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The Environmental Management Project Manager's Handbook for Improved Project Definition

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CHAPTER 1
INTRODUCTION

ADEQUATE PROJECT DEFINITION IS CRITICAL TO SUCCESSFUL PROJECT PERFORMANCE

The United States Department of Energy (DOE) is committed to providing high quality products that satisfy customer needs and are the best possible value for the customer's investment. To meet the challenge associated with this goal, DOE personnel must possess the knowledge, skills, and abilities to ensure successful job performance. In addition, there must be recognition that the greatest obstacle to proper project performance is inadequate project definition. Without strong project definition, DOE environmental management efforts are vulnerable to fragmented solutions, duplication of effort, and wasted resources. The primary means of ensuring environmental management projects meet cost and schedule milestones is through a structured and graded approach to project definition, which is the focus of this handbook.

1.1 OBJECTIVE

The objective of the DOE project definition initiative is to improve project performance through the creation of a project definition policy, process criteria, and the development of this project definition handbook, which outlines the project definition process. Since the project definition process outlined in this handbook is meant to provide a conceptual framework for all types of projects, terminology specific to any guidance or directive is not used. The project definition process will:

- provide an integrated, systematic approach to project definition resulting in effective and efficient planning, execution, control, and completion of DOE projects;
- establish realistic technical scope, schedule, and cost baselines for managing projects across fiscal year boundaries to project completion;
- measure successful completion of projects and other aspects of project performance against technical, schedule, and cost baselines; and
- avoid commitment of resources before a project is adequately defined.

PROJECT DEFINITION IS A THREE-PHASED PROCESS:

- *CONCEPTUAL DEVELOPMENT*
- *PRELIMINARY DEFINITION*
- *FULL DEFINITION*

The handbook not only outlines the overall project definition process but also provides modifications to traditional DOE directives that encourage a proactive approach to decision-making.

1.2 APPROACH

Project definition consists of all planning activities undertaken prior to final detailed design and project execution. If properly and thoroughly executed, these activities will ensure project technical, cost, and schedule success; reduce regulatory and community concerns; and satisfy the customer. The project definition process can be divided into three phases which, if focused properly, lead to successful project completion. These phases are discussed in the following paragraphs.

Phase I - Conceptual Development: the phase of a project's lifecycle in which the project need is identified and justified, objectives and functional requirements to meet those objectives are outlined, rough milestones and cost estimates are established, a preliminary risk assessment is completed, potential stakeholders are identified, communication networks are established, and project team formation begins.

Phase II - Preliminary Project Definition: the phase of a project's lifecycle in which additional information is gathered to enhance the results of the conceptual development phase; alternative courses of action are identified; design criteria are developed; community, stakeholder, and regulatory agreement on an alternative is established; conceptual design is created for the identified alternative; more accurate estimates of technical scope, schedule, and cost are developed for the identified alternatives; and the value engineering process is further developed.

Phase III - Full Project Definition: the phase of a project's lifecycle in which a preliminary project design is created for the agreed upon alternative, a finalized work scope is created, and final cost and schedule baselines are established. **Completion of full project definition indicates that the project has been adequately defined to commit resources to its final detailed design, execution, completion, closure, and/or operational status.** This basic process, illustrated in Figure 1-1, shows the natural progression from initial project conceptualization to successful project execution.

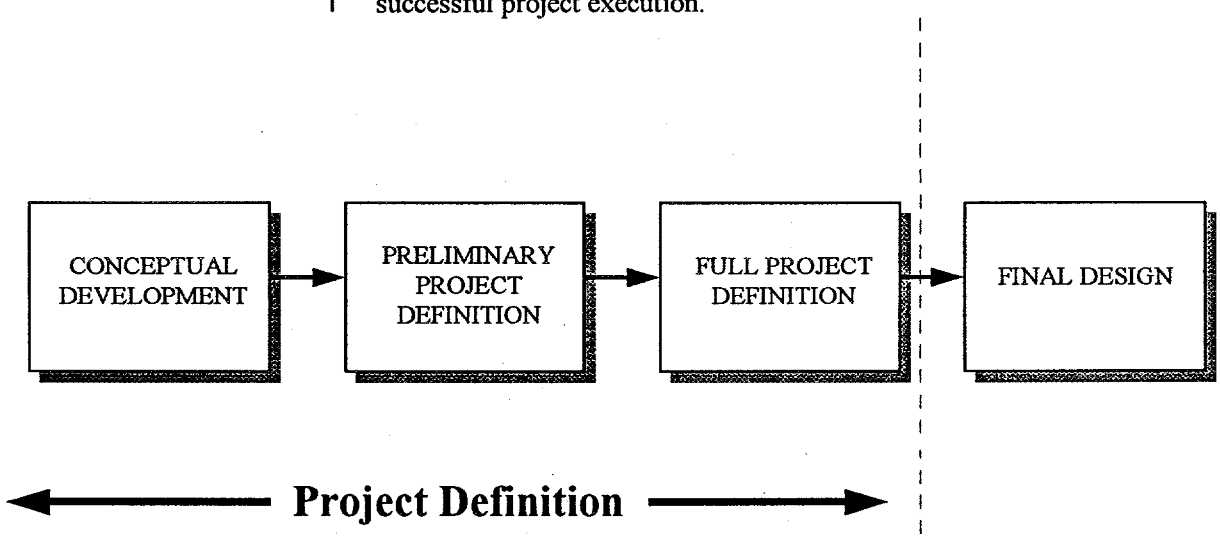


Figure 1-1. Flow Chart Illustrating Elements of Project Definition Process.

1.3 ENVIRONMENT

For any project definition effort to be successful, it must be performed by motivated and qualified individuals (people), executed within a supportive and cooperative cultural environment (culture), and composed of managerially sound and technically correct processes (process); these factors do not exist in isolation from one another. It is these three factors, operating as a single entity that can be called the project definition environment, or the environment in which the process outlined in Section 1.2 operates. All attempts at improving project definition need to address three major components of the project definition environment (see Figure 1-2):

PEOPLE ARE THE MOST IMPORTANT COMPONENT OF ANY PROJECT

- <u>People</u> - People are the most important component of any project. Issues that affect project definition and which involve people include project team formulation, the training and experience of team personnel, clarity of roles and responsibilities, and community and regulator relations.

- <u>Culture</u> - All projects occur within an existing cultural framework. Cultural issues affecting project definition include program planning, the regulatory environment, stakeholder attitudes, incentives and motivation, learning and sharing among project personnel, and a history of building cooperative behavior; all these tasks must be managed by the Project Manager. Strong steps must be taken to ensure that the cultural environment is supportive of the project definition process.

- <u>Process</u> - Projects are typically part of a larger managerial and technical program mission process. The larger process includes activities central to project definition: scheduling, budgeting and cost estimating, performance measurement, and tracking. The procedural components of the project definition process can be viewed as consisting of project need identification and justification, conceptual development, scope and design creation and refinement, and execution planning.

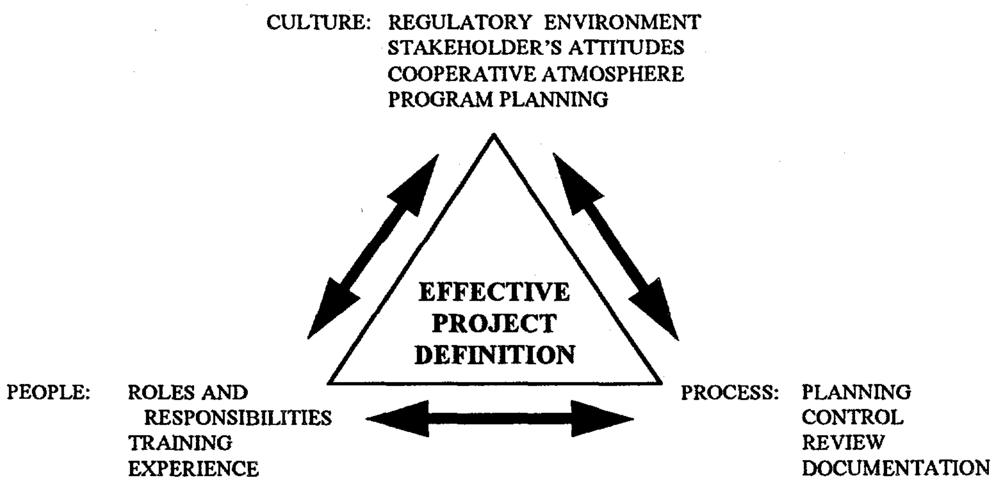


Figure 1-2. Focus on People, Culture, and Process for Effective Project Definition.

1.4 HANDBOOK OUTLINE

HANDBOOK PROVIDES SUPPLEMENTAL INFORMATION.

This handbook is intended to provide users with a basic and solid understanding of project definition so each organization's approach will be observable, measurable, controllable, and consistent. That approach is focused on making smarter, faster, and less costly project management decisions through applying a comprehensive definition process within an integrated decision environment and through early planning activities directed toward a common goal. This handbook should be considered a starting point or base from which to expand understanding of how to define projects to improve project performance. It provides supplemental information only and is not intended to replace regulatory guidance or DOE Orders concerning project management.

THE PROJECT DEFINITION PROCESS CAN BE APPLIED TO ALL TYPES OF PROJECTS.

Readers of this handbook are encouraged to consult other resources to familiarize themselves with available decision aids. Although all attempts at project definition will encompass the same basic aspects, there will be slight differences in the required input into project definition dependent upon the type of project. The basic approach outlined in this handbook can be adapted and easily applied to all types of projects, such as:

- waste management
- environmental restoration
- construction
- decommissioning and decontamination
- Nuclear Regulatory Commission (NRC)
- Formerly Utilized Sites Remedial Action Project (FUSRAP)
- Uranium Mill Tailings Remedial Action (UMTRA)

THE PROJECT DEFINITION HANDBOOK IS A LIVING DOCUMENT

This handbook is intended to be a living document and will evolve as a better understanding of the project definition process and its effects on project cost, schedule, and success develops through experience and concentrated effort at using the process. Experience and documented lessons learned from each DOE project to which this process is applied will be incorporated in subsequent versions of this document. Whether one is a contractor, a DOE Project Manager, Contractor Project Manager, technical specialist, or other member of the project team, this handbook can be helpful when considering project definition roles and improving the impact each role contributes to the process.

Information contained in this document progresses from a general outline of the process to the specific steps of implementing the process under given circumstances. For reference, a brief summary of each section is given as follows.

Chapter 2-Project Definition: People
The roles and responsibilities of the key individuals (or key groups) that should be involved in all phases of the project definition process are discussed in detail in this chapter. It asserts the need for adequate training of all project personnel and outlines the importance of community and regulator communications.

Chapter 3-Project Definition: Culture
This chapter discusses the various aspects of the culture or environment in which the project exists and which the project definition process must effectively address to be successful.

Chapter 4-Project Definition: The Process
Chapter 4 outlines the basic project definition process through three phases of evolution: conceptual development, preliminary project definition, and full project definition. It provides a list of activities and products that must be completed during or at the end of each phase and details factors that may negatively influence project definition and must be considered.

Chapter 5-Project Definition: Auxiliary Process Information
Background information on several activities such as function analysis, project risk assessment, value and system engineering, work scope creation, scheduling, cost estimating, the budget process, contracting, and performance measurement. It is advantageous to have knowledge of these topics prior to undertaking project definition activities.

Chapter 6-Project Definition: Environmental Restoration
Chapter 6 outlines the departures from normal project definition that are necessary to further improve the process and will lead to successful project planning and execution within the ER Program.

Chapter 7-Project Definition: Waste Management
The relationship between the basic project definition process and the process used within the Waste Management Program is presented in Chapter 6. Actions that will lead to improved project planning and execution within the existing Waste Management Program process are also discussed.

Chapter 8-Project Definition: Facilities Transition
A description of the process of facilities transition is presented in Chapter 8.

Chapter 9-Project Definition: References
A list of resources referenced during the creation of this handbook, as well as, suggested reading for further information are provided in this chapter.

Appendix A: Tools
Appendix A includes checklists that assist in effective and efficient project definition throughout the various phases. Checklists are provided for cost estimating, community relations, and other activities described in previous chapters.

Appendix B presents the glossary, and **Appendix C** presents the acronyms list. A subject index is included in **Appendix D**.

CHAPTER 2
PROJECT DEFINITION: PEOPLE

For any project definition process to be effective, the project definition task must be performed by a team of motivated and qualified individuals. The project management effort and team involvement supports the project definition. To ensure that project personnel make project planning work towards the benefit of successful project completion, roles and responsibilities must be clearly defined, individuals with appropriate capabilities and experience should be selected, training should be provided to develop or enhance under-represented capabilities or skills, and proactive communication should be strongly encouraged.

2.1 ROLES AND RESPONSIBILITIES

THE PROJECT TEAM MUST CONSIST OF MOTIVATED AND QUALIFIED INDIVIDUALS WORKING IN A SUPPORTIVE ENVIRONMENT

Projects are often divided into discrete pieces with each individual managing their piece of the total project. The nature of projects makes everyone a customer and a supplier in the process. Therefore, it is paramount that all involved personnel have a clear understanding of their roles and responsibilities. Prior to commencement of any project definition and implementation activities, the individuals involved must understand and concur with the distribution of responsibility and accountability among the Project Team.

2.1.1 Program Manager

In DOE Headquarters and field office organizations, the Program Manager is the individual responsible for the management and establishment of program policy and procedures, planning and strategy, budget formulation and execution, and assurance of program objectives. The actual responsibility for the project execution, however, lies with the Project Manager. To ensure that similar project goals are met, the Program Manager and Project Manager should work as a team throughout the life of the project. As a minimum, the Program Manager should participate in the following activities to ensure a successful project and proper coordination with the Project Manager and team:

- participate, where appropriate, in project execution planning, review planning documentation, and approval of Project Execution Plans;
- participate, where appropriate, in reviews to ensure compliance with program requirements;
- conduct periodic on-site review and assessment of project status throughout project development and execution;
- review and analyze project reports;
- participate in the design review process to ensure programmatic requirements are satisfied;

SUCCESSFUL PROJECT DEFINITION REQUIRES CLEARLY DEFINED ROLES AND RESPONSIBILITIES

- ensure environmental, safety, and health planning and documentation to meet programmatic requirements;
- review and approve project change requests above agreed-upon thresholds for program approval; and
- serve as principal interface for project issues with Department of Defense, Defense Nuclear Facilities Safety Board, Office of Management and Budget, Congressional Staff, and Headquarters functional elements.

2.1.2 Project Manager

The Project Manager is the individual who has been assigned responsibility for accomplishing a specifically designated unit of work or group of closely related efforts established to achieve a designated objective within a certain time frame. The Project Manager is ultimately responsible for assuring that project goals and objectives are achieved (i.e., quality work, on time, and within budget) and exercising appropriate, timely management decisions on the project. Furthermore, the Project Manager must be technically capable, mature, readily available, on good terms with senior management, a team motivator, and knowledgable of all levels of DOE organizations.

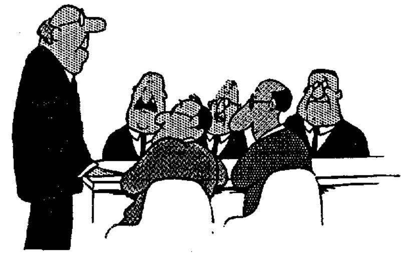
Project Managers differ from functional managers in that functional managers are only concerned with their particular area of expertise, while Project Managers must know not only their requirements but also the requirements of regulators, contractors, and customers. The Project Manager must then ensure all requirements are blended into a project acceptable to all interested parties.

A GOOD PM MUST OCCASIONALLY ACCOMPLISH THE IMPOSSIBLE

A good Project Manager knows the rules and understands the differing priorities of the various project participants. A number of different organizations and individuals are orchestrated by the Project Manager into a team effort that ensures the project goals and objectives are met. The Project Manager is the primary contact for all response actions and coordinates, directs, and reviews the work of all individuals involved. The Project Manager must manage quality through direct involvement in planning, team leadership, and technical decision making and is also responsible for reporting upward to senior management.

One of the biggest challenges the Project Manager may face is managing individuals who are not motivated or completely qualified. To work in this type of situation, the Project Manager must maintain a positive attitude and assign work that is appropriate for the individual's capabilities.

It is through the Project Manager that the facility complies with the laws, regulations, court orders, and work plans required by regulatory agencies. The Project Manager is responsible for the following areas: developing a plan for management and control of the project, managing the quality of technical work, communication, scheduling and budgeting, contracting, forming and coordinating the project team, overseeing site work and contractors, data management, reporting, health and safety, developing personnel resources, recognizing and responding to emergencies, and tracking/measuring project performance.

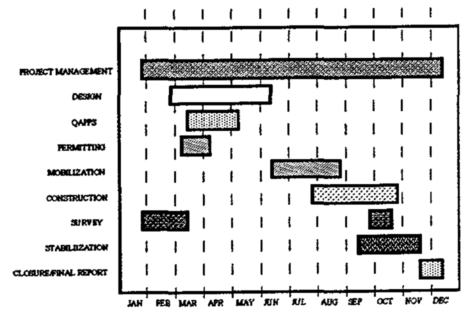


COMMUNICATION IS AN ESSENTIAL ELEMENT TO ANY PROCESS INVOLVING MULTIPLE TEAM MEMBERS

The Project Execution Plan, as defined by DOE Order 4700.1, is the document that sets forth the plans, organization, and systems individuals responsible for managing the project shall use. The content and extent of detail of the Project Execution Plan will vary in accordance with the size and type of project and state of project execution. The plan should be kept current as the project progresses through a periodic review conducted by the Project Manager. The Project Execution Plan should include, to the extent necessary, the following elements: project's purpose, scope, primary participants, contracts, objectives, management organization and responsibilities, work plan, work breakdown structure, schedule, logic diagrams, performance criteria, cost estimates, work force planning, information and reporting, quality assurance, and responsibility matrix. The Project Manager is responsible for ensuring that realistic baselines are established in the Project Execution Plan and that these baselines are maintained.

Managing the quality of technical work requires the Project Manager to develop sound specifications and/or standards, audit project activities, and review project documentation. Specifications should clearly define project objectives, address all project activities, and provide clear, quantitative measures of performance. Technical audits must not only identify problems but also ensure that the problems are resolved and do not recur.

Communication involves coordinating contractors; federal, state, and local regulatory agencies; site management; clients; and the community. Since the Project Manager is directly responsible for all project activities, he or she should act as the project spokesperson and be closely involved with all public relations activities. For more detailed information on community and regulator relations, see Chapter 3, Section 3.1.



REALISTIC SCHEDULING ENABLES SMOOTH PROJECT EXECUTION

Realistic Scheduling and Budgeting enable the smooth execution of the project by ensuring that funding and labor are available and that there is an agreement about the actions taken. A detailed discussion of scheduling, budgeting, and cost estimating can be found in Chapter 8.

Contracting after project definition is complete must be performed in accordance with the schedules in the Record of Decision, Project Execution Plan, or any interagency agreements. The Project Manager must consider the potentially appropriate contracting strategy during the planning stages. Since several contracts and contractors may be involved at any given site, realistic planning, programming, and budgeting will help obtain the necessary funding, labor, and concurrence on proposed actions. Contracting is discussed further in Chapter 5, Section 5.12.

ONE OF THE PROJECT MANAGER'S MOST CRUCIAL RESPONSIBILITIES IS FORMING THE PROJECT TEAM.

Forming and Leading the Project Team is one of the most crucial Project Manager responsibilities. As the primary point of contact for project activities, the Project Manager is in the best position to know what strengths the project team needs and what staff are available to meet those needs. The Project Manager should begin to create a list of potential team members as the basic nature of the project becomes known. Early team formation enhances future success by establishing early group communication and a sense of ownership of the project. Once formed, the team relies on the Project Manager for "big picture" input to individual tasks. The Project Team is discussed further in Section 2.1.3.

Overseeing Site Work and Contractors includes informing and reminding contractors and all other Project Team members of rules and procedures that will affect on-site work. The Project Manager should regularly check contractor performance to validate conformance with procedures and the scope of work. Oversight should continue throughout the duration of the project until closure is achieved.

Data Management and evaluation are crucial for management's ability to defend its decisions with applicable and necessary data. The Project Manager must ensure that careful records are kept and that project files are kept up to date and maintained for future needs.

Reporting includes the maintaining of all site activity reports and records such as documentation of the contractors' work, the sampling and analysis and site health and safety plans, permits, and other project specific documentation.

Developing Human Resources (i.e., hiring and/or training) in the areas of community relations, health and safety, engineering, and the environment is key to project success. Training is discussed in further detail in Section 2.2.

WELL-MANAGED HUMAN RESOURCES ARE VITAL TO PROJECT SUCCESS

Ensuring Quality Assurance activities are performed is the responsibility of the Project Manager. The Project Manager must either develop a Quality Assurance plan for the project or designate a Quality Assurance manager to whom that responsibility is delegated.

Recognizing and Responding to Emergencies consists of the ability to recognize emergency situations and respond promptly to execute emergency response actions. Emergencies that can occur during project execution range from contaminant releases, industrial accidents, and equipment failure to worker injuries.

Emergency planning is the responsibility of the Project Manager only if the Project Manager is also the on-site environmental coordinator. Preparing current and easily understandable contingency and emergency plans is critical to the well-being of the off-site population as well as on-site personnel in a rapid response situation.

