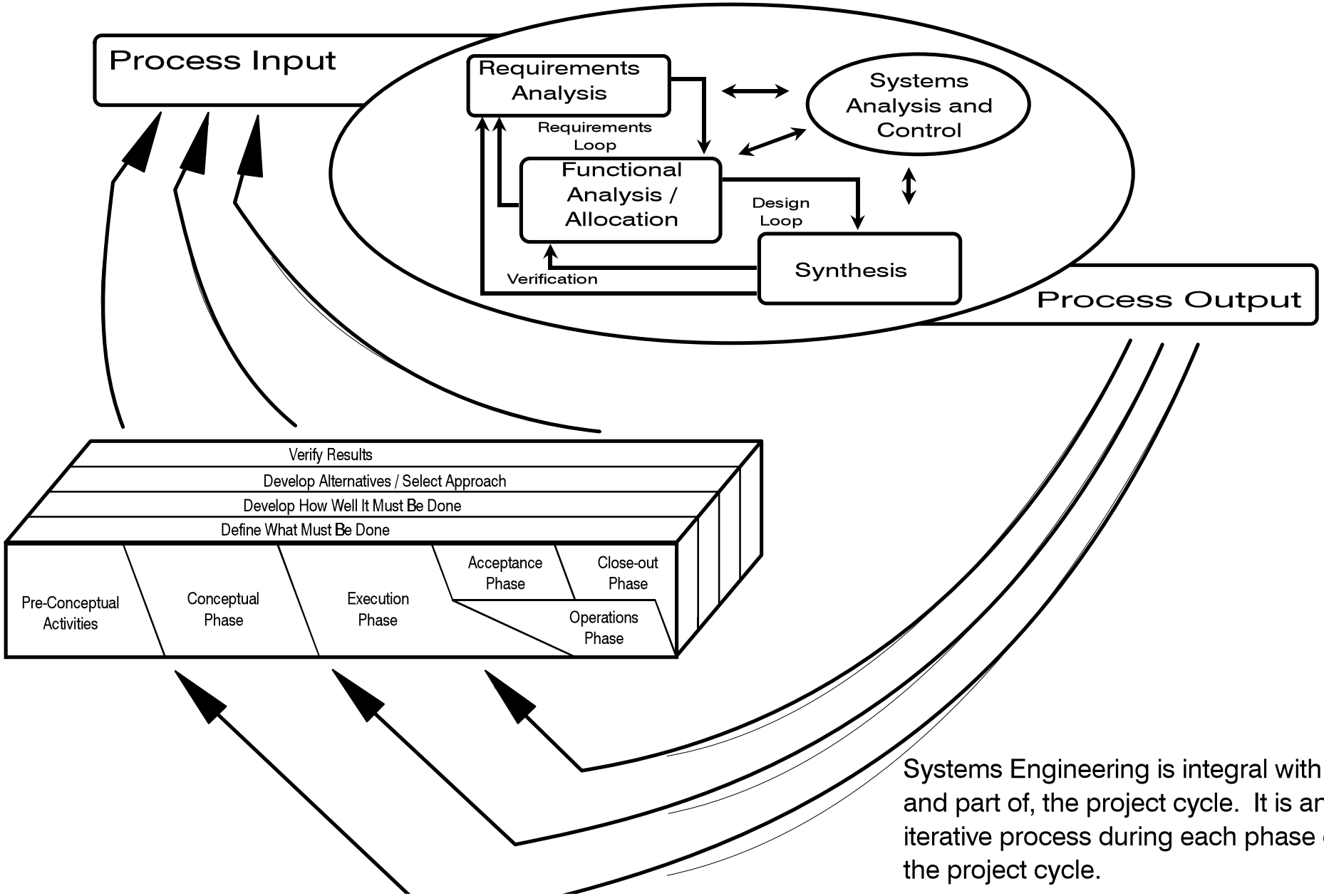
Figure 2: TYPICAL SYSTEMS ENGINEERING PROCESS



Systems Engineering is integral with, and part of, the project cycle. It is an iterative process during each phase of the project cycle.