<u>Project Performance Tracking/Measurement</u> can be accomplished by comparing project execution against an overall plan for project performance. The development of a set of criteria for minimum acceptable project performance, which will include objective completion, budget, time, and end user satisfaction factors, will be formulated and agreed upon by the Project Team under the leadership of the Project Manager. The Project Manager is responsible for understanding the need for and value of adequate reporting to measure baseline performance and for establishing the proper control mechanism to measure project performance. These requirements demand that the Project Manager be fully cognizant of the concepts and procedural details of the tools available for use. Project performance tracking and measurement techniques are further discussed in Chapter 5, Section 5.11.

2.1.3 Team

The Project Manager will need to form a Project Team that will be able to accomplish the following project definition tasks (refer to Example 1, Team Development):

- develop WBS for the project
- evaluate existing information
- determine the need for additional information (i.e., data gaps)
- establish strategy for acquiring information
- identify components necessary for project execution
- identify and ensure compliance with applicable environmental laws
- assist Project Manager with Project Manager responsibilities (see Section 2.1.2)
- account for all sites and clearly define the regulatory framework for project implementation at each site
- plan all phases of the project (continually assess scope and changing needs)

TEAM DIVERSITY IS AN INFORMATION RESOURCE WHICH WILL ENHANCE THE PROJECT DEFINITION.

The compilation of the team may vary by project, but generally the members fall within four categories: the core team, the base support team, outside agencies, and the decision-makers. The Project Manager

EXAMPLE 1: TEAM DEVELOPMENT
Project Team Alignment Sessions

Fernald Environmental Management Project has developed a tool to encourage communication among project team members and all involved groups and contractors at the onset of a project. The tool consists of holding three-day Team Alignment Sessions immediately after all team members on a project, including contractor support, have been identified. The objective of the session is to develop a cohesive working group that is not only familiar with the expectations of the project and the roles and responsibilities of him or herself but also of the entire participating group.

The Sessions are organized by having each individual generate a list of issues and ideas on the following topics:

- team expectations
- common paradigms
- mission statement
- stakeholder expectations
- critical issues/barriers
- roles and responsibilities of everybody involved

Each list is then combined into a group "issue" list and discussed. By the end of the session, each issue under each topic is addressed and resolved. If a resolution is not reached on a particular issue by the end of the session, an individual is assigned the responsibility of gathering the information needed and resolving the issue by a particular date.

A proactive and positive attitude is necessary from all participants to facilitate a progressive atmosphere. Due to this positive outline for the development of roles and responsibilities, the brainstorming method has been effective and cost-efficient and will serve as a quality model for future project definition and communication between team members.

should exert as much control over the makeup of the team as possible. The Project Manager must determine what areas of expertise are needed in the core Project Team. For example, the expertise required for an environmental restoration project might consist of environmental assessment, health & safety, biological sampling, water/wastewater sampling, soil sampling, air sampling, engineering experts (environmental, civil, safety, and mechanical), public affair/community relations coordination, legal assistance, planning commission (local planning and design), industrial hygiene, construction contractor with engineer oversight, and various technical expertise for review committees.

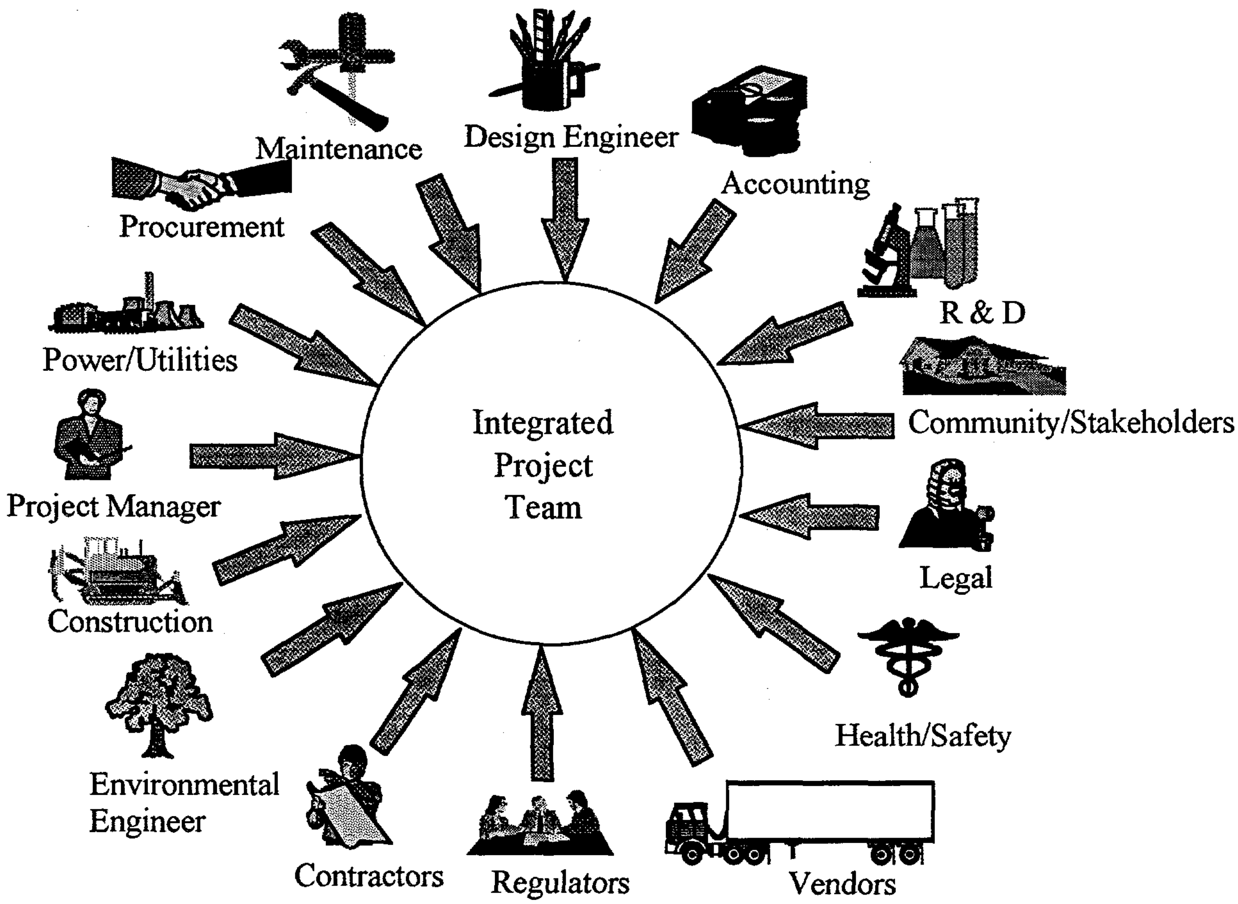


Figure 2-1. Integrated Project Team.

The Project Team for every DOE project may broadly include individuals from the future facility operators, various DOE organizations, DOE primary contractors and subcontractors, and private sector consultants. To facilitate communications, as well as manage Project Team efforts, points of contact are typically assigned to the project by the various organizations for which they work.

THE PROJECT TEAM FORMULATES A SET OF CRITERIA FOR MINIMUM ACCEPTABLE PROJECT

A Team Directory, which will include name; functional title;

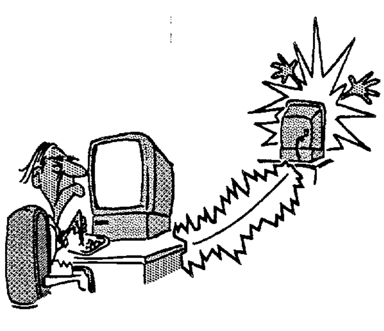
TEAM MAKE-UP SHOULD REMAIN FLUID AS THE PROJECT EVOLVES.

area of involvement or expertise within the project; address; and phone, pager, and fax numbers should be developed to facilitate communication between team members. This directory should be updated and distributed with every change in the makeup of the Project Team. It is key for Team members to get to know each other and feel comfortable expressing ideas and concerns freely amongst each other regardless of each member's level within the organization or the amount of their authority. It is the responsibility of the Project Manager to encourage team members to communicate openly and foster a team atmosphere. At the onset of a project, the Project Manager should coordinate sessions with the core team and base support team to discuss roles and responsibilities and project goals.

Since most DOE projects are long term, it is probable that some of the starting team will not be there when the project is finished. Furthermore, different phases of a project may require different core competencies from Project Team members. The Project Team makeup must be fluid enough to adjust to the project's changing expertise needs. The Project Manager should become familiar with all the staff of various organizations that are available or can be made available to the project.

The Project Team should have the authority, ownership, and responsibility to make all necessary technical decisions after initial approval from DOE-HQ. Project Team members should communicate the level of responsibility and accountability they have been assigned to the other team members to gain their understanding and sanction as early in the process as possible. The core team and base support team should meet periodically to coordinate all parts of the project and organize and prepare all information pertinent to the regulatory agencies. Regulatory agencies should be present only for formal meetings (as discussed in Chapter 3). Hold informal meetings before the formal meetings to organize and prepare all pertinent information.

The Project Team will be responsible for defining the project and its work scope (see Chapter 5, Section 5.2). Detailed feasibility studies can answer preliminary questions that govern all projects, such as type of project, time constraints, environmental impacts, labor issues, cost, scheduling, scope, hazards, etc.



THE PM AND CONTRACTOR PM SHOULD WORK TOGETHER TO PROVIDE COMPLEMENTARY AND COMPREHENSIVE MANAGEMENT.

2.1.4 Contractor Project Manager

The Contractor Project Manager is the designated contract official who coordinates, monitors, and manages the activities of the DOE contractor for the project. This Project Manager's main responsibility is to ensure the scope of work on the DOE contract is followed. The DOE contractor may be responsible for all or only a few action items in the implementation of the project but should familiarize him or herself with the overall project objectives. The Contractor Project Manager will be part of the core Project Team and will report directly to the Project Manager.

The DOE Project Manager must communicate with the DOE Contracting Officer to familiarize him or herself with the amount of direction that can be given to the contractor. It is imperative that the DOE Project Manager remembers he or she, and not the contractor, is ultimately responsible for the project's outcome. The DOE Project Manager is a customer to the contractor.

The Contractor Project Manager must ensure that DOE contractor activities support the goals and objectives of the project and DOE and comply with all DOE rules, procedures, and regulations. The Contractor Project Manager is ultimately responsible for DOE contractor performance; however, the DOE Project Manager is ultimately responsible for the overall project performance.

2.1.5 Customer

CUSTOMER SATISFACTION IS:

priority 1

The customer is the entity that will most directly operate, use, or benefit from the product of the project. The customer is responsible for providing a clear initial description of the project purpose and objective. The Project Manager should make the customer aware of their responsibilities. As early as possible, the Project Manager should inform the customer that failure is possible if the project cannot be clearly defined and scoped early on. Frequent changes by the customer can result in cost and schedule delays. Continuous and intensive communication between the customer and the project team must occur during the project definition stage and is crucial to the development of the Project Execution Plan and the successful completion of the project in accordance with that plan. The customer will be primarily concerned with quality and function and will rely on the Project Manager and Project Team for technical decisions, cost control, and schedule aspects of the project.

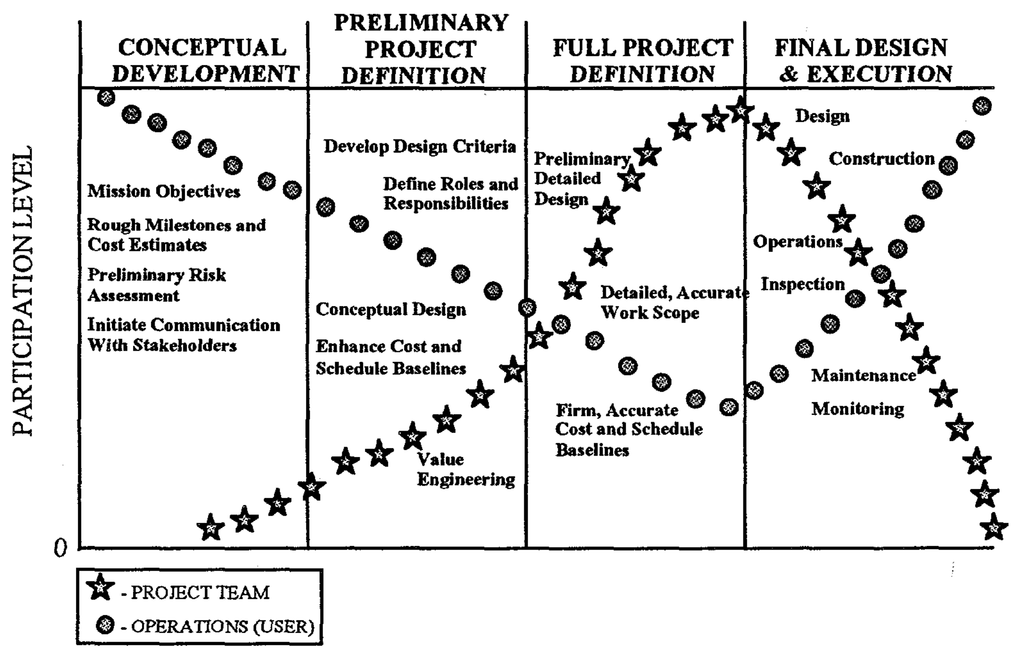


Figure 2-2. Participation Level in Project Development.

DOE's stakeholders and customers include the U.S. taxpayer; local, state, and national interest groups; federal, state, and local regulators; labor unions; citizens who live near DOE facilities; the businesses who work with DOE laboratories, or who are affected by their products; the families of DOE employees; laboratories, universities, contractors, and suppliers; federal agencies; state and local governments; Native American Nations; the Congress; the President and his Administration; foreign governments; and the news media. When the project objective is to demonstrate to the private sector the utility or feasibility of a given process or product for commercial application, the identity of the ultimate customer may not be known. In such cases, only the most likely type of customer (utility, constructor, energy supplier) may be identifiable. Possible customer needs that should be factored into project definition include lifecycle costs - how much will the project cost the customer to maintain or use once complete; alternative strategies; and alternative funding profiles.

2.2 TRAINING

TRAINING MUST BE FACTORED INTO THE PROJECT SCHEDULING AND COST-ESTIMATING PHASES OF PROJECT DEFINITION

Once Project Team members have been selected to take part in the project, it is the responsibility of the Project Manager to ensure that each individual has the necessary training to complete the assigned project task. The Project Manager needs to factor training into the project scheduling and cost estimating phases of project definition. Assessing project personnel training needs requires three steps:

- evaluation of the job functions of all Project Team personnel;
- development of essential and supplemental core competency requirements for the Project Manager and other key project personnel based upon the multidisciplinary nature of the project definition process; and
- identification and evaluation of current project management, project definition, and process-specific training offered by DOE, contractors, regulatory agencies, and others.

Figure 2-3, a flow chart of the training needs assessment process, provides a framework for the evaluation of training needs and the identification of training resources for all members of a DOE Project Team.

Certificates, licenses, and other documentation associated with formal training should be carefully tracked and maintained in a training file or database. It should be noted that often the training for many types of projects is on-the-job by nature. The Project Manager should develop some kind of documentation process that traces on-the-job (informal) training. All training files should be periodically reviewed for currentness. An excellent means for tracking and improving an individual's training and qualifications is to create individual development plans for each team member.

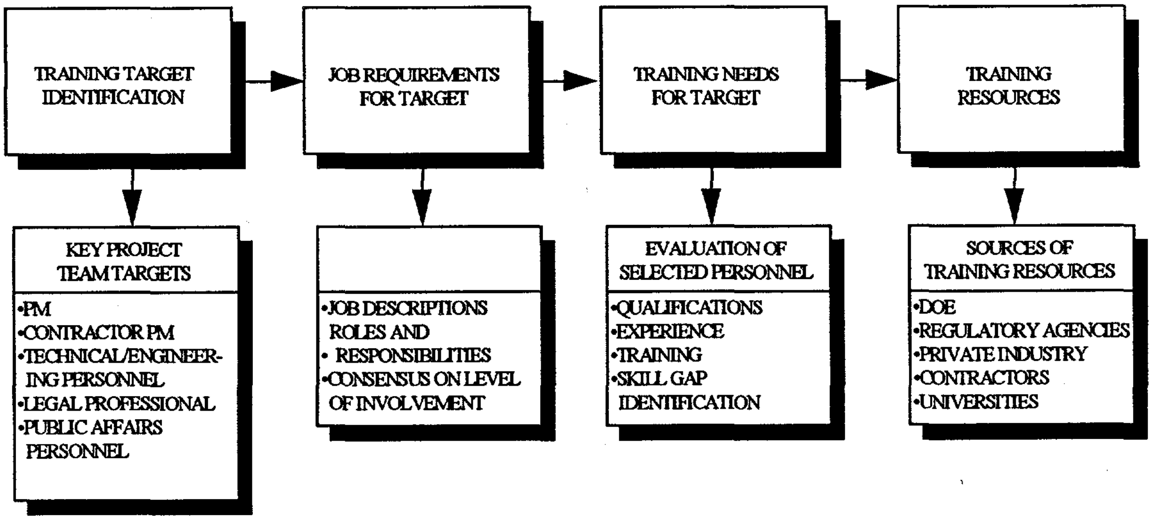


Figure 2-3. Flow Chart Illustrating Elements of theTraining Evaluation Approach.

The Field Office Manager, or in some cases the Program Manager, is responsible for selecting a Project Manager who is qualified for the project and ensuring that the Project Manager receives any additional training which might be mandated by the nature of the project. It is the Project Manager's responsibility to ensure that all Project Team members have the training required to successfully fulfill their designated roles and responsibilities.

2.2.1 Resources

DOE EM-10 is currently developing a series of project management courses which were piloted in January 1995. Project definition will be addressed in several modules.

The search for training resources should not be limited to DOE alone. Many regulatory agencies, private training corporations, universities, and contractors provide training guidance and courses that may be attended by Project Team members.

TRAINING IS AVAILABLE FROM A VARIETY OF SOURCES

Regulatory agencies offer training courses to Project Managers and teams who must follow their regulations either free of charge or at a nominal cost.

Several DOE contractors also offer project management and other pertinent training that may assist the team in meeting its training needs.

2.3 SUMMARY

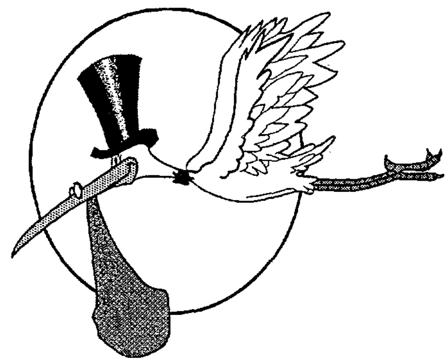
The people involved in the project definition process activities have a major effect on the quality and feasibility of the final project. The Project Manager must be sensitive to the roles and responsibilities of each individual involved in the project and make a concentrated effort to ensure their needs have been met, thereby enabling them to work with increased effectiveness and efficiency. The roles and responsibilities of each individual must be apparent to all team members early on in the project. A cohesive, well-trained team that has a clear understanding of each team member's job and level of involvement will lead to improved overall project execution and performance.

CHAPTER 3
PROJECT DEFINITION: CULTURE

Once all of the people who will be participating in the project and the project definition process are identified, the Project Manager must facilitate communication between the Project Team members and between the Project Team and stakeholders, community representatives, and regulators to ensure that the project is directed toward a satisfactory common goal. Successful project definition depends upon creating an atmosphere that encourages involved individuals to use their talents effectively to the benefit of the project and ultimately the program. This atmosphere, or culture, encompasses the regulatory environment; stakeholder and community attitudes; and community, stakeholder, regulator, and Project Team communication. It is also important to remember that the project is part of a larger program and that the programmatic culture or atmosphere will influence the direction, efficiency, and effectiveness of all project definition efforts.

3.1 COMMUNITY AND REGULATOR RELATIONS

Establishing good community and regulator relations is crucial to the success of any project and is the responsibility of the Project Manager. The Project Manager is responsible for:



THE COMMUNITY AND REGULATORS MUST BE INVOLVED FROM THE CONCEPTION OF THE PROJECT.

- early involvement of regulators in investigation, characterization, and assessment activities;
- including the community and stakeholders in all appropriate decision-making processes;
- responding to community and regulator inquiries; and
- providing information about any unplanned incidents, accidents, or releases of hazardous substances.

Regulations inherently require regulator participation in the project; however, it should be noted that many regulations explicitly require public involvement at specific stages of some types of projects. While most of these requirements consist of a public comment period and a public meeting on proposed actions, other steps to ensure public awareness of impending decisions are required. For example, permit actions or orders issued by regulators may require community involvement. Although each law has separate minimum requirements for community relations, the common goal is to inform and involve the community at every major decision point. Possible community and regulator relations activities include:

- establishing a site-specific advisory board (SSAB) to gain input and facilitate the review of and comments on response actions and any proposed actions (Example 2);

EXAMPLE 2: THE SITE-SPECIFIC ADVISORY BOARD

One mechanism that a project manager may employ to establish and promote stakeholder involvement in the definition of a project is the site-specific advisory board (SSAB). As part of an effort to institutionalize stakeholder involvement, the Environmental Management (EM) program has established the Environmental Management Advisory Board (EMAB), which is chartered under the Federal Advisory Committee Act (FACA). At present, several SSABs have been formed by DOE operations offices. Each board has a unique membership, but all are subgroups of the overall EM EMAB. The EM EMAB serves as an umbrella group that includes the members of all boards and allows each board to make consensus recommendations to the EM program.

Although an SSAB is not a requisite for DOE sites, it provides the site with an established forum for the Project Manager to interact with stakeholders. When an important decision is to be made or a project is being considered, DOE representatives can turn to the board for consent. In turn, the board can provide a consistent source of opinions and feedback for DOE.

Some important issues surround the establishment of SSABs. One of the most critical issues is compliance with FACA, the law that provides standards and uniform procedures for advisory committees. Although the charter for the general EM EMAB was approved under FACA, the membership, charters, administration, and operation of local boards must also meet FACA criteria. This requirement is managed by submitting details about the proposed advisory boards to General Counsel at DOE Headquarters, which then approves the boards or provides advice for revisions of plans. FACA is a significant concern for all advisory boards, though EM's single, general FACA charter has made it easier and less time-consuming for DOE sites to establish their own SSABs.

Another issue in the establishment of advisory boards is funding. Although sites can request funding for independent technical review of key documents or for compensation for certain members of the board, sites must cover the administrative costs of their advisory boards. According to the guidelines set by the EM program, each operations office should submit funding requests for its SSAB to EM's Office of Public Accountability at DOE Headquarters, which will then review the requests and identify funding. The Office of Public Accountability uses a graded approach to budgeting, under the premise that the funding of a local board should reflect the size of the site. Actual site-by-site funding, however, is determined individually.

The Office of Environmental Management has recently issued its Site-Specific Advisory Board Guidance document, which provides information on everything from establishing an SSAB to the independent evaluation of SSABs.

- including public representatives of the community on the SSAB;
- establishing a Public Affairs (PA) staff for the project (in some cases the Project Manager can function as the PA representative and PA activities may be arranged by the Project Manager's technical staff);
- coordinating news releases, responses to media queries, and briefings;
- notifying civic leaders and spokespersons for local interest groups;
- preparing a community impact meeting;
- maintaining a list of qualified speakers;
- conducting community interviews;
- maintaining and updating a mailing list throughout the life of the project;
- coordinating and publicizing public meetings;
- preparing a written, project-specific community relations plan; and
- hosting a round-table discussion with invited members of the community and involved regulatory agencies.

THE PM IS RESPONSIBLE FOR PUBLIC AFFAIRS AND INTERACTION WITH THE NEWS MEDIA

MAINTAINING A POSITIVE PUBLIC VIEWPOINT IS ESSENTIAL AND IS THE PM'S RESPONSIBILITY

For additional community and regulator relations activities, consult the Community Relations Checklist in Appendix A (also refer to Example 3 for Community Education, the STEP Program).

3.1.1 Round-table Discussions

One of the previously described activities, the round-table discussion, is particularly successful at breaking down communications barriers and building understanding between various parties involved in a project. A round-table discussion is an intensive work session, usually at the customer site. It can last several days and is attended by the customers, community representatives, Project Manager, Contractor Project Manager, Project Team, and representatives from regulatory agencies. Round-table discussions eliminate distractions by having tight, hour-by-hour schedules and long work days. Participants leave their normal work environments and concentrate solely on the project; therefore, the customer, community leaders, Project Team, and regulators will be at the disposal of project issues. Round-table discussions also eliminate delays typically created by scheduling conflicts among project participants. Furthermore, the face-to-face interaction eliminates many miscommunications. Written requirements and concerns only scratch the surface; there are subtleties, whims, biases, insights, and inspirations that are not included in formal written communication but which have a profound effect on project success. The intense and focused atmosphere

ROUND TABLE DISCUSSION
-PARTNERING
-COMMUNICATION
-COLLABORATION
-UNDERSTANDING

EXAMPLE 3: COMMUNITY EDUCATION
STEP Program

The Fernald Environmental Management Project has created a comprehensive community environmental education course entitled "Science, Technology, the Environment, and the Public" (STEP). The goal of the STEP program is to encourage and facilitate public participation in the decision-making process at Fernald. The program was developed by Fernald in conjunction with DOE, community stakeholders, local educators, and representatives of area special interest groups. The involvement of these individuals in the creation of the program is itself a significant example of positive community and stakeholder communication. The program benefits both Fernald and the community by:

- fostering the image of Fernald as being reliable and trustworthy by presenting neutral, science-based information on environmental issues along with site-specific samples;
- acting as an impartial gateway to public participation by removing traditional and existing barriers to communication and by encouraging and assisting all individuals and groups, especially those who are historically underrepresented;
- providing citizens and policy makers both information and experiences to help them make intelligent decisions regarding their environmental future;
- helping communities anticipate as well as understand how they can contribute to their own quality of life and that of future generations; and
- empowering the public to investigate the environmental challenges we all face, while enlarging not only their vision of the future but also their confidence in themselves as effective decision makers.

The STEP program provides basic and hands-on education and information about science, technology, and environmental issues and their relationship to the environmental management activities at Fernald. STEP consists of seven 2-hour sessions that combine lecture, demonstration, hands-on activities, exhibit and display, print materials, and video sessions and are broken into 15- to 30-minute "learning segments." Both the instructional methods and the course structure are designed to accomodate a wide variety of learning styles and informational needs. The sessions are taught by subject-area experts (individuals currently working with the technologies/issues being discussed) and are held near the site to provide highest consideration and convenience to those stakeholders who neighbor the site.

The seven STEP sessions focus on three main stakeholder groupings. One session is directed specifically to the needs of educators, educational policy makers, and administrators. Two sessions are addressed specifically to opinion leaders, media, and information services. The remaining four sessions are focused on the needs of the general public. Topics covered in the STEP program include: Site and Regulatory History, Operable Units, Public Participation, Assessing Risk, Worker and Public Safety, Monitoring Techniques, Remediation Technologies, Waste Storage and Disposal, and Fiscal Impact.

Since its inception in the Fall of 1993, the STEP program has experienced great success, making Fernald a leader in community and stakeholder relations.

of the round-table discussion increases participant collaboration and promotes partnering and conflict resolution.

Planning is crucial to the success of community and regulator relations. To prevent embarrassing situations and potential crises, the Project Manager should gather as much information about the needs and demands of the affected community and the requirements and constraints of the appropriate regulatory agencies. The Project Manager is responsible for documenting all project decision processes and the efforts to include community and regulators in those processes. Failure to keep complete and up-to-date records of project decision processes and community/regulator relations efforts could result in the project being legally and publicly indefensible.

3.2 PROGRAM PLANNING

All project planning and project definition takes place within the larger context of the program. It is important to remember that the reason the project exists is that it fulfills a programmatic requirement or mission goal. Given that relationship, program planning, or comprehensive master planning, is the larger process from which sound project definition flows. To ensure that accurate planning for a project can occur during the conceptual design phase, program-wide screening analyses of all similar projects should have been implemented previously. Programmatic planning includes identification of all programmatic problems, an analysis of relevant current and historical data for those problems, programmatic risk assessments, identification of the most likely courses of action, and programmatic cost estimates. These activities will give the Program Manager the ability to prioritize the projects according to risk and cost. Without knowledge of these aspects, the conceptual design cannot accurately represent the mission need and project justification.

3.3 SUMMARY

The success of project definition depends upon more than determining the correct actions to take and identifying the appropriate people to perform them. The culture within which the problem and people exist and within which the actions to address the problem must be performed has a critical impact upon the direction and effectiveness of all project definition efforts. Identifying the cultural constraints within which the project and the project definition process will have to work and addressing those requirements within the process itself eliminates many "political" delays and contributes to the completion of a highly successful and effective project.

CHAPTER 4
PROJECT DEFINITION: THE PROCESS

4.1 INTRODUCTION

Project definition consists of all planning activities undertaken prior to final design which ensure project technical success, the attainment of cost and schedule milestones, a reduction of regulatory and community concerns, and complete customer satisfaction. The key to improving project definition is to fully understand the basic process of how project definition is achieved. The project definition process can be divided into three phases:

STRONG PROJECT DEFINITION ENSURES:

- *PROJECT TECHNICAL SUCCESS*
- *COST AND SCHEDULE MILESTONES*
- *REDUCTION OF CONCERNS*
- *COMPLETE CUSTOMER SATISFACTION*

<u>Conceptual Development</u> - the phase of a project's lifecycle in which the project need is identified and justified, systems engineering is employed, objectives and functional requirements to meet those objectives are outlined, rough milestones and cost estimates are established, a preliminary risk assessment is completed, the value engineering process is initiated, potential stakeholders are identified, communication networks are established, and Project Team formation begins.

<u>Preliminary Project Definition</u> - the phase of a project's lifecycle in which additional information is gathered to enhance the results of the conceptual development phase; alternative courses of action are identified; community, stakeholder, and regulatory agreement on an alternative is established; design criteria are developed; conceptual design is created for the identified alternative; more accurate estimates of technical scope, schedule, and cost are developed for the identified alternative; and the value engineering process is further developed.

<u>Full Project Definition</u> - the phase of a project's lifecycle in which a preliminary project design is created for the selected alternative, a finalized work scope is created, and final cost and schedule baselines are established. During this phase, value engineering principles are applied to both the preliminary design and work scope to strive toward continual improvement. Completion of full project definition indicates that the project has been adequately defined to commit resources to its final design, and execution and ensure successful completion.

This chapter discusses the progression of activities that should occur during each phase to ensure proper and timely execution of the project definition process. In addition, the activities described in this chapter are discussed in further detail in Chapter 5.

4.2 CONCEPTUAL DEVELOPMENT

The first phase of a project, which occurs before the formal start of the project, includes identification of a project idea and a preliminary evaluation of the idea (Figure 4-1). Central to this phase is

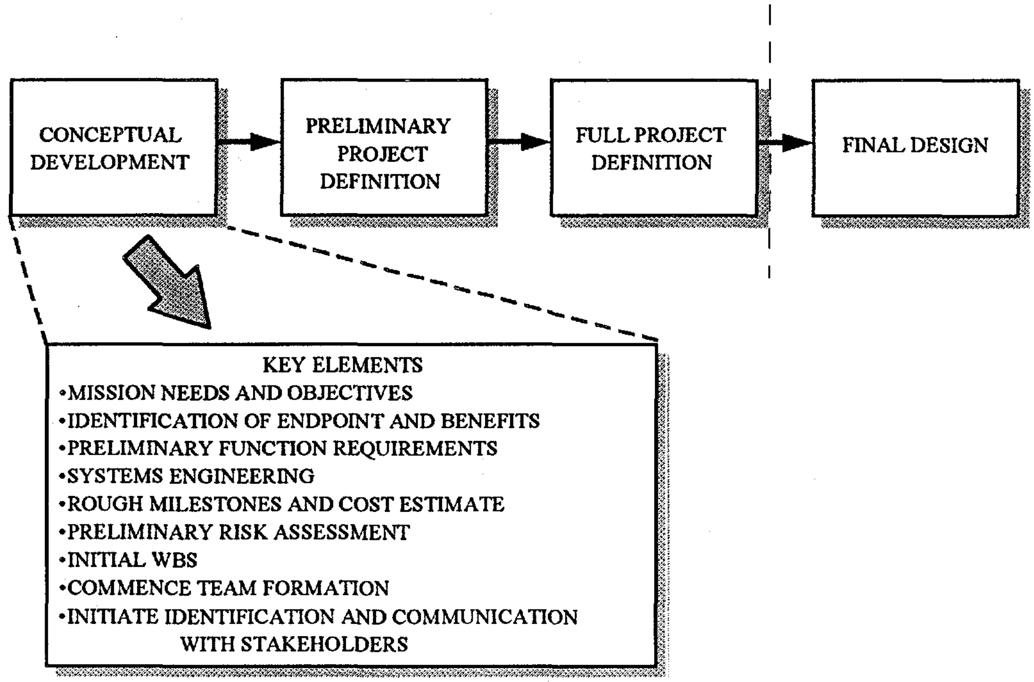


Figure 4-1. Flow Chart Illustrating Elements of Conceptual Development Phase of Project Definition.

a preliminary analysis of the risks and resulting impact on the functional requirements, schedule, and cost combined with the potential impact on DOE mission and resources. The first step of the conceptual development phase involves identification and justification of the project and how it will support a DOE mission. The responsible Program Manager must define the project concept by:

- stating the mission need,
- explaining the anticipated results and benefits to be gained from the project,
- identifying the preliminary function requirements and documenting their basis,
- conducting initial systems engineering steps,
- establishing a preliminary schedule of project milestones,
- describing the preliminary risk assessment for the project and basis for the assessment,
- development of the initial Work Breakdown Structure (WBS),
- providing a rough estimate of total project costs (specifically, identifying the cost of the next phase),

- identifying potential permitting requirements,
- preparing for further project development through the formation of a cadre or initial Project Team, and
- identifying potential stakeholders and establishing lines of communication.

All of these tasks should be conducted by applying the graded approach; the level of complexity of the project will be commensurate with the analysis, documentation, and actions necessary to comply with the projects objectives.

GRADED APPROACH: *A PROCESS BY WHICH THE LEVEL OF ANALYSIS, DOCUMENTATION, AND ACTIONS NECESSARY TO COMPLY WITH A REQUIREMENT ARE MADE COMMENSURATE WITH THE COMPLEXITY OF THE PROJECT.*

4.2.1 Mission Needs and Objectives

The Program Manager should establish the technical objectives and the essential elements of the proposed project necessary to achieve those objectives. Essential elements of the project description include:

- technical objectives that must be achieved;
- customer requirements;
- description of each phase of the project;
- major project events, technical activities, and decision points; and
- potential problems and proposed contingencies.

4.2.2 Endpoint and Benefits Identification

The establishment of project requirements is required early in the project to help the project management team focus its activities as it proceeds through the phases of project evolution. Without clearly defined requirements, a well-structured project may be developed, but it may be the wrong project or accomplish objectives that are not in the best financial interest of DOE. Therefore, clear identification of the endpoint and benefits of a project is an important part of the funding process which provides project need justification.

4.2.3 Function Analysis

Analysis of the function requirements of the project is the cornerstone of effective project planning. A team of involved project personnel and stakeholders formulate the function requirements after the project's mission need has been identified. These requirements are those steps (functions) necessary for the project to be completed. Function requirements later become the basis for the design criteria, system and value engineering studies, project risk assessment, WBS, and cost estimates.

4.2.4 Systems Engineering

It is during the conceptual development phase of the project definition process that the Program Manager should initiate the systems engineering concept. Systems engineering is the application of scientific and engineering efforts to integrate project factors and improve organizational effectiveness, enhance customer/stakeholder involvement, and emphasize risk management. The process provides a common, disciplined and structured process for the development and management of efforts; a common format for collecting, assessing, and sharing information; and a more cost-effective use of resources. Systems engineering, although most likely started by the Program Manager, will eventually become the responsibility of the Project Manager who will continue systems engineering throughout the entire project definition process.

Application of the systems engineering process and acceptance of its underlying concepts within the project definition framework will ensure choice of the most beneficial solution to the problem and will outline the optimal course to reaching that solution. It will allow all participants to understand what they are doing and why, while reducing risks, surprises, and cost and schedule overruns. Systems engineering will also result in identification and documentation of lessons learned to be applied to future projects and for training that will result in more effective team participants.

4.2.5 Preliminary Schedule and Milestones

The preliminary schedule should provide a rough estimate of the duration and milestones of the project from the initiation of conceptual development to project completion. Historical data on the schedules, both proposed and actual, for similar projects can be used as the foundation for this estimate. This schedule is a planning tool and will not be used to measure project performance. Refinement of the schedule and milestones occurs as the project definition process progresses and more information on the unique nature of the specific project is revealed and analyzed.

PROJECT RISKS SHOULD BE IDENTIFIED IN ADVANCE.

4.2.6 Preliminary Risk Assessment

The Program Manager should conduct a risk assessment to identify potential situations that will have a significant impact on overall project success. The types of risks that shall be addressed are technical; schedule; cost; and others such as environmental, health, safety, and regulatory and institutional impediments. Included in the risk assessment are a preliminary evaluation of legislative mandates that will have to be met and identification of environmental permits necessary to complete project tasking. The probability of mission success must be addressed, and the following types of information must be provided:

- type of risk (technical, schedule, cost, etc.)

- level of risk (low, medium, high)
- project elements contributing to risk
- implications of the risk (e.g., cost, schedule, politics, etc.)
- risk mitigation or contingency strategies

The risk assessment evaluation must be an iterative process through the planning stages until project controls are implemented in the full project definition phase. Before initialization of the project and baseline are approved, it is the Project Manager's responsibility to evaluate all unique project characteristics and associated risks to ensure the proper degree of project controls are applied.

4.2.7 Develop Initial Work Breakdown Structure

The WBS is a valuable project management tool that can be used by the Project Manager. The initial WBS should be formed during conceptual development and be based on the functional requirements determined earlier in this phase.

4.2.8 Preliminary Cost Estimates

Cost estimates are an important tool in successful project management. Preliminary cost estimates are developed at the time of project identification and should be based on best available information. Since these are developed prior to conceptual design, they are only rough-order-of-magnitude estimates and will *not* be used to measure project performance. Guidance on cost estimating can be located in the *DOE Cost Guide*, the *EM-20 Cost Quality Management Assessment*, the *Independent Cost Estimating Guide*, the *EM-30 Cost Guide*, and other references.

4.2.9 Initial Team Formation

During this phase of project definition, the Program Manager has total responsibility for the completion of any required actions. However, it is strongly recommended that a cadre be assembled at this time to assist the Program Manager in planning for the next phase of project definition development and initiating the conceptual project design in an accurate and timely manner in anticipation of project approval. This team should be considered the framework of the future Project Team and should include individuals with the capabilities needed in all possible future phases of the project, as well as several qualified candidates for Project Manager. For more information on team formation see Chapter 2, Section 2.1.2.

In reality, the Program Manager may not have the available staff to start developing a team prior to the preliminary project definition phase. Moreover, personnel typically support multiple projects concurrently during early phases. Therefore, it is imperative that a Project Manager be identified as soon as possible and that extensive communication occur between the Program Manager and the Project Manager during the conceptual phase.

4.2.10 Stakeholder Involvement

STAKEHOLDERS MUST BE INVOLVED IN ALL PHASES OF PROJECT DEFINITION.

Once the project idea has been defined and characterized on a basic level, the Program Manager should begin to identify all possible stakeholders in the conceptualized project. Because stakeholders may vary according to the phase of project development and means of project execution, the Program Manager must include stakeholder involvement in all possible project development alternatives. The Program Manager should begin establishing contacts within each potential stakeholder group and determine the best methods for establishing communications with each group. Possible stakeholder groups that must be considered include:

- regulatory bodies,
- affected communities,
- public interest groups,
- other DOE programs or facilities,
- state agencies,
- potential customers, and
- private industry.

4.3 PRELIMINARY PROJECT DEFINITION

The second phase of the project definition process is preliminary project definition, which is a continuation and refinement of the elements described in the conceptual development phase. During this phase, additional information is gathered so that more realistic estimates of technical scope, schedule, and cost can be developed (Figure 4-2). This phase also includes preparation of the documentation necessary to support the project. For Environmental Restoration (ER) projects, this phase includes an iterative process of gathering site environmental data so that the nature and extent of contamination can be characterized and a more accurate picture of the scope and technical requirements of the project can be developed. This phase should include:

- official appointment of a qualified and certified Project Manager (certification criteria are specified in 4700.5);

- formation of a formal Project Team;
- clear definitions of the roles and responsibilities of the Project Team;
- refinement of function requirements and other elements identified in the conceptual phase;
- development of design criteria;
- community, stakeholder, and regulatory consensus on an alternative:
- creation of conceptual design for the chosen alternative;
- creation of a project execution plan (see Section 2.1.2);
- development of preliminary cost and schedule baselines; and
- application of value engineering concepts.

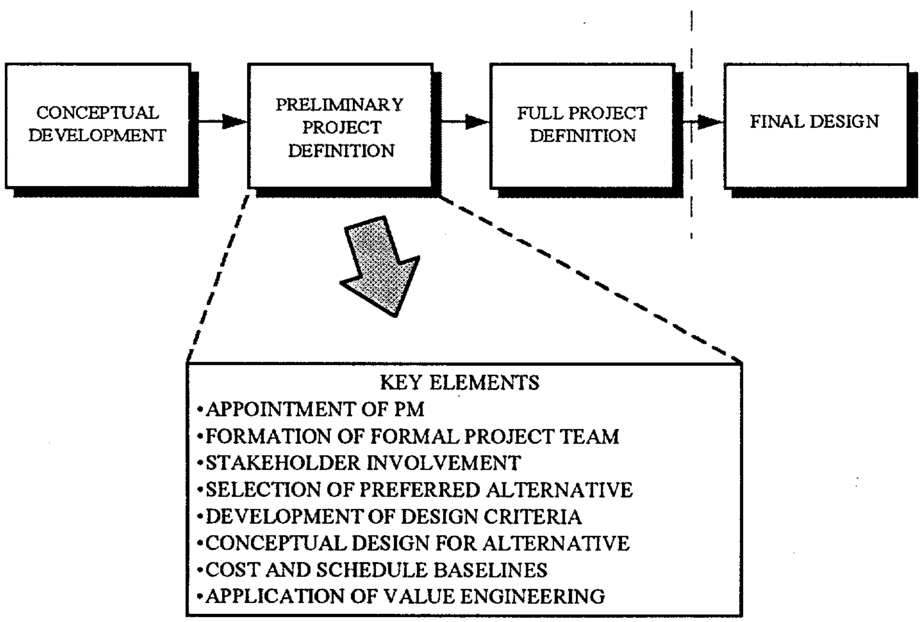


Figure 4-2. Flow Chart Illustrating Elements of Preliminary Project Definition.

4.3.1 Appointment of Project Manager

At this time a qualified, certified Project Manager is appointed. The appointed Project Manager should be one of the Project Manager candidates from the initial Project Team. Often, this individual will have been functioning as the Project Manager in an unofficial capacity throughout the latter part of the conceptual development phase.

4.3.2 Project Team Expansion

The Project Team will be formed from members of the initial

PRELIMINARY DEFINITION IS A REFINEMENT OF EARLY PROJECT CONCEPT.

THE PRIMARY PURPOSE OF THE DESIGN CRITERIA IS TO DETERMINE AND INCLUDE INFORMATION APPLICABLE TO THE DESIGN EFFORT.

team created during the conceptual development phase, with additional personnel to provide unrepresented skills, experience, or competencies. This Project Team will complete much of the actual project definition work. For more information on the makeup of the team and selection criteria for team members, see Chapter 2, Section 2.1.3.

4.3.3 Roles and Responsibilities

Once the official Project Manager, Project Team members, and other key project personnel are in place, the roles and responsibilities of each individual connected with the project must be clearly defined and communicated to all concerned parties. Every individual should determine his/her level of involvement and effectively communicate decisions to all other project personnel. For more information on roles and responsibilities, see Chapter 2, Section 2.1.

4.3.4 Refinement of Conceptual Phase Elements

An initial analysis of the project elements was performed during the conceptual development phase, resulting in a statement of mission need, a preliminary schedule, rough cost estimate, and risk assessment. As the understanding of the scope of the project matures and funds and authority to pursue the project have been granted, each of these initial elements should be refined and updated. It is the Project Manager's responsibility to ensure the incorporation of all information that would aid in the refinement of these elements. Sufficient information needs to be gathered during preliminary definition to allow project personnel and stakeholders to make a logical, careful, accurate, and beneficial decision between the alternatives.

4.3.5 Design Criteria

Ideally, development of design criteria begins during the conceptual development phase, when the need for the project is identified. The foundation upon which the criteria are built contains functional parameters that the project must meet. These functional criteria are further developed, validated, and expanded during the preliminary definition phase. The development of criteria that are complete and specifically related to the project objectives allows for orderly development of the design. Although completeness of the design criteria is emphasized, care should be taken to avoid citing superfluous codes and standards, which would waste time and hinder effective project development. The primary purpose of the design criteria is to identify only those criteria applicable to a specific design effort. Ultimately, the design criteria should:

- briefly define the purpose of the project;
- provide a general description of the project;
- give the designer room to exercise expertise in design disciplines and

use up-to-date design applications, resulting in cost and schedule savings;

- provide all design requirements to be applied by the designer (e.g., quantities, limits, capacities, space allocations, etc.);

- include plans to mitigate environmental impacts (if applicable);

- identify needed permits or licenses; and

- identify all regulations, codes, and standards which might affect the project during its lifecycle.

4.3.6 Conceptual Design

The preliminary stage of project design uses the information gathered in the conceptual development phase and the design criteria that have been prepared for the project as a design basis. Conceptual designs will be developed for the top project execution alternative that was selected and approved by the program, stakeholders, and coummunity. In situations where more than one feasible alternative exists and concurrence on a single alternative was not obtained, the cost in labor and time of simultaneously developing conceptual designs for two alternatives is relatively low when compared with the cost of developing alternative designs independently. The conceptual design should include:

- results of preliminary trade-off studies, including evaluation of alternative design approaches;

- definition of the project design criteria and establishment of quality levels for systems and components in greater detail;

- expansion of conceptual development information in greater detail and development of initial work scope and design drawings based on new design concepts;

- development of outline specifications for procurement;

- conducted environmental assessments, including safety and health assessments;

- evaluation and selection of energy sources and measures to prevent pollution and conserve energy; and

- contingencies for anticipated problems (when possible, identify and cost potential problems).

4.3.7 Cost and Schedule Baselines Development

SITE-SPECIFIC INFORMATION SHOULD BE CONSIDERED WHEN MAKING A COST ESTIMATE

The preliminary cost and schedule estimates made during the conceptual development phase (primarily based on historical data) should be enhanced with the site-specific information gathered for the design criteria and conceptual design. The detailed cost estimate completed at this point should be itemized to provide estimates for labor, equipment, material, long-lead procurement items, contingency, and other major cost factors. The cost and schedule baselines developed during the preliminary definition phase should be realistic, reasonable, and as accurate as possible given the available information.

4.3.8 Value Engineering

Value engineering is an organized effort to analyze the functions of systems, equipment, facilities, services, and supplies for the purpose of achieving the essential functions at the lowest lifecycle cost consistent with required performance, reliability, availability, quality, and safety. Value engineering principles should be applied throughout the project definition process but especially during the initial stages of preliminary project definition. The value engineering process consists of five phases:

VALUE ENGINEERING: HIGH QUALITY, LOW COST

- information (What must be done?) (What are the function requirements of the project?)
- speculative or creative (Will anything else do the same job better or for less cost?)
- analysis or judgment (Which ideas are the best?)
- development (What is the impact if adopted?)
- presentation and reporting (Show recommendations to Project Team and stakeholders)

Value engineering encourages continuous striving for improvement. Throughout the project definition process, team members must be encouraged to find ways in which the chosen alternative can be implemented more effectively, more efficiently, and at less cost. Value engineering entails the continuous analysis of the design and work scope to incorporate any new cost saving or time savings ideas, including new technology, new labor, new contracting strategy, etc. Note that only the manner in which the objectives of the selected alternatives are achieved changes, *not the objectives themselves.*

For further guidance on value engineering, consult DOE Order 4010.1A.

4.3.9 Project Action Consensus

Communication with stakeholders should be actively maintained throughout the development of project execution alternatives. Constant communication with stakeholders during alternative development allows for incorporation of requirements, concerns, and expectations into the project execution alternatives. Open communication during the development of project execution alternatives facilitates stakeholder/project planner consensus on which alternative will be pursued in the conceptual design. By reaching this consensus prior to process deadlines, such as the ROD in the case of CERCLA projects, the Full Project Definition phase of the project definition process is fast-tracked, the risk of scope changes and the cost and schedule overruns associated with them is decreased, and customer satisfaction is improved. Appendix A contains a checklist for initiating and maintaining community relations.

STAKEHOLDERS AND PROJECT PLANNERS WILL NEGOTIATE CONSENSUS ON ISSUES.

4.4 FULL PROJECT DEFINITION

In the final phase of project definition, the project progresses from a well-defined project to a preliminary design of the final end product (Figure 4-3). Documentation, drawings, and construction specifications should be at least 30% complete by the end of this phase. It should be noted that the level of definition necessary for approval of various elements will vary; some systems or technologies may require 75-90% completion, while others may require only 10-15%. The full project definition phase includes:

CORRECT PROJECT DEFINITION ENSURES:

- *PROJECT TECHNICAL SUCCESS*
- *MEETING COST AND SCHEDULE MILESTONES*

- creation of a preliminary design (30%),
- development of a final scope of work,
- establishment of accurate cost and schedule baselines (+30, -15)
- continued application of value and system engineering principles to existing design and work scope,
- statement of contingencies for projected risks, and
- final establishment of project controls for determined project risks.

4.4.1 Preliminary Design

The preliminary design uses the conceptual design and any revised project design criteria as its base. Project definition traditionally ends at the completion of the preliminary design, which is equivalent to Title I, when the design is approximately 30% complete. The preliminary design should include:

- restudy and redesign work resulting from changes as may be required from the conceptual design;

- development of preliminary (working) drawings and specifications of the selected alternative;

- a detailed work breakdown structure;

- preparation of analyses for health, safety, environmental, and other project aspects;

- identification of test plan;

- preparation of procurement plan; and

- statement of contingencies for projected risks.

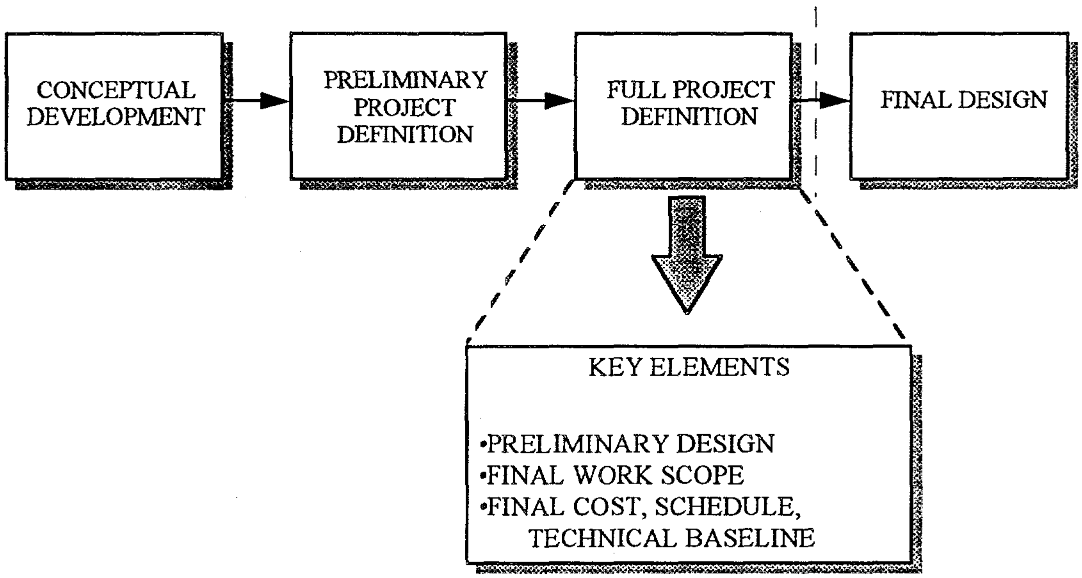


Figure 4-3. Flow Chart Illustrating Elements of Full Project Definition.

4.4.2 Final Work Scope

Final work scope is the end product of full project definition. Throughout the project definition process, steps are being undertaken to develop and structure the project's technical work to ensure that defined objectives are achieved and an accurate work scope is developed. The work scope must be described in sufficient detail to ensure that the functional design requirements, major physical attributes, and performance characteristics, controlled by DOE, are clearly accomplished. The work scope should be developed enough to ensure a high probability of project execution success and minimize the probability of scope changes that lead to cost and schedule overruns. The final work scope should include:

- a comprehensive technical description,

- detailed engineering designs,
- fixed and accurate cost and schedule baselines, and
- all other information needed to begin immediate and successful project execution.

PLANNING IS ESSENTIAL TO SUCCESSFUL PROJECT DEFINITION.

4.4.3 Cost and Schedule Baselines

The full project definition phase entails the development of detailed estimates of the cost of construction; labor, procurement and construction or execution schedules; methods of performance; and identification of work packages. Identification of construction, labor, equipment, and material quantities throughout the project's lifecycle will aid in the creation of accurate cost baselines. The WBS should be used to organize the cost data. The importance of continual iterations on the development of cost and schedule baselines cannot be overemphasized. Cost and schedule baselines that exist at the time of approval to complete design and begin execution are often what project performance will be measured against. Estimates of project costs should be sufficiently detailed by components in units and unit costs to facilitate review, evaluation, and project validation.

It should be noted that since the project definition process outlined previously is designed to provide a framework that will support existing traditional project definition and management directives such as DOE Order 4700.1 and CERCLA, the process incorporates any decision points included in applicable directives. For example, the RI/FS phase of CERCLA requires approval before advancement to the Remedial Design/Remedial Action phase. This decision point is adapted to and incorporated into the project definition process and falls roughly at the end of the preliminary project definition phase.

4.4.4 Technical Baseline

A technical baseline, which is measurable (quantitative parameters), must be established by the end of the full project definition phase so that technical performance can be monitored and controlled throughout the project's lifecycle. The technical baseline must also relate to the schedule and cost baselines so that technical performance monitoring can correlate and be simultaneous to cost and schedule monitoring. Typically, the technical baseline will include a description of the function requirements and performance parameters, assumptions, and specific technical requirements (i.e., work scope).

4.4.5 Project Contingencies

As cost and schedule baselines are developed in the full project definition phase, project contingencies must also be considered and addressed. Contingencies are estimated funds intended to cover potential unknowns, scope uncertainties, and discoveries (e;g., incomplete designs, technology changes, construction disturbances, unforeseen safety requirements, etc.). The Project Manager should be able to track, monitor, and report contingency usage throughout the project. Some factors that may affect contingencies are market conditions, regulatory uncertainty, and public acceptance.

4.4.6 Project Controls

Before validation and initiation of the project, when baselines are established and approved, the Project Manager must implement the appropriate controls on those project areas which were evaluated and identified as a high risk. The Project Manager can control a project using the graded approach by regulating the degree of detail, frequency of feedback, accuracy of feedback, timeliness of feedback, and the formality of feedback based on unique project characteristics and complexity. Because risk analysis and the development of potential risk controlling strategies was an iterative process since the conceptual development stage, the Project Manager should be able to easily document the necessary project controls at this point.

4.5 SUMMARY

Project definition consists of all planning activities undertaken prior to final design. To improve project definition, it is essential to understand the process as it unfolds. The project definition process can be seen as consisting of three distinct phases: conceptual development, preliminary project definition, and full project definition. The conceptual development phase marks the identification of project need and the development of the basic functional and technical components that must be included to meet that need. The preliminary project definition phase signals the maturation of the project concept. Additional information is gathered, alternative courses of action are identified, plans are made as to how the functional and technical components are to be developed, initial cost and schedule estimates are formulated, a preferred alternative is selected, and plans for project execution are created. The full project definition phase produces a final work scope and initiates preliminary technical and engineering plans for project completion and accurate cost and schedule baselines.

All three phases should include the application of value engineering principles to strive for continual improvement and the maintenance of strong lines of communication with stakeholders and regulators to ensure an adequate and useful conclusion to the project definition process. Specific actions to improve the process are discussed in Chapters 5-8.

CHAPTER 5
PROJECT DEFINITION: AUXILIARY PROCESS INFORMATION

As illustrated by Figure 1-2, effective project definition comprises components that fit into three basic categories: culture, people, and processes. Various culture and people factors that influence successful project definition are discussed in Chapters 2 and 3 of this handbook. This chapter provides an overview of the specific components that comprise the project definition process discussed in Chapter 4. The information on these processes provided here is not intended to replace official guidance but to enhance its overall effectiveness by providing the information and framework for developing the unique characteristics of independent projects. Where available, references to applicable guidance documents are provided.

5.1 FUNCTION ANALYSIS AND REQUIREMENTS

Function is what a product or service must provide to make it work and/or sell. Analysis of the functional requirements of a project is the heart of project planning and developing project definition. Accurate formulation of the function requirements of a project will lead to the assurance that the project accomplishes its basic mission need and required goal. Function requirements become the basis for many other key project planning elements including the design criteria, WBS, cost estimate, systems engineering, and value engineering studies.

To facilitate this activity, the Project Manager should create a function analysis team early in the conceptual development phase after the project mission goals and objectives have been identified. The required function analysis team members vary between DOE Operations Offices but usually consist of individuals who are familiar with the project such as technical personnel, end users, program personnel (i.e., Program Manager, health and safety representatives, etc.), and the Field Operating Contractor. A diverse team stimulates the sharing of knowledge, experience, and subject expertise while generating solutions and evaluating alternatives. Some benefits to the Project Manager of performing this analysis early on and with multiple project representatives include:

A FUNCTION ANALYSIS TEAM SHOULD BE CREATED EARLY IN THE CONCEPTUAL DEVELOPMENT PHASE.

- obtaining a better understanding of the users perception of the project's function,
- minimizing the potential for developing unnecessary or redundant functions,
- evaluating alternatives early when change is not costly,

- improving cost estimates during the conceptual development phase,
- providing the opportunity for early stakeholder involvement and buy-in on project requirements,
- and expediting the design process.

The functional analysis typically begins with the identification of top level functions and ends with the allocation of those functions to a lower, more specific level. A complex project may have dozens of functions, and there will be levels of functions that support and help accomplish other functions. To perform a function analysis for a project, a Functional Logic Diagram that shows the functions and their inter-relationships is typically developed. The DOE Operations Offices have different requirements and procedures for conducting a functional analysis; the Project Manager must be familiar with these requirements.

One of the most common and effective methods to generate the project's required functions is to develop a Function Analysis System Technique (FAST) diagram, see Figure 5-1.

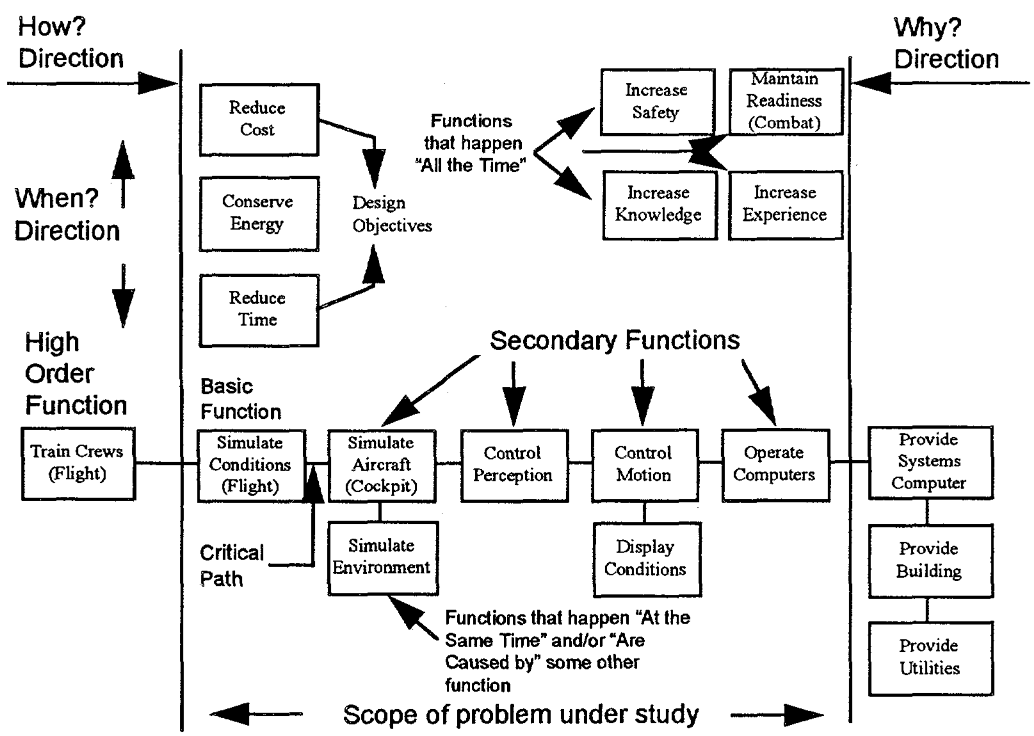


Figure 5-1. Function Analysis System Technique Diagram.

The depicted FAST diagram is constructed by the team as presented in the following discussion: The team is initiated with a need to find a solution to the project; in this example it is a better way of training flight crews. The team, in this case, selected as the higher order function, or objective, "Train Crews." The team identified some design objectives as "Reduce Costs," "Conserve Energy," and "Reduce Time," and displayed those in the upper left hand corner of the diagram. The team then asks the question, "How" can we train crews (working to the right), and chose the basic function of "Simulate Conditions," of flight. The team then works to the left and asks "Why" do we simulate conditions and the answer is to train crews. This process is repeated until all functions necessary to accomplish the higher order objective are identified. The logic must hold up while working both ways or the process has not been completed properly. The team also identifies all functions that occur simultaneously with the basic or secondary functions. For example, when the function "Simulate Aircraft" takes place, the function "Simulate Environment" must take place at the same time. The team discusses the problem and project until all functions have been identified and all unnecessary functions are eliminated. In the upper right corner are functions that must happen continuously. For example, "Increase Safety" is a function required at all times. After all functions are identified, the project or problem is scoped, and the team can identify requirements, design criteria, etc.

FAST is a thinking process and involves discipline that helps a team to identify the "right" problem up front when scoping a project, process, or problem. The process is demanding but forces good communication, improves understanding, aids team building, and focuses attention on the right issues. For additional information on constructing a FAST diagram, the example provided in Section 5.3, Value Engineering, includes a diagram completed for a Process Water Treatment Facility.

5.2 WORK SCOPE

A SOUND WORK SCOPE IS THE PRIMARY PRODUCT OF PROJECT DEFINITION.

The term "scope" refers to those performance and design requirements, criteria, and characteristics derived from mission needs and functions that provide the basis for project direction and execution. Work processes for each type of project must be defined in sufficient detail to adequately establish the context (nature, complexity, duration, oversight, contracting, public interest, etc.) influencing work scope development. Work scope is a product of the project definition process and includes the following:

- technical description
- detailed engineering drawings
- cost, schedule, and technical baselines
- all other information needed to begin project execution

5.2.1 Elements

Basic work scope elements are summarized in the following

WORK SCOPE ELEMENTS MUST IDENTIFY ALL KNOWN, KNOWN BUT UNCERTAIN, AND ASSUMED INFORMATION RELATED TO PLANNING, ORGANIZING, EXECUTING, AND CONTROLLING PROJECT ACTIVITIES.

list. The content and depth to which the scope is developed is project-specific and is established by the site and Project Team members.

- technical scope of the project is defined
- description of the project and any sub-projects is presented
- health and safety considerations are identified
- justification for the project is included, and sponsor support for the project is documented
- technical parameters and complexity of the project are discussed
- descriptions of the basic programmatic systems and equipment are discussed
- alternative considerations are addressed
- relationships to other projects/facilities at the site are presented
- preliminary level of quality assurance for the various project elements is defined
- safeguard and security considerations are identified

Work scope elements for each project type must be identified in a manner that completely describes all known, known but uncertain, and assumed information related to planning, organizing, executing, and controlling all project activities. Work scope may also need to address secondary project issues that are not encompassed in the project definition and provide justification for their exclusion.

5.2.2 Maintenance

Once a detailed work scope has been put in place, the integrity of that work scope must be maintained to avoid schedule and budget overruns and ensure traceability of work scope information over the life of the project. **The chief reason for work scope changes, and the resulting cost overruns, is inadequate project definition.**

INADEQUATE PROJECT DEFINITION RESULTS IN SCOPE CHANGES, COST OVERRUNS, AND SCHEDULE SLIPPAGE.

5.2.3 Traceability

Work scope traceability to appropriate program and project documentation must be ensured to provide credibility and confidence in use of the work scope description. Furthermore, since changes to the work scope are inevitable, even with extensive pre-scope investigation, the Project Manager should have documentation to substantiate the need for any changes to the original work scope and justify any resulting budget overruns. Traceability and documentation will allow the Project

Manager to review the project and develop lessons learned.

5.3 VALUE ENGINEERING

Value Engineering is an organized team effort led by a person trained in the methodology to analyze the functions of systems, equipment, facilities, services, and processes for the purpose of achieving the essential functions at the lowest life cycle cost while maintaining required performance, reliability, availability, quality, and safety.

Although the methodology can be used to improve and/or plan many things, it is often applied to a project that has reached the conceptual design stage (in the preliminary project definition phase described in this handbook). The Project Manager can arrange to have a value engineering study performed to assess whether the project design meets its required functions in the most cost-effective manner. A team of value engineers can be brought in on a contract basis for a short period of time to conduct the study. In addition, in-house personnel can be used when the needed expertise is available. The duration of the study varies from 1 to 5 days in most cases but is dependent upon the complexity and magnitude of the project or problem under study.

The most opportune and effective time to apply the value engineering techniques is at the beginning of a project when changes can be made easily without a substantial cost impact. The next best time is as early in the design process as feasible. Although value engineering can be performed at any time during the project's life, the later the Project Manager waits to implement the study, the fewer benefits will be derived.

Value engineering, a DOE term synonymous with value analysis and value management, is intended to, and can result in accomplishing the following:

- providing high quality end product and increased productivity
- improving team building and communications
- providing cross training in other functional areas and increased job satisfaction
- eliminating cost and schedule overruns
- improving allocation of resources and project performance
- reducing risk and safety hazards
- reducing project costs significantly

In a value engineering study, a team effort is used to identify opportunities for improvement by focusing on the functions to be performed. The process is known as the "job plan," which is a systematic approach divided into five phases:

Phase 1 is the "Information" phase in which the team is chosen and all necessary background information related to the project is gathered (including cost information, imposed constraints, environmental data, etc.). An overview of the design and requirements is presented by the designer to the value engineering team. "Function Analysis" is performed where the functions of the project are identified and a function diagram is prepared. This phase is the heart of the value engineering process; its use requires the team to think of the project in terms of basic and secondary functions and their associated costs.

Phase 2 is the "Creative" phase in which the knowledge gained in the previous phase is used to generate ideas about how to improve the project or problem under study to provide all required functions while reducing costs. This phase is typically facilitated by a "brainstorming session" among the VE team members. All ideas generated are recorded and judgement of ideas is withheld until the next phase.

Phase 3 is the "Analysis or Judgement" phase in which the team jointly analyzes and judges all ideas generated in the creative phase. Ideas are evaluated according to their potential for project improvement and cost savings. Those ideas considered worthy of further consideration are given a numerical ranking, and the highest ranking ideas are considered viable alternatives. Ideas that cannot be accurately estimated but are thought to represent improvement to the project are labeled "design suggestions."

Phase 4 is the "Development" phase in which each viable alternative and design suggestion is developed into a complete and concise alternative (proposal), taking into account all costs attributed to the alternative, including life cycle cost comparisons where necessary. Advantages, disadvantages, and a short narrative description are written during this phase accompanied by supporting sketches, calculations, cost worksheets, etc.

Phase 5 is the "Presentation" and "Reporting" phase in which a briefing is given to management regarding the proposed alternatives. This gives management an opportunity to make comments and/or ask questions regarding the results of the study. Subsequent to this briefing a written report is issued that documents the process used, identifies the team and all participants, and documents all recommendations (proposals). This report is then the basis for implementing the proposals into the project or process being studied and provides the basis for validating the improvements.

After reviewing the report, the owner and designer of the project typically prepares a response that either accepts, accepts with modification, or rejects the alternatives.

5.4 SYSTEMS ENGINEERING

Systems engineering encompasses the management of the engineering and technical effort required to transform project objectives into an operational system. Through systems engineering, an identified mission need is transformed into system performance parameters and a preferred system configuration by an iterative process of definition, synthesis, analysis, design, and evaluation. The approach integrates related technical parameters and ensures compatibility of all physical, functional, and program interfaces in a manner that optimizes the total system definition and design. Factors such as reliability, maintainability, safety, survivability, and human factors are integrated into the total engineering effort to meet cost, life cycle costing, schedule, environmental safety and health, and technical performance objectives.

As illustrated in Figure 5-3, the systems engineering process is driven by the overall project planning process (i.e., the project definition process described in this handbook). Systems engineering typically starts in the conceptual development phase of project definition. As described previously, function analysis is conducted at this stage to identify all function requirements of the project and relationships among function requirements. All identified project functions and subfunctions are then allocated to a set of performance and design requirements that are developed in a System Requirements Document. The functional relationships and project performance/design requirements identified in this document are then reviewed. The Systems Requirement Document serves as the basis for development of quality assurance activities; preliminary safety analysis reports; reliability, availability, and maintainability (RAM) analyses; buy/make analyses, etc.

While the conceptual design is being developed and produced, performance and design requirements are integrated and synthesized into a consolidated conceptual design effort. In this stage, all studies appropriate for project evaluation and optimization are identified (e.g., buy/make analyses, RAM analyses, NEPA documentation, life cycle

EXAMPLE 4: VALUE ENGINEERING STUDIES AND REPORTS

The purpose of a value engineering study is to provide assistance in planning a project that will meet its basic required function at the least possible total cost of effective ownership without compromising its quality in terms of performance, reliability, and maintainability. This example describes one of several proposals in a value engineering report based on a study conducted during August 1994 for the Process Waste Treatment Facility (PWTF) to be constructed at Oak Ridge National Laboratory in Oak Ridge, Tennessee. Mason & Hanger Engineering, Inc., in association with Lewis & Zimmerman Associates performed the study for Martin Marietta Energy Systems, Inc. (MMES), the facility manager for the U.S. Department of Energy. The PWTF was designed to replace the current Process Waste Treatment Plant, provide treatment of process wastewater contaminated with cesium-137 and strontium-90 to meet regulatory requirements, and produce a solid waste that would meet relevant waste acceptance criteria.

The study used the traditional five-phase value engineering job plan process in a workshop context. This process is a team effort that usually takes place within a 40-hour period using a comprehensive, systematic approach. Before the value engineering study began, all necessary background information was collected, and cost and graphical models relating to design, construction, and operational requirements were compiled (including all information such as funding limitations, environmental data, constraints, criteria, etc.) The information gathered in the initial stage is identified in the value engineering report. The Project Description section of the PWTF value engineering report contains a listing of the project economic data; the functional analysis diagram; and a detailed project description stating the objectives and requirements of the project, waste characteristics, design drawings, and a cost model.

The value engineering job plan process consists of five phases: the Information Phase, the Speculative or Creative Phase, the Analysis or Judgement Phase, the Development Phase, and the Presentation or Recommendation Phase. In the Information Phase of the PWTF value engineering study, the MMES project team met with the VE team several times to present the project design and requirements and for a site visit. A key step in this phase is conducting function analysis and preparation of a FAST diagram (see Figure 5-2). This diagram shows all required functions of the project and the relationships of all functions to each other. This is critical because functions drive requirements, and requirements cost money. In the Speculative or Creative Phase, the value engineering team conducted a brainstorming session to identify any potential opportunities for value improvement (i.e., more cost-effective design solutions for constructing the project that would still satisfy all technical and environmental requirements). In the Analysis or Judgement Phase, the value engineering team and the MMES project team analyzed and evaluated all ideas generated in the brainstorming session. Ideas with the greatest potential cost savings or that would improve the project in other ways were developed as proposed alternatives in the Development Phase; these alternatives were then ranked from "1" to "10", with "10" being the most desirable. Ideas ranked "8" or higher were considered viable alternatives. Alternatives that represented an improvement to the project, but could not be sufficiently estimated within the time allowed for the study, were considered "design suggestions." The PWTF value engineering team generated 35 creative ideas that resulted in 21 viable alternatives. Research and development of these alternatives yielded nine proposals for change and three design suggestions. Each of these proposals and design suggestions were presented

EXAMPLE 4: (Continued)

to the MMES (and contractor) team representatives in the Presentation or Recommendation Phase of the study at the end of the workshop.

The proposed changes and design suggestions for value improvement of the PWTF project are contained in the value engineering report in tabular format and are accompanied by design sketches and estimated cost savings. The following illustrates one of the several cost reduction recommendations of the PWTF value engineering team:

- Design a two-story building instead of a one-story building to reduce the building footprint; this will avoid remediation of a hazardous landfill prior to construction and result in potential cost savings of approximately $1,099,210 (illustrated below.)

VALUE ENGINEERING PROPOSAL		**Mason & Hanger Engineering, Inc.**
PROJECT: X-10 PROCESS WASTE TREATMENT FACILITY, ORNL	**DATE:** 08/23-26/94	**PROPOSAL NO.** B-1
ITEM: DESIGN TWO-STORY BUILDING		**SHEET NO.** 1 & 2 of 6

ORIGINAL DESIGN: (Attach sketch where appropriate)

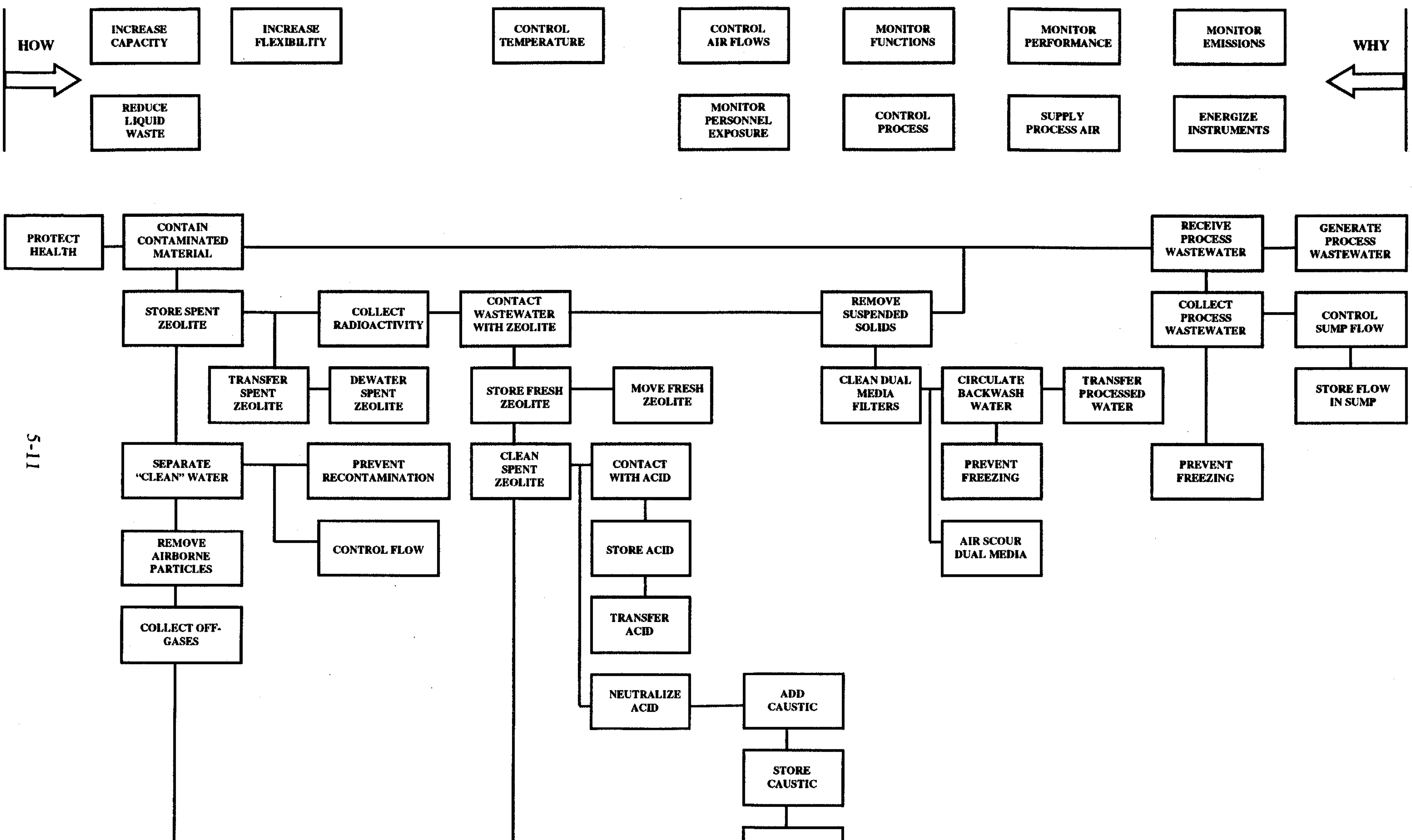
Provided a one-story, 10,504 sq.ft, pre-engineered metal building with a slab on grade and accompanying site work. This will include excavation to establish elevation, hazardous solid waste removal and utilities relocation.

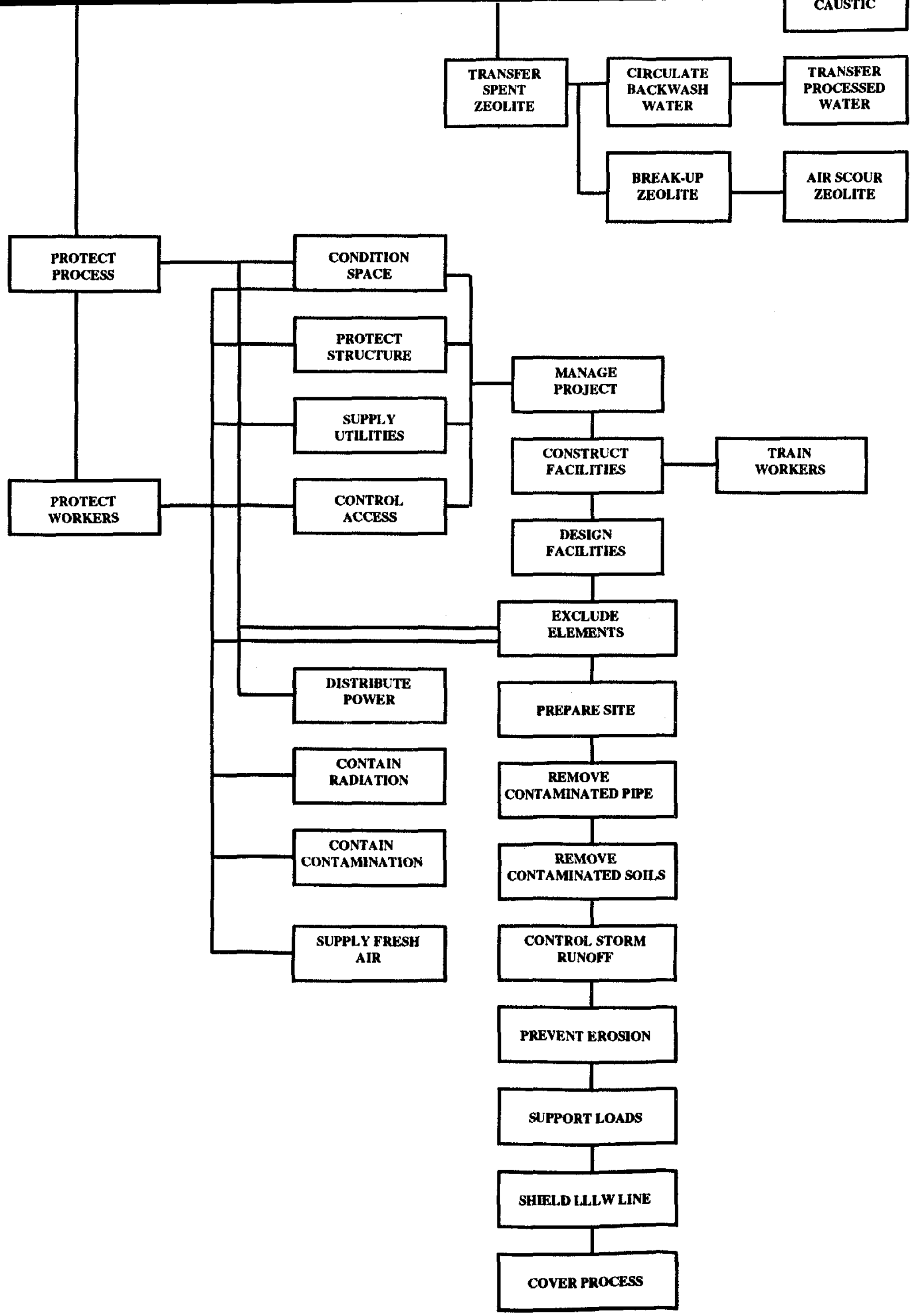
PROPOSED CHANGE: (Attach sketch where appropriate)

Provide a 7,669 sq.ft pre-engineered metal building with a 2,835 sq.ft mezzanine over the laboratory and control room areas. Reduce the site work accordingly.

COST SUMMARY	TOTAL LABOR AND MATERIAL	MARKUP	CAPITAL COST	LIFE-CYCLE COST	TOTAL COST
ORIGINAL DESIGN	$3,682,000	2.87	$10,567,340	$ ---	$10,567,340
PROPOSED CHANGE	$3,299,000	2.87	$ 9,468,130	$ ---	$ 9,468,130
SAVINGS			**$ 1,099,210**	**$ ---**	**$ 1,099,210**

FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F.A.S.T.) DIAGRAM X-10 PROCESS WATER TREATMENT FACILITY




CAUSTIC
TRANSFER SPENT ZEOLITE
CIRCULATE BACKWASH WATER
TRANSFER PROCESSED WATER
BREAK-UP ZEOLITE
AIR SCOUR ZEOLITE
PROTECT PROCESS
CONDITION SPACE
PROTECT STRUCTURE
MANAGE PROJECT
SUPPLY UTILITIES
CONSTRUCT FACILITIES
TRAIN WORKERS
PROTECT WORKERS
CONTROL ACCESS
DESIGN FACILITIES
EXCLUDE ELEMENTS
DISTRIBUTE POWER
PREPARE SITE
CONTAIN RADIATION
REMOVE CONTAMINATED PIPE
CONTAIN CONTAMINATION
REMOVE CONTAMINATED SOILS
SUPPLY FRESH AIR
CONTROL STORM RUNOFF
PREVENT EROSION
SUPPORT LOADS
SHIELD LLLW LINE
COVER PROCESS

costing, value engineering, etc.) These studies are scheduled with the appropriate time-phased relationships to other project milestones. Upon completion of the conceptual design report, a readiness review is conducted; part of this review is to further examine the technical content of the system specifications and evaluate the allocated technical requirements in terms of optimization, correlation, completeness, and risk. After conceptual design approval, further project management attention is necessary to ensure that all interface requirements and analysis schedules are met.

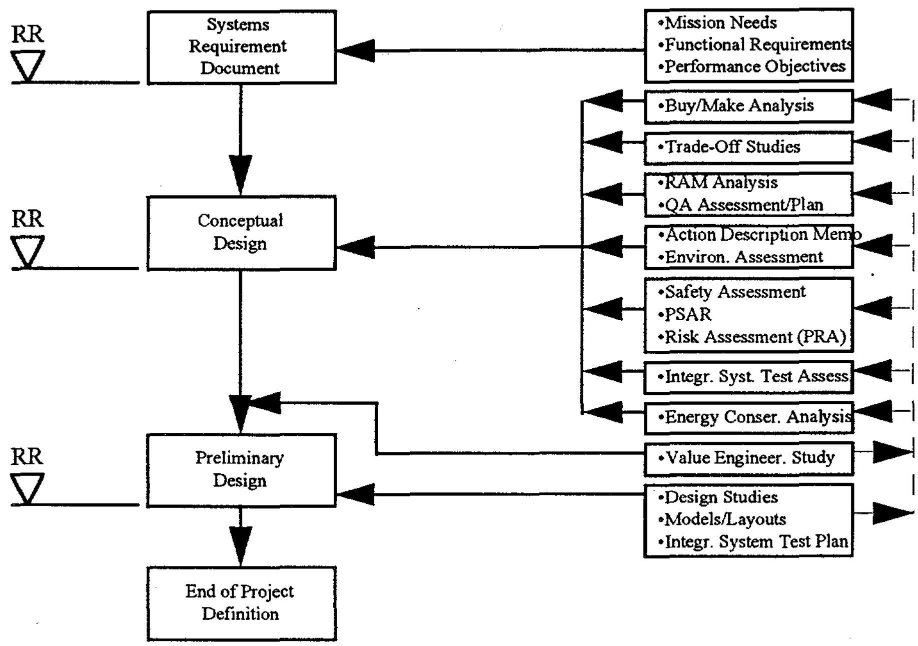


Figure 5-3. Example Systems Engineering Process.

REVISIONS

5.5 PROJECT RISK ANALYSIS

The Project Manager should conduct iterative risk assessments throughout the project definition process to identify those areas of the project scope that could have a potential impact on the overall project success. As discussed in Chapter 4, the Project Manager should initiate this activity during the conceptual development phase after the function requirements have been identified and continue to evaluate the risks as necessary until the project is completely defined. Performing this type of risk assessment allows the Project Manager to plan and implement project controls in an organized fashion before contracting work on final design and execution. As risk will vary with the scope and complexity of a project, risks should be evaluated by a graded approach; therefore the time and effort spent on evaluating the risk will be proportional to the potential impact.

So that effective project control can be developed from this assessment, project specific risk areas and complexity factors must be evaluated. The *DOE Project Control Systems Guidelines*

Risk Factor		Risk Level		
		Low	**Moderate**	**High**
1.	**Technology**	Proven feasible and commonly used (i.e. civil/conventional construction)	Proven state-of -the-art Engineered equipment Testing	Unproven technology, new technology, highly engineered equipment, R&D or investigative requirements
2.	**Time**	Ample time to perform work	Reasonable time to perform work	Compressed time to perform work. (DOE commitments to other agencies (EPA, NRC, DOD)
3.	**Interfaces**	No major impact on site operations, other contractors, projects, programs, etc	Potential impact on site operations	Will have major impact on site operations or other projects and require expert logistics
4.	**Number of Key Participants**	1	2-3	4 or more
5.	**Contractor Capability**	Proven track record and resources available now	Limited experience and resources	Newly acquired capabilities, or resources committed to other projects
6.	**Magnitude and Type of Environmental Contamination**	Hazardous or low-level waste, fully characterized	Hazardous or low level waste, moderately characterized	High level or mixed waste regardless of characterization; or poorly characterized wastes
7.	**Regulatory Involvement**	None	Regulators involved, but agreements reached`	Regulators involved, but agreements not reached and currently out of compliance
8.	**NEPA**	Categorical Exclusion	Environmental Assessment	Environmental Assessment or EIS
9.	**Environmental Permits**	No permits	Ordinary permitting	Unique permitting required
10.	**Number of Locations**	1	2-3	4 or more
11.	**Site Ownership**	DOE property	Government, State, or Participant property	Private property
12.	**Site Improvement or Access**	No infrastructure improvements required, and accessible	Minor infrastructure improvements required and accessible	Major infrastructure/improvements required, or difficult access
13.	**Labor Skills Required for Project**	Low labor skills required	Moderately skilled labor required	Highly skilled labor required
14.	**Labor Availability**	Readily available	Availability Restricted	Availability severely restricted
15.	**Staff Build-up**	Gradual	Measured or phased	Rapid

16.	**Labor Productivity**	Low or average productivity assumed to complete job and low risk schedule	Low or average productivity assumed to complete job and moderate schedule risk	Average or high productivity required to complete job and high schedule risk
17.	**Quality Requirements**	Large quality tolerances and low productivity risk	Moderate quality tolerance (re-work likely) and moderate productivity risk	Precision work (re-work expected) and moderate or high productivity risk
18.	**Funding**	Less than one year	2-3 year duration	3 or more year duration
19.	**Political Visibility**	None	Minor	Major
20.	**Cost Sharing (number of contributors in addition to DOE)**	None	1	2 or more
21.	**Public Involvement**	None	Minor	Major
22.	**Disposal Requirements**	Disposal facility identified	Disposal facilities are not limited for the waste, but acceptance pending	Disposal facility location limited and acceptance pending
23.	**Other**			

Implementation Reference Manual outlines several different risk factors the Project Manager should consider and divides the associated level of risks into qualitative categories describing the magnitude of the risk (low, medium, or high). The following matrix, which identifies common project risks and risk levels, should be evaluated by the Project Manager while the project planning effort is being performed. The risk analysis, however, should not be conducted by the Project Manager alone; known participants including the Program Manager, Project Team, and the DOE Field Contractor should be included in this activity. Analyzing the risks with several participants who are involved with and knowledgeable about the project will permit the sharing of experience, knowledge, similar projects, trends, and expertise and allow for an accurate assessment.

Once determining each of the risks affiliated with the factors in this matrix, the Project Manager should identify those that were categorized as high risk and begin to apply project controls. Section 5.6 describes specifically how the Project Manager can implement controls to the cost, schedule, and technical baseline to mitigate these risks.

5.6 PROJECT CONTROLS

Implementing the graded approach to controlling project risks consists of identifying all project risks, assessing their potential magnitude of impact, and instituting up-front, necessary capabilities. It is the Project Manager's responsibility to ensure information gathered from the qualitative project risk assessment is addressed and that project-specific applications are implemented as necessary to control **specific** areas (i.e., technical function, cost, schedule). The management controls established should maintain visibility on the high risk areas thus ensuring that timely corrective actions are initiated as appropriate.

The risk-based graded approach promotes the development of customized project-specific controls based on the complexity of the project (i.e., total estimated cost, size, stakeholders, etc.) thus creating a balance between effectiveness and economy. The Project Manager must consider the benefits of additional requirements and controls versus the impact these will have on the project resources, such as time and cost. Although additional reporting may aid the project manager in tracking progress, the contractor will have to spend additional time and resources in the documentation preparation. The Project Manager may also find tracking rigorous reporting requirements constraining on his or her time. The effort spent on the risk analysis and the subsequent project controls should be proportional to the complexity of the project as shown in Figure 5-4.

Consideration in determining the complexity of a project should be given to:

- contractor function,

- contractual arrangements,
- contract type,
- project duration,
- costs, and
- risks.

The Project Manager has many areas to which he can implement controls to regulate the progress of the project including the degree of detail, frequency, accuracy, and timeliness and the formality of the feedback. The following matrix provides a tool the Project Manager can use to decide the types of control required based on the specific areas determined as a high risk in the risk analysis.

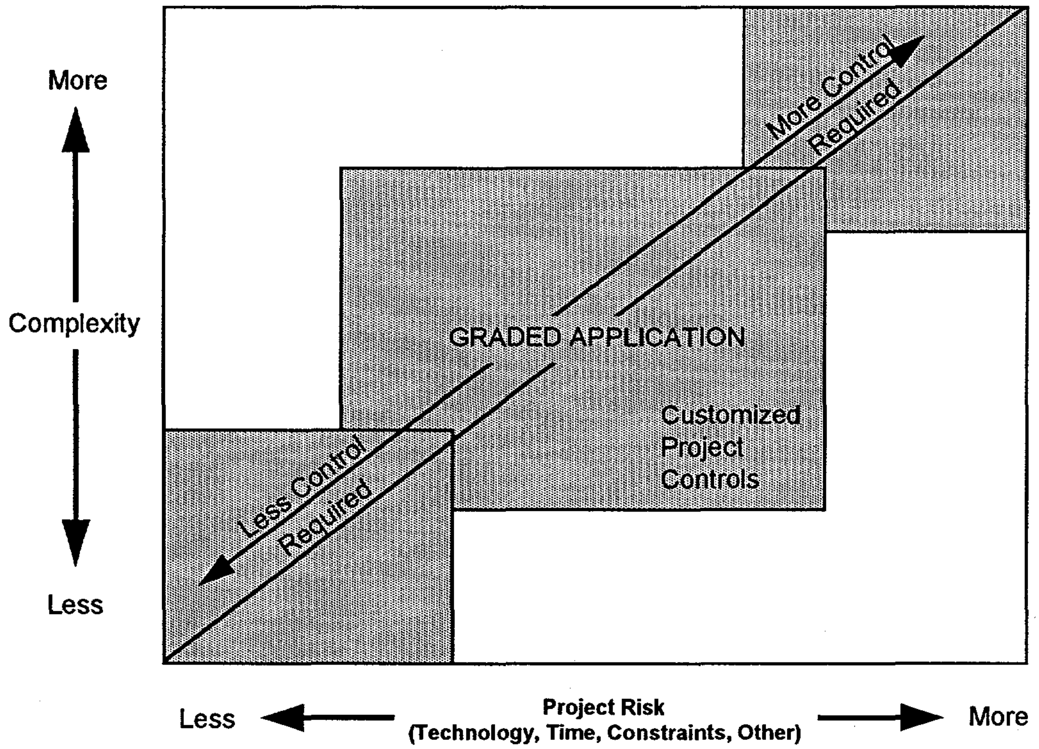


Figure 5-4. Graded Approach to Project Risk.

5.7 PROJECT SCHEDULING

Project scheduling is critical to project success and also facilitates the planning and budgeting process. Numerous PC-compatible software packages are available to help the Project Manager plan budgets, plan concurrent activities, fast-track a project, resolve time conflicts with on-site operations, and set milestones to track project

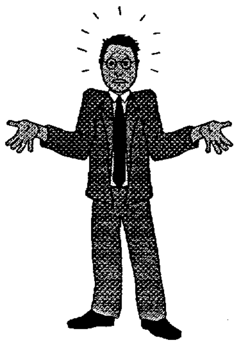
GUIDELINE	LOW	MEDIUM	HIGH	COMMON
Technical Baseline & Work Scope Definition	Unique project ID with accounting system accounts. Use of charge accounts or accounting resource codes in lieu of WBS elements or as supplements to minimum number of element breakdowns.	Clear terminal elements and definition but formal index and dictionary not required.	Formal index dictionary. DOE specified summary WBS. Contractor extended WBS. DOE specified reporting elements.	Clearly defined scope. Technical scope described in sufficient detail to ensure functional design requirements, major physical attributes, and performance characteristics to be controlled by DOE are clearly defined.
Roles & Responsibilities	Identify project manager.	Identify project manager. Formal organization chart with all organization participants identified.	Formal organizational structure (OBS). Responsibility assignment matrix. Formal Control Account Manager assignments. Key personnel identified and responsibilities delineated.	Project participants identified.
Cost Estimating* *** appropriate mix of techniques**	Contractor review/approval. Upper WBS Level 1 estimating. Less precise technique (e.g., expert opinion) Estimate @ KD1 or when baselines are validated and KD3 only No independent estimate required.	DOE Field Office review/approval. Mid WBS Level 2 estimating. More precise technique (e.g., parametric analogy). Estimate at KDS only. Independent estimate optional.	DOE HQ approval. Lowest WBS Level 3 estimating. Precise technique (e.g., take-off/bottoms-up).	Considerations: - size - type - phase (maturity) - data availability

Planning & Scheduling* *** Not all required.** **** Analysis/ Projection**	Contractor specified milestones. Start/complete milestones. Bar chart schedules	DOE Field Office specified milestones. Formal milestone definitions (e.g., dictionary). Master Schedule. Summary network (as required). Detailed CPM network.	DOE Headquarters specified milestones. Formal milestone completion criteria and definitions (e.g. dictionary). Master schedule, summary network (as required). Detailed CPM network. Resource loaded (where applicable). Schedule specification.	Identify requirements and constraints that may affect technical, schedule, or cost baselines. Develop baseline schedules.
Cost Baselines	Few number of control accounts.	Moderate number of control accounts. Earned value techniques optional.	Multiple control account structure. Use of management reserve. Earned value techniques normally used.	Time-phased budget. Each control account contains specific scope. Sum of all control accounts reconciles with cost estimate.
Funds Management				Funds management required for all projects.
Accounting				Fundamental accounting principles with same method regardless of project type
Work Authorization				All control accounts work authorized.

Performance Analysis & Reporting* *** Not all required** ****Analysis/projection**	Cumulative cost plan. Cumulative costs. Schedule status.** Frequency: Quarterly/as needed/at completion.	Cumulative cost plan. Cumulative costs. Schedule/ milestone status**(CPM). Technical/ Physical progress indicators. Earned value techniques where beneficial (e.g., CSSR). Scope, schedule, cost variance. Labor (hours and dollars). Performance trending technical/ schedule/cost/ labor, etc. Frequency: Monthly/ quarterly as required by DOE.	Cumulative cost plan. Current/ cumulative costs. Current and revised cost plan. Schedule/milestone status**(CPM). Technical/physical progress indicators. Earned value techniques (CSSR or CPR). Cost/schedule/ scope variances. Labor (hours and dollars). Performance trending technical/schedule/ cost/labor, etc. Frequency: Monthly/as required by DOE.	Narrative project/contract status report (problems, scope, schedule, costs, changes, etc.). EACs Funds status.** Change status.** Schedule status.** Cost status.**
Change Control				Technical scope, schedule baselined and subject to formal change control. Threshold dependence in accordance with DOE and DOE-approved contractor change control requirements.

progress. Planning in advance for conflicts with other on-site operations minimizes interference with the mission of the site. It is important to note that frequent communication is necessary to obtain useful planning data and resolve known conflicts. The Project Manager should proceed with concurrent actions if practical.

THE PROGRAM MANAGER NEEDS DOCUMENTATION TO JUSTIFY ANY CHANGES TO THE ORIGINAL WORK SCOPE.



One should not underestimate the time required to execute the project in its entirety. The initial schedule tends to be the schedule by which performance and compliance are measured. The Project Manager should develop a checklist, similar to those presented in Appendix A, that outlines the necessary schedule elements including:

- mobilization time,
- demobilization time,
- obtaining required permits (be aware of potential lag time),
- proposal review and contract negotiations,
- engineering design,
- regulatory review time (establish reasonable review times),
- unanticipated down-time,
- site preparations,
- interference by on-going site operations, and
- associated support process turnaround times (i.e., laboratory test processing).

Obtain site, regulatory, and contractor input early and often for the initial schedule and for subsequent updates of the schedule. The schedule should have milestones tied to completion and approval of project deliverables, such as work plans, status reports, etc. In addition to the obvious milestones of deliverables, less obvious milestones for the project should be considered. Also, less obvious activities that can delay schedules should be anticipated early (i.e., reviews and approvals, permit acquisition, funding dates, funding deadlines, public notice and comment periods, bidding time, and contract negotiations).

Despite the establishing of deadlines and milestones, the project schedule must be flexible enough to allow for fast-track responses to an imminent threat, changes in the funding schedule, and shifts in public awareness. Fast-track scheduling applies to projects requiring abbreviated schedules. Simply stated, it is a way to speed up the process by beginning an activity before completing the previous activity. An extreme form of fast-track structuring is to begin independent portions of the project before the entire project design is complete. The decision to "fast-track" a project should not be made lightly and should not be made without first consulting all of the players involved (i.e., contractor Project Manager, Project Team members, customer, regulators, etc.).

5.7.1 Identifying Schedule Milestones

Milestones serve as a basis for schedule monitoring and to integrate work scopes of different contractors. Milestones may be controlled at different levels (e.g., DOE-controlled, contractor-controlled, project manager controlled, etc.) but should be integrated in a hierarchy so that lower level milestones support upper level milestones. The criteria for identifying milestones are:

- meaningful,
- definable,
- measurable,
- related to technical baselines set by DOE,
- any schedule driver.

MILESTONE LOGS ARE USEFUL FOR THOROUGHLY DOCUMENTING MILESTONES.

Milestones should be thoroughly documented in a milestone log including the exact date associated with the milestone, the complete definition of each milestone, and a clear statement of criteria for completion of each milestone.

5.7.2 Critical Path Method

The Critical Path Method is an approach to scheduling that identifies activities and events that control project completion, determines the shortest time for completion, identifies activities that are critical to successful project completion (necessary for completion on time and within budget), and shows available "float" for non-critical activities (the slack time available for completing an activity without disrupting the overall schedule). The critical path is (1) the longest time path through a network (or logic diagram) from the initial activity to the terminal activity and (2) the series of activities in a network with the least amount of total float. Each activity has four time values associated with it:

Early Start (ES_i): the earliest possible time an activity *I* can begin based on network logic;
Early Finish (EF_i): the earliest possible time an activity *I* can be finished based on network logic;
Late Start (LS_i):the latest possible time an activity *I* can start without delaying project completion; and

EXAMPLE 5: SCHEDULING TOOLS

Types of Schedules

Most schedules are displayed graphically, and each scheduling technique has different uses, advantages, and disadvantages. Some of the most common scheduling tools include:

1. **Bar charts:** time-scaled, graphic representations of project activities.

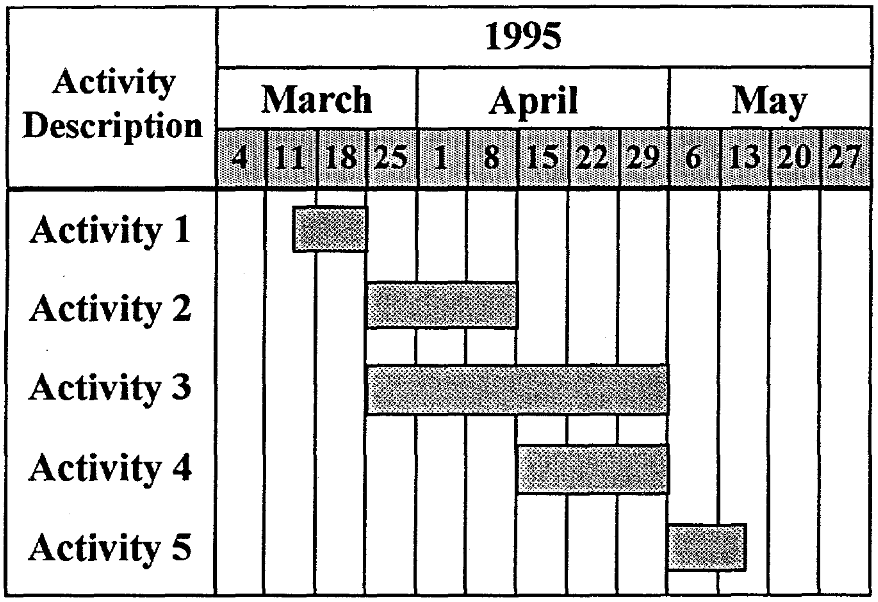


Figure 5-5. Example Bar Chart.

Advantages:
- easy to prepare and understand, quick to review, and low cost to prepare
- good for scheduling simple projects and summarizing complex project schedules

Disadvantages:
- do not show relationships between activities or resources required
- difficult to use for coordinating activities, detecting delays, and deter mining effects of delays on project completion

2. **Networks or logic diagrams:** graphic representations of the logical sequence of project activities; they may or may not be time-scaled. Network logic is determined by the relationships between activities;

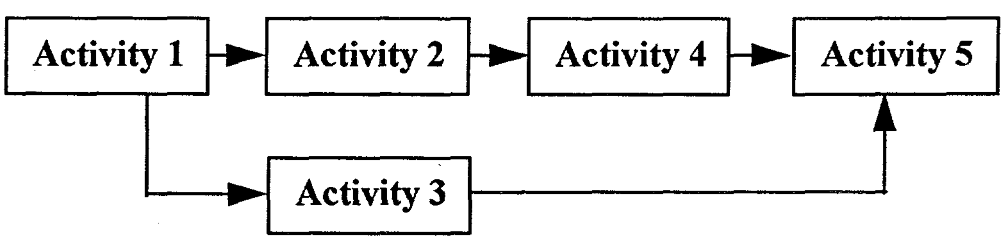


Figure 5-6. Example Network Diagram.

EXAMPLE 5: (Continued)

Advantages:
- good for scheduling a wide variety of projects, anticipating bottlenecks, improving coordination and communication during project execution, planning for resource requirements over time, and tracking project per formance

Disadvantages:
- can be more complicated and more difficult to prepare than bar charts

3. Computer software programs: for creating and maintaining schedules.

Picture Drawers

Advantages:
- are relatively easy to use

Disadvantages:
- difficult to update and lack true logic capability

Low-End Scheduling Software

Advantages:
- relatively inexpensive and easy to use

Disadvantages:
- accepts a limited array of parameters and has limited reporting and graphics capabilities

High-End Scheduling Software

Advantages:
- accepts a large array of codes and parameters

Disadvantages:
- expensive to purchase and usually requires training and user support

Cost-Schedule Management Reporting Packages

Advantages:
- accepts a large array of codes and parameters and in cludes cost component

Disadvantages:
- can be costly to implement and may require user train ing and periodic updating

<u>Late Finish (LF_i)</u>:the latest possible time an activity *I* can be finished without delaying project completion.

To identify the critical path, two types of calculations may be performed using these four time values:

<u>Forward Pass</u>: a procedure to determine the earliest time each activity may start (ES_i) and the earliest time each activity may finish (EF_i):

$$EF_i = ES_i + t_i$$

where t_i = time required to complete activity *I*

<u>Backward Pass</u>: a procedure to determine the latest time each activity may start (LS_i) and the latest time each activity may finish (LF_i) without disturbing the end date of the project:

$$LS_i = LF_i - t_i$$

The *difference in time between the backward pass and the forward pass is the float*. The activity time values and the float define the critical activities and the envelope of time in which a project should be managed (the "schedule envelope"). The flexible critical path scheduling method allows Project Managers to focus on critical activities that are most likely to cause delays, to apply discretionary resources where they may derive the most benefit, and to make more informed management decisions.

5.7.3 Schedule Contingency

Schedule contingency is an amount of time identified within a project's critical path schedule to compensate for the potential occurrence of schedule risk factors. The contingency represents the difference between a planned completion date and a committed completion date. Schedule contingency is determined by rigorous analysis of schedule risk (potential for delay, cost overruns, etc.) at the lowest level of schedule detail. Identification of schedule contingencies allows the Project Manager to track and monitor performance to the committed completion date while managing any small, unplanned delays. Schedule contingency is essential to overcome impacts caused by project unknowns, uncertainties, and undefined technical scope.

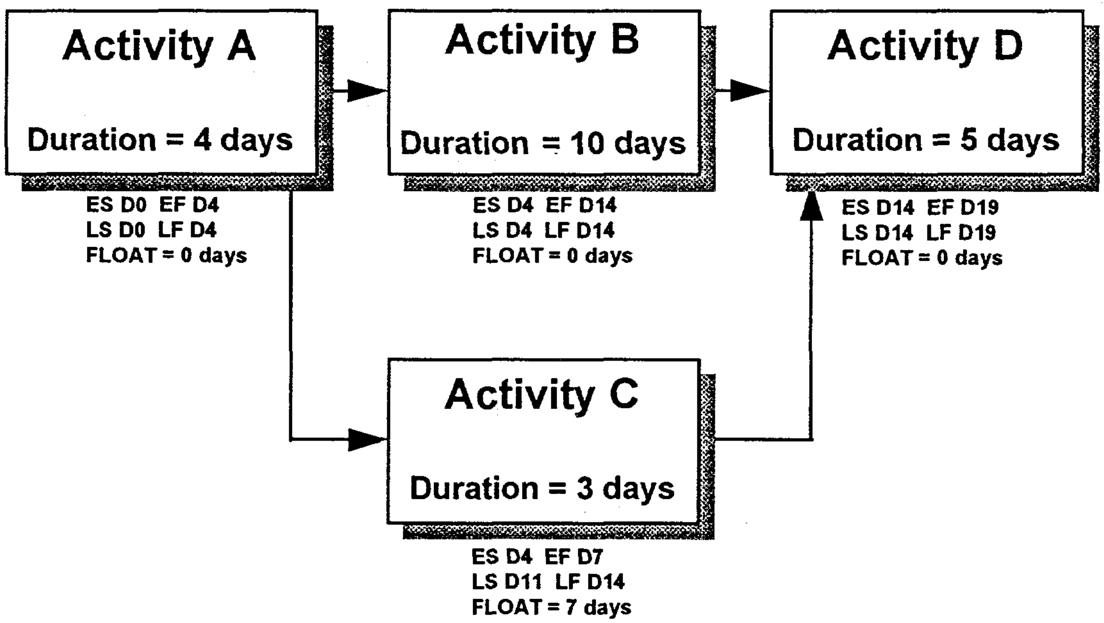
5.8 PROJECT COST ESTIMATING PROCESS

5.8.1 Cost Estimating

Cost estimating is the process of projecting financial requirements to accomplish a specified objective. Cost estimates can be used to evaluate scope of design alternatives to prioritize among optional uses of budgets and are a key element of a project (or program)

EXAMPLE 6: CRITICAL PATH HYPOTHETICAL DRUM STORAGE SCENARIO

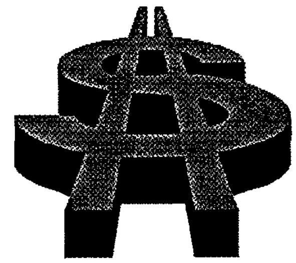
The hypothetical B&S Corporation has recently been hired by a DOE site to overpack and transport drums containing hazardous waste to a new storage location onsite. To facilitate this effort, B&S has divided the work into the following basic steps: (A) inventory and barcoding of waste drums, (B) overpacking the drums, (C) preparing the new storage area (not assuming construction), and (D) transporting the drums to the new on-site storage area. The following network diagram illustrates the logical sequence of events and the calculated float. (Note: Activity A must be completed before Activities B and C; Activity D must be performed after completion of Activities B and C.)



D0 = Day 0; D4 = Day 4; D7 = Day 7; D11 = Day 11; D14 = Day 14; D19 = Day 19

As shown in the diagram, there would be 7 days of float time for Activity C but no float time for Activities A, B, and D. Therefore, Activities A, B, and D are the critical activities necessary for project completion on time and within budget.

baseline for tracking, reporting, and change control. Sound, consistent, and traceable estimates are the product of good project definition. Conversely, careful evaluation of the elements that should be included in the cost estimate will contribute to the accuracy of the definition process.



COST ESTIMATES ARE USED FOR :

EVALUATION OF ALTERNATIVES

PRIORITIZATION

BASELINE CONTROL

In addition, cost estimating must be performed during all the phases for all projects to:

- ensure that projected budget requirements match scope requirements which may (and often do) change during design evolution;
- support trade-off and benefit-cost studies;
- provide the basis for resources and staffing the work to be accomplished;
- provide cost information to support contracting strategy development;
- ensure that bid evaluations and contract negotiations are reasonable and reliable; and
- evaluate the scope/cost/schedule implications and reasonableness of change orders and claims; and calculate the effects of project stretch-outs due to funding perturbations, strikes, weather, materials shortages, new regulations, etc.

Projects throughout the DOE complex cover a wide variety of activities. In addition, customer needs and regulatory requirements result in different planning methods and design solutions. A Project Manager is responsible for knowing how these requirements translate to the best cost estimating approaches throughout the life of the project. Although various guidance documents outline cost estimating processes in somewhat different ways and also encourage the use of different estimating techniques, the principal cost estimating tasks are:

- establishing the basis for the estimate by working with the estimator(s), customer(s), and the designers to arrive at the best possible scope and design information commensurate with the project stage;
- translating the total scope to the Work Breakdown Structure (WBS);
- selecting estimating techniques for the WBS elements in accordance with the level of design information available, e.g., material take-off estimating, factor-ratio estimating, parametric estimating and/or engineering judgment/allowances. (Until definitive design is completed, estimates are derived based on use of a combination of these.);

- applying the appropriate cost estimating techniques to each WBS element;

- working with the scheduler(s) to determine the project's likely schedule and apply escalation factors as appropriate and develop a funding profile;

- performing contingency analyses and apply contingency factors; and

- documenting the cost estimate including all ground rules and assumptions, quotes, source materials, work sheets, and design information.

COST ESTIMATES SHOULD BE PERFORMED DURING EACH PHASE OF PROJECT DEFINITION; COST ESTIMATE ACCURACY SHOULD IMPROVE WITH EACH REVISION.

Cost estimating guidance that may prove useful or that may be mandated by project type and initiating organization include local estimating guides, the *DOE Cost Guide (Vol. 6)* dated November 1994 available from the Office of Infrastructure Acquisition (FM-50), the EM-20 *Cost Quality Management Assessment Handbook*, the EM-20 *Independent Cost Estimating Guide*, the EM-30 *Cost Guide*, the EM-40 *EM-CAT Handbook*, and *Parametric Estimating: A Guide* (available from the Office of Construction and Capital Projects, DP-32). Professional societies such as the American Association for Cost Engineers, the Society for Cost Estimating and Analysis, and the International Society of Parametric Analysts have conference proceedings, journals, and other educational resource materials that may be of value in different aspects of cost estimating. In addition, commercially available information and cost data sources are available and include *Mean's Cost Estimating Guide*, Richardson's Estimating System, and Micro-Computer Aided Cost Engineering Support System (M-CASES), which is the version available to the public of the U.S. Corps of Engineers unit price data base.

While there are only three primary elements comprising a cost estimate, (i.e. what, amount, and "unit" cost), developing realistic cost estimates involves rigorous attention to obtaining the best possible information about the project scope and all assumptions surrounding its execution. First, the realism of the estimate is significantly related to costing the right thing, "what" (e.g., a Mercedes Benz versus a Geo Metro.) Second, quantity (1 or 100) is essential. The accuracy of the quantity value is directly proportional to the depth of detail in the project description used to develop the estimate. Third, the accuracy of the "unit" [note: the size of the unit often changes as design becomes defined (e.g., from lump sum to xxx linear feet, etc.)]. Cost value can be affected by its source. Information can be obtained through site-specific, historical experience from analogous projects/items, data from other DOE sites, and other sources mentioned earlier.

All data that are obtained for the project estimating purpose must be "normalized" or made equivalent to the "what," "amount" (ensure that scale economies and the learning curve have been appropriately accounted for), and "unit cost" (determine whether the cost data you are using are direct only or direct and indirect cost.) Using data that include indirect costs (overheads, general and administrative, and fee) can be dangerous since those costs can vary from organization to organization and even from job to job within an organization. It is essential that the Project Manager and the cost estimating professionals understand the particular indirect cost categories, how they affect the project cost, and how the organization for which they work applies indirect costs.

In addition to variability of indirect cost factors, there are other discrete tasks and factors that vary for each project type and situation and which the Project Manager and cost professionals should consider:

- project management, engineering and design service
- spares and cold start-up
- regulatory agreements/requirements
- contracting strategies
- work plan/technical approach
- labor productivity and rates
- union agreements
- labor availability
- material/equipment costs
- material/equipment availability
- security requirements
- WBS (develop, use existing, or modify existing)
- emerging technologies
- R&D status/requirements
- review and approval requirements
- health and safety regulations/requirements
- project execution plan
- risk factors
- project schedule and major milestones

IT IS ESSENTIAL THAT THE PROJECT MANAGER AND COST ESTIMATING PROFESSIONALS UNDERSTAND THE PARTICULAR INDIRECT COST CATEGORIES.

- quality assurance program/procedures
- preliminary assessment/site investigation
- sampling plan/characterization plan
- analytical costs
- life cycle costs

Examples and additional/alternative factors are provided by the checklists for cost estimation located in Appendix A. Chapter 8 in the EM-40 CAT *Cost Estimating Handbook for Environmental Restoration* contains a specific checklist which the estimator can use as a tool.

5.8.2 Types of Project Cost Estimates

The Project Manager should be aware of the various types of project cost estimates. Total Project Cost (TPC) represents all project costs prior to operation. The TPC is composed of two parts, the Total Estimated Cost (TEC) and the Other Project Costs (OPC). The TEC includes all costs related to engineering design, land and land rights, facility construction, equipment, contingency and escalation, etc. The OPC includes all other project or operating costs such as conceptual design, studies, training, etc. during transition to operation. Thorough project management should include distinction among types of project costs so as to provide consistency in estimating and reporting, and uniformity in cost data bases. (Note that environmental projects may not distinguish between TEC and OPC because they are funded through operating funds.) Table 5.1 provides a limited sample of some of the types of project activities that would be included in the different cost categories.

5.8.3 Cost Estimate Contingency Funds

CONTINGENCY REDUCES THE RISK OF COST OVERRUNS.

When figuring potential cost items, **the inclusion of contingency funds must not be overlooked.** Contingency is defined as the sum of funds included within an estimate to cover materials, labor, conditions, and risk situations that are an intrinsic part of the presently intended scope of work but are not specifically costed elsewhere in the estimate due to uncertainty either as to their existence, nature, likelihood of occurrence, or magnitude of effect. Contingency is necessary to cover unknowns and is absolutely necessary to the successful execution of a project. It is, like the quantity value, highly determined by the depth of project characterization achieved and provided to the Project Manager and cost professional for inclusion in the cost estimate.

No standard percentage for contingency is currently available. However, several techniques for assessing and calculating contingency

TABLE 5.1. TPC, OPC, and TEC Guidance and Clarification

Activity	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
1. Pre-Key Decision-0 (Prior to Determination of Mission Need)					
A. Engineering Study	X				
B. Alternatives Assessment/Site Selection Studies	X				
C. Functional Design Criteria	X				
2. Key Decision-0 and Key Decision-1 (Determination of Mission Need and Approval of New Start)					
A. Conceptual Design Report	X				
C. Conceptual Project Schedule	X				
E. Project Management Plan	X				
3. Key Decision-1 and Key Decision-2 (Approval of New Start and Start of Detailed Design: Title I & II)					
A. Integrated/Detailed Project Schedules/Critical Path			X		
B. Design Calculations/Analysis		X			
4. Key Decision-3 to Key Decision-4 (Approval to Start Construction/Full Scale Development and Title III)					
A. Construction Coordination and Planning			X	X	
B. Procurement Coordination			X	X	X
C. Cost Plus Award Fee/Fixed Price Construction		X			X
5. Key Decision-4 Planning and Preparation for Acceptance/Operational Start-up and Pre-production for Commencement of Operations					
A. Perform Acceptance Testing			X		X
B. Final Safety Analysis Report			X		
C. Start-up Costs	X				

*ED&I (Engineering, Design and Inspection), PM (Project Management), CM (Construction Management), CC (Construction Contracts) do exist. A few are expert opinion questionnaires, weighting techniques, the Monte Carlo technique, industry-related "rules of thumb," and statistical studies.

Several studies have suggested that the amount of contingency required is usually a function of the maturity of design, the level of new technologies that are included in the project, the general complexity of the project (design, number of steps, number of objectives, length of the project, amount of money, etc.), the experience of the project personnel, the material(s) (exotic, volatile, unknown, difficult to locate, etc.) that will be used, status of agreement with regulators, how far into the future initiation of the project will be, political sensitivity, and funding availability.

5.8.4 Project Budget Process

The cost estimate is used as the basis for the project budget request. Budgeting for a project is a function of weighing many needs and requirements against availability of scarce resources. Therefore, the budget climate is a factor that the Project Manager must be cognizant of from the inception of a project. It is the Project Manager's responsibility to ensure that the design, estimating, review, and validation outputs that are essential inputs for budget requests are phased commensurate with the requirements of the budget cycles.

After the budget is approved and funds are received, the Project Manager must ensure that the funds are identified to the appropriate tasks and controlled to ensure completion of the project tasks within schedule. Five steps are involved in the budgeting process:

- define the discrete tasks to be performed
- determine how long it will take to complete each task
- determine the resources (personnel and financial) needed to complete the task in the pre-determined time frame
- prioritize the tasks according to funding needs and project importance
- allocate funds according to the prioritized task list

Definition of the discrete tasks to be performed should have been completed during the cost estimation phase. To determine the funding needs of each task, the Project Manager must determine the amount of time available to complete the task and then determine the effort (how many and what type of personnel) and materials costs for completing the task in the desired time. Once the cost factors of each task have been identified, the Project Manager and Project Team must examine the task list and decide how to allocate available project funds to best accomplish the project objectives. This means prioritizing the tasks by weighing task funding requirements against the importance of the task to the overall objective of the project. After prioritization, the Project Manager can set task accounts, allocate funds, and begin task execution.

5.9 ACTIVITY DATA SHEET

The Activity Data Sheet (ADS) is prepared at the installation level to show specific plans, milestones, funding, compliance requirements, human resources, and other pertinent information and is the responsibility of the appropriate Program Manager. The ADS contains descriptive information that identifies the activity or element of work to be conducted. It also identifies the regulatory and other drivers of the project or activity and indicates which is the primary driver. In addition, the ADS contains information pertaining to current funding levels and future requirements by fund-type, personhours, and proposed expenditures by driver categories such as agreements, regulatory requirements, or good management practices. It allows for identification of Priority 1 activities for expedited funding for those activities that address immediate risks to human health and safety and/or the environment. The ADS must contain specific information about the scope of the project, what has been accomplished to date, anticipated activities for the current and budget year, and outyear expectations of work to be performed. Careful description of project activities and the impacts of funding will require precise documentation in the various sections of the ADS. ADS impact statements include:

- the effects of funding levels on meeting legal requirements;

- environmental, safety, and health impacts of insufficient funding (i.e. risk drivers);

- any financial impact of project funding (i.e., increased cost due to schedule delay); and

- potential program benefits from insufficient funding (i.e., expected availability of a new technology or an anticipated less expensive way to approach the activity).

5.10 WORK BREAKDOWN STRUCTURE

Work Breakdown Structures are the cornerstone of effective project planning and execution. It is the structure and code that integrates and relates all project work (cost, schedule, and technical). All of the work contained in the WBS must be estimated, scheduled, and budgeted. Therefore, the WBS will contain the project's technical baselines necessary to achieve the technical objectives of the work described. The WBS is used as a management tool throughout the lifecycle of the project to identify and track specific work scopes. Once funding is received, the Project Manager (or Program Manager depending upon the level to which responsibility is delegated) will develop the WBS that will provide direct funds according to the schedule and needs of the tasks in the elements of the WBS. The WBS is a multi-level framework that organizes and graphically displays elements representing work to be accomplished in logical relationships. The Project Manager must structure the work into WBS elements that are:

- manageable - specific responsibility and authority that can be assigned,
- independent - minimum interface with or dependence on other ongoing elements,
- integrable - integrate with other elements to show the whole package, and
- measurable - can be used to measure progress of a project.

The relationships among WBS elements and detailed descriptions of each element are presented in the WBS dictionary which accompanies the hierarchical diagram. The WBS dictionary is a key project definition tool that defines the work scope for each element; documents assumptions about the work; includes deliverables, milestones, and quantities (if applicable), lists required resources and processes; and provides links to key technical design or engineering documents. Operation Offices often have standardized WBS dictionaries and coding to allow tracking of similar work.

For DOE projects, three types of WBSs are typically developed that correspond to different levels of responsibility. The three types must be compatible and integrated to show the relationship between the program, project, and contractors performing the work.

The Program WBS: This WBS starts at the DOE Headquarters or field office level and divides an entire DOE program into organization/ management elements or projects (e.g., EM Program WBS, Figure 5-7). Each organization (EM-30, EM-40, EM-50) has defined the levels of a programmatic WBS for their organizations.

The Project Summary WBS: This WBS summarizes an entire project and usually consists of three levels of project and work definition. It also serves as a starting point for contractors to develop their own contract-specific WBSs. The Project Summary WBS is the responsibility of the DOE project office. All the ADS information for a given Headquarters Program Office can be summarized in a report generated at this level.

The Contractor WBS: This WBS is developed by the individual contractors on a project according to the scope of the contract work. The contractor is responsible for extending the Project Summary WBS elements to create a Contractor WBS for DOE evaluation. The Contractor WBS should provide the basis for all management activities between the contractor and DOE; ensure agreement on cost, schedule, and scope; and serve as the basis for contractor accountability and reporting.

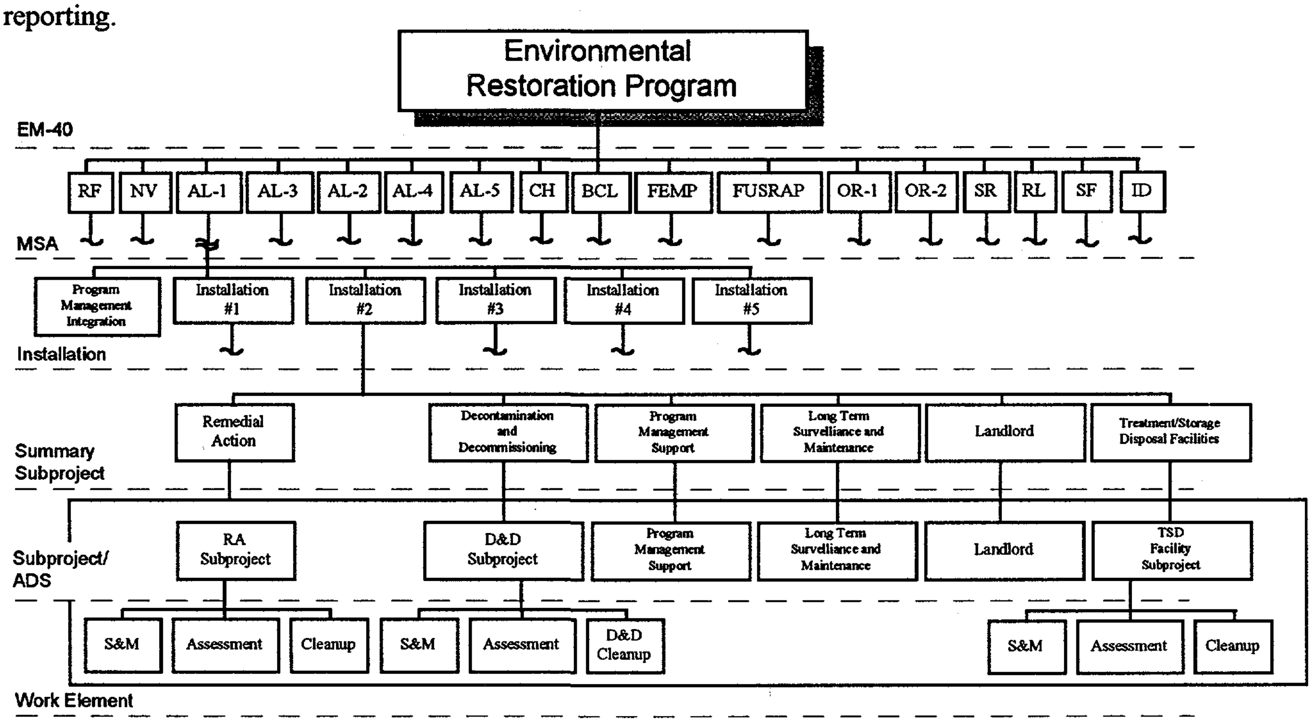


Figure 5-7. Example ER Program WBS.

The WBS can then be further used to develop a Responsibility Assignment Matrix (RAM), see Figure 5-8.

The RAM integrates each organizational component of the WBS with the responsible organization for performing the work. The result is a matrix that identifies the individual who is accountable for the work. Although the contractor produces this matrix, the DOE Project Manager can use it as a tool to ensure that an individual is responsible for each WBS element. The RAM can also serve as a warning of "resource overloading" if a single individual is given an unproportional amount of work. In addition, the RAM serves as a basis for developing cost accounts or control accounts.

DOE has applied the WBS hierarchial methodology to include project phases, key decision points, or various budgeting units of measure such as ADSs.

A critical tool for organizing work, building realistic cost and schedule estimates, and reporting/tracking/controlling, the WBS is developed and used for all projects and, in the Project Manager's case, is used for all programs.

WBS / Responsible Organization	Remedial Investigation Subproject A	Remedial Investigation Subproject B	Feasibility Study Subproject	RA Equipment	Remove Asbestos Subproject A
Project Management	C. Bates		C. Bates		
Environmental Engineering					L. Gary
Conceptual Design					
Procurement				J. Jones	
Risk Assessment		B. Smith			

Figure 5-8. Example Responsibility Assignment Matrix.

The *PTS Field Office Implementation Guidance Manual* gives a list of ADS elements. These elements can be added, deleted, or changed with the prior written approval of the program office. In addition, the Interagency Cost Estimating Group has developed a WBS to the fourth level for remedial action projects and a WBS to the third level for environmental restoration assessments and studies and project activities. Currently, these WBSs are available from the U.S. Corps of Engineers.

5.10.1 Developing a WBS

The Project Manager can use the WBS as a framework for defining and assigning work, estimating and scheduling, budgeting and costing, reporting progress, managing funds, and controlling changes in a project.

DOE and contractor managers have flexibility in developing WBSs to suit their objectives and systems for management, organization, and reporting. The Project Manager can categorize work into a WBS in several ways:

Function or skill (e.g., waste treatment, quality assurance, etc.)
Physical product (e.g., building, concrete pad, etc.)
Systems (e.g., utilities, cooling, etc.)
Phase (e.g., Preliminary Design, RI/FS, etc.)
Responsibility or organization (e.g., Subcontractor, Design Engineer, etc.)
Geographic area or location (e.g., 200 Area, Waste Area Grouping, Operable Unit, etc.)

Resource type (e.g., labor, materials, etc.)
Funding source (e.g., EM, Capital, etc.)

The WBS should also reflect other factors such as environmental, safety, and health compliance and quality assurance measures.

WBSs can be developed from top to bottom or from bottom to top. The top to bottom approach allows for fewer initial assumptions about the structure of the project, since it begins with identifying only the major project requirements or objectives as opposed to starting with the most detailed, lowest level work elements in the bottom to top approach. The Project Manager then brainstorms all other major project requirements, groups similar requirements, and breaks requirements down into smaller and more defined elements until a work scope, schedule, and cost can be assigned to each element. The number of levels needed in the WBS depends on the project size and complexity, technical uncertainty, organizational constraints, and contractor management's assessment of need. A good rule of thumb is to restrict the number of levels to only those necessary for effective project management with full definition of all required technical work; this is known as a "graded approach."

Each element of the WBS is assigned its own numerical code to identify it throughout the life of the project. The coding system is hierarchical and represents the logical connection between an element and lower level subordinate elements (e.g., 1.0, 1.1, 1.1.1, 1.1.2, 1.2, 1.2.1, etc.) All codes in a project WBS must be consistent with and traceable to WBSs at other responsibility levels. For instance, a Contractor WBS must be logically traceable to the Project Summary WBS.

For more information on developing WBSs, see the *DOE Work Breakdown Structure Guide* (1987).

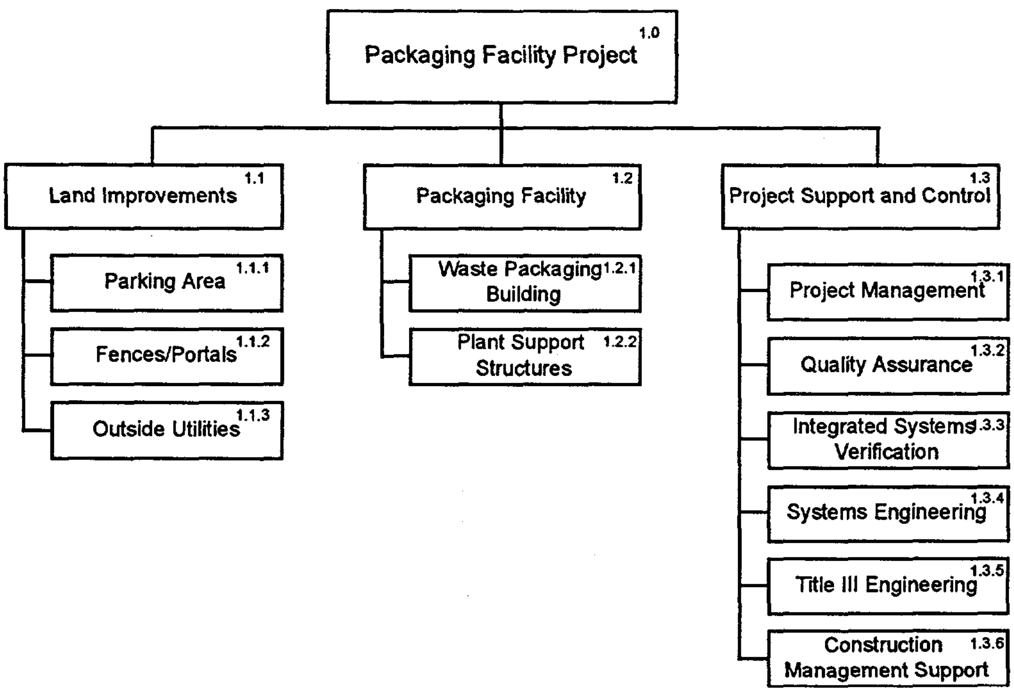
5.11 PROJECT PERFORMANCE MEASUREMENT

The importance, complexity, and cost of many DOE projects require the use of performance measurement techniques that promote highly effective planning, managing, and control. As discussed earlier in Section 5.6, Project Controls, the Project Manager is responsible for monitoring project performance through reports, regular meetings, and periodic reviews with all project participants. DOE does not impose any specific systems on the contractor, as these elements are normally inherent in the contractor's management control systems. The contractor is allowed maximum flexibility in determining how internal operations are to be conducted as long as the internal management control systems satisfy the needs of both the contractor and DOE for project performance information. Compliance with approved cost estimates and schedules is integral to proper project management and performance measurement.

CUSTOMER SATISFACTION IS A PRIMARY MEASURE OF PROJECT PERFORMANCE.

EXAMPLE 7: DEVELOPING A WORK BREAKDOWN STRUCTURE

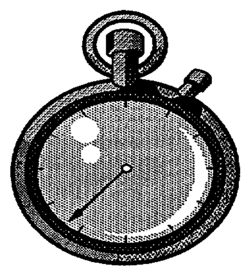
Project Description. To illustrate how a Project Manager might develop a WBS for a project, it is assumed that a radioactive waste packaging facility will be built at a DOE site. Participants in the project will include DOE, the site operating contractor, an architect-engineer (A&E), a construction management contractor, and various other contractors required to construct the facility. The sample WBS was created from the viewpoint of the site operating contractor Project Manager. The operating contractor will be responsible for making the necessary land improvements onsite, including providing parking, fencing, and controlled facility access and extending utilities to the new facility. The operating contractor will construct the facility and support structures by employing a construction management contractor who will manage all construction subcontracts to perform all construction and procurement of materials. The operating contractor will also furnish overall project support and control onsite (under the overall project management and approval of DOE). Project support and control activities include project management activities (scheduling, budgeting, reviewing design provided by the architect-engineer, managing project integration, etc.), quality assurance measures, integrated systems verification (demonstration tests, operational readiness tests, etc.), systems engineering studies, Title III engineering, and construction management support (serving as a link between construction contractors, the A&E, and DOE). An example of one approach to developing a project summary level WBS for this hypothetical project follows.



The project was broken out into three major sets of operating contractor tasks according to function: land improvements, facility construction, and activities to support and control the project. As mentioned previously in this example, there are many ways to organize work into a WBS. The Project Manager should choose a way that allows for the most effective project management.

In addition to cost and schedule performance criteria, project performance can be measured by other important standards such as customer satisfaction with the process or resulting product, technical accuracy of the process or product, regulatory compliance or non-compliance, and the generation of positive private sector interest in the process or product. In other words, **excellent performance ratings consist of more than completing the project on time and budget.**

EXCELLENT PERFORMANCE RATINGS CONSIST OF MORE THAN COMPLETING THE PROJECT ON TIME AND WITHIN BUDGET.



- Does the process or product work?
- How well does it work?
- Does it work like the customer wants it to work?
- Does it accomplish its goals while complying with all applicable regulations?
- Does the private sector want to learn more about the process or product?
- Is the private sector interested in investing in further development of the process or product?
- Are other customers for the process or product generated by the value of the completed project?

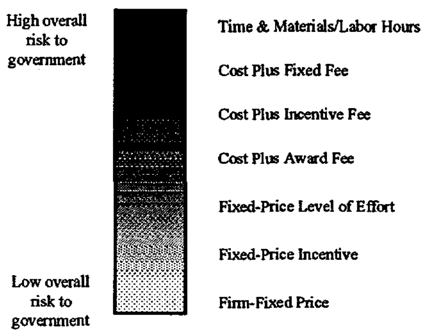
5.12 CONTRACTING STRATEGY

A contract is a binding legal relationship basically obligating the seller to furnish personal property or non-personal services (including construction) for which the buyer compensates. It includes all types of commitments that obligate the government to an expenditure of funds and which, except as otherwise authorized, are in writing. In addition to a two-signature document, it includes all transactions resulting from orders or task orders issued thereunder; letter contracts; letters of intent; and orders, such as purchase orders, under which the contract becomes effective by written acceptance or performance.

THE CONTRACTING STRATEGY CHOSEN BY THE PROJECT MANAGER SHOULD MINIMIZE RISK TO THE CONTRACTOR.

The type of contract selected is driven by the degree of project definition attained. As the Project Manager develops the project scope, the contracting mechanism should remain a key consideration. Contractors bidding on the work should be provided with the following information:

- background - a brief discussion of the regulatory and DOE requirements that drive the project and why the project exists.
- location - describe the project location, if applicable and of consequence. Indicate the site's proximity to major landmarks, water



bodies, water shed basins, population centers, roads, etc.

- history - provide a brief history of the site or development of the need for the project.

- current status - state if there are currently any regulatory constraints.

- previous actions - summarize all previous actions regarding the site, project objective, or situation driving the initiation of the project.

- objective - explicitly state what the contractor is being contracted to do.

- schedule - explicitly state what time constraints on project completion exist, their origin, and what penalties exist for not meeting the time constraints.

- detailed description of tasks - task descriptions should include but not be limited to all tasks, deliverables, meetings, and reports the contractor must create and provide to DOE to complete the work.

- special considerations - discuss submittals, the disclosure of information, and the confidentiality of written documents. Also address meeting minutes, correspondence, and monthly progress reports. The submittals section should describe the requirements for internal drafts, draft memos, final reports, technical reports, monthly reports, points of contact or reviewers, and cost reporting.

The contracting strategy should be selected carefully and based upon project knowledge and specific requirements identified in the project definition process. Base the selection of contract delivery arrangements on knowledge of the quantity.

Firm fixed-price - This contract establishes up front a fixed price or fixed-unit price for the delivery of supplies or services from the contractor; the price is not subject to adjustment. The firm fixed-price contract is perhaps the quickest, easiest, and least costly contract to award and administer as there are minimal contract award and administration requirements. It provides the greatest incentive to the contractor for producing the product or performing the work effectively and efficiently and for controlling costs because the risks associated with the cost of performance are assumed by the contractor. However, this type of contract necessitates the preparation of extremely detailed specifications and/or statements of work because that is the only means of control over contractor performance. The risk of paying a potentially higher cost than necessary is also a factor because the contractor will figure assumption of risk into the bid and there is no decrease in price if the actual cost to complete work is less than the fixed-price amount.

Fixed-price-award-fee - This contract is a firm fixed-price contract with an additional pool of money initially set aside for the contractor to earn during the contract performance period, provided performance is evaluated as better than satisfactory at the end of specific evaluation periods. This type of contract provides several advantages to the government. While being quick and easy to award, this contract provides the opportunity to evaluate actual performance and the conditions under which work is achieved. Such evaluations and subsequent awards can motivate the contractor to perform exceptionally. Furthermore, while the award fee evaluation criteria are subjective, the award fee evaluation and determination is unilateral, which the contractor cannot appeal. Among the disadvantages of employing this type of contract are the requirement of periodic evaluations of the contractor's work and the time, documentation, meetings, and administration associated with such evaluation. Moreover, when used in situations where significant uncertainty exists about the work, it may increase costs and create administrative burden through processing of change orders.

Fixed-price with economic price adjustment - This contract is a fixed-price contract that takes into account the possibility of significant changes in the prices of services or products during the life of the project. This type of contract allows for the benefits of the firm fixed-price contract with the added benefit of increased contractor satisfaction with the contract terms. Unfortunately, price adjustments may be tied to published price indices, which may or may not be correct and are subject to frequent change.

THE FIXED-PRICE-AWARD-FEE CONTRACT PROVIDES THE OPPORTUNITY TO EVALUATE ACTUAL PERFORMANCE AND CONDITIONS UNDER WHICH WORK IS ACHIEVED.

Fixed-price with incentive firm - This is a fixed-price contract that provides an incentive of more profit if the contractor can reduce the delivery time, reduce costs, and/or improve the product or service. This type of contract provides additional incentive to the contractor to conduct operations effectively and efficiently and manage costs. It discourages contractor inefficiencies and waste because the risks associated with the costs of performance are assumed by the contractor. In addition, there is no price increase if the actual cost to produce the product or perform the service exceeds that of the fixed-price amount. Unfortunately, this type of contract requires development, negotiations, and establishment of targets up front. It requires the existence, collection, and analysis of pricing information with which to establish these targets. These processes may necessitate special internal reviews and approvals. Furthermore, there is no decrease in price if the actual costs are less than the fixed-price amount.

Fixed-price level of effort - This is a contract that specifies a level of effort, usually as hours over a certain period of time, to be provided by the contractor for a fixed price; it is useful for work done over a long period. In addition, this type of contract is useful when work cannot be clearly defined as it provides flexibility to handle changes to work with ease. Fairly quick and easy to award and administer, the level of effort contract also provides opportunity to exert control over the direction of the work. However, payment is based on effort expended rather than results achieved; therefore, there is no incentive for the contractor to achieve the desired result which is to, operate efficiently and effectively and/or control costs.

Fixed-price contracts are certainly desirable. However, if there is uncertainty in the proposed project requirements, lean towards cost-reimbursement type or time and materials type of contracts with proven contractors. Since the degree of uncertainty inherent in the work dictates the contract type chosen, it is crucial to have a comprehensive project definition in place prior to initiating contracting activities. There are as many types of cost-reimbursement contracts as there are types of fixed-price contracts. A few more common examples of the cost-reimbursement contract include:

COST PLUS INCENTIVE FEE CONTRACTS REQUIRE CLOSE MONITORING OF CONTRACTOR WORK.

Cost plus incentive fee - This cost-reimbursement contract allows for a negotiated target cost, target fee, and minimum and maximum fees. This type of contract encourages the contractor to perform the work economically and efficiently and control costs. Total funding is not required up front because of the built in incremental funding option. Furthermore, there are statutory limits on the amount of fee that can be established. The cost plus incentive fee contract provides flexibility to handle changes and uncertainties in work plus the opportunity to exert increased control over the direction of work. However, there are a few drawbacks to using this type of contract. The cost plus incentive fee contract requires that the contractor's performance be closely monitored to ensure that efficient methods and effective cost controls are being employed. Contract award and administration effort costs are high because of contract award and administration requirements. Moreover, risk associated with the costs of performance are not assumed by the contractor.

Cost plus award fee - This type of cost-reimbursement contract provides a ceiling price based on the estimate to perform the work and a base or minimum fee and a reward or award fee. This type of contract motivates the contractor to perform exceptionally. Additional benefits to using the cost plus award fee contract are that evaluation criteria are subjective, fee evaluation and determination is unilateral and cannot be appealed by the contractor, and it provides an opportunity to evaluate actual performance and conditions under which it was achieved. This type of contract requires that written evaluations of the contractor's performance be conducted regularly and involves sizable contract award and administration efforts because of contract award and contractor performance monitoring and evaluation requirements.

Cost plus fixed fee - This cost-reimbursement contract consists of an estimated cost and a fixed amount of fee for the contractor. This type of contract also provides control over work direction while providing flexibility for handling changes in work scope. There is no requirement for all funding to be available up front because it can be incrementally funded. Furthermore, statutory limits exist on the amount of fee that can be established. This type of contract does have some disadvantages: the contractor's work must be closely monitored, the contractor has no incentive to effectively and efficiently conduct the work and control costs, risks associated with the cost of performance are not assumed by the contractor, and significant contract award and administration efforts exist due to procurement procedures and performance monitoring requirements.

Time and materials - This is a cost-reimbursement contract that provides for the reimbursement of actual labor hours at fixed unit price and materials costs. The advantages to time and materials contracts include increased control over the direction of work, increased flexibility to handle changes in work scope, option of incremental funding, and statutory limits on the amount of fee that can be provided. A few disadvantages are also associated with the time and materials contract. Major disadvantages include no incentive for the contractor to operate effectively and efficiently and control costs, no performance cost risk assumption by the contractor, the necessity to closely monitor the contractor's performance, and costly contract award and administration efforts.

IN COST PLUS AWARD FEE CONTRACTS, FEE EVALUATION AND DETERMINATION IS UNILATERAL AND CANNOT BE APPEALED BY THE CONTRACTOR.

Labor-hours - This cost-reimbursement contract provides for the reimbursement of all labor hours expended. Fixed hourly rates are established that include factors for overhead and profit.

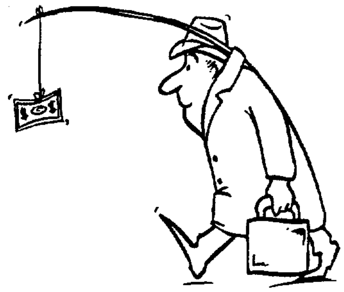
The advantages to labor-hour contracts include increased control over the direction of work, increased flexibility to handle changes in work scope, option of incremental funding, and statutory limits on the amount of fee that can be provided. Major disadvantages include no incentive for the contractor to operate effectively and efficiently and control costs, no performance cost risk assumption by the contractor, the necessity to closely monitor the contractor's performance, and costly contract award and administration efforts.

It is the PM's responsibility to try to minimize contract risk as much as possible. The best tool available to the PM is to have the contracting specialist directly involved in project planning. When inclusion of the contract specialist in project planning activities is not a viable option, a checklist can guide the PM while deciding the type of contract that should be employed.

5.12.1 Contract Incentives

As can be seen in the descriptions of some typical fixed-price and cost-reimbursement contracts, there are several incentive mechanisms that can be incorporated into contracts in an attempt to improve contractor performance. Although contracting itself is considered a process, the use and choice of contract incentives is dependent upon corporate culture. The Project Manager can be creative with incentives and has several proved incentives from which to choose. Examples of typical contract incentives include:

<u>Cost plus award fee</u> (usually used for extremely large projects) is when the contract is negotiated and performance evaluation criteria (PECs) are established. These criteria are used to review the contractor's work at pre-established evaluation periods. Typical PECs include Project Performance, Safety & Health, and Safeguards & Security, etc. PECs can be changed at the beginning of any evaluation period. This type of contract is extremely subjective.



<u>Incentive projects</u> are based on objective goals. For example, a contractor working on a 90-day contract will receive a predetermined fee. However, if the contractor completes all of the specified work within 50 days, the contractor will receive the predetermined fee plus X additional dollars. This type of contract incentive is used to encourage "fast-track" progress.

<u>Fixed-price incentive contracts</u> generally have two parts which make up the total contracted fee: the base fee and the award fee. The base fee is usually 50% of the total negotiated fee, and the award fee is the remaining 50%. Therefore, 50% of the negotiated total fee depends upon evaluation of contractor performance. While the entire total fee is technically in jeopardy in this type of contract, the most a contractor can usually lose is 50% of the base fee (or 25% of the total fee). The base fee on this type of contract is usually equal to the fixed fee in the firm fixed-price contract described in Section 5.12.

5.13 SUMMARY

Several processes augment the project definition process and influence its success; these processes include (but are not necessarily limited to) function analysis, project risk and control, work scope creation, maintenance and traceability, scheduling, cost estimating and budgeting, performance measurement, and contracting. This chapter provides general background on each of these processes and indicates the Project Manager's need to seek further information. Existing guidance has been cited where available.

CHAPTER 6
PROJECT DEFINITION: ENVIRONMENTAL RESTORATION

6.1 INTRODUCTION

SUCCESSFUL PROJECT DEFINITION ENSURES:

- *ACCELERATED ACTIVITY*
- *GRADED APPROACH TO UNCERTAINTY*
- *EARLY CONVERGENCE ON COURSE OF ACTION*

The Environmental Restoration (ER) project planning process is sufficiently flexible to allow for a proactive approach to process improvement. Changes in the placement and timing of certain project planning elements can improve the project definition process, enhancing its value and effectiveness for the ER program and producing well-defined, high quality, on-schedule and in-budget projects. Besides explaining changes in attitude and approach that can achieve improved project definition, this chapter explores the larger environment in which the project will exist and suggests planning at a level that will facilitate improved project definition and superior project performance regardless of the project type or process directive(s) followed.

6.2 APPROACH

A proactive and structured approach to the project definition process is best for eliminating cost and schedule overruns. In the early phases of project definition, scope changes can be incorporated with little impact (Figure 6-1). As a project moves from conceptual development to full project definition and ultimately to execution, scope changes can more significantly influence the total cost and schedule. When compared, it is less costly to change calculations than drawings and most certainly less costly than changing construction. It is imperative that the Project Manager strive to finalize as many decisions as possible while in the project definition phase. Clearly, an early and accelerated effort to obtain necessary environmental characterization data and technology related information is the best approach to improve project definition and minimize scope changes, cost overruns, and schedule slippages.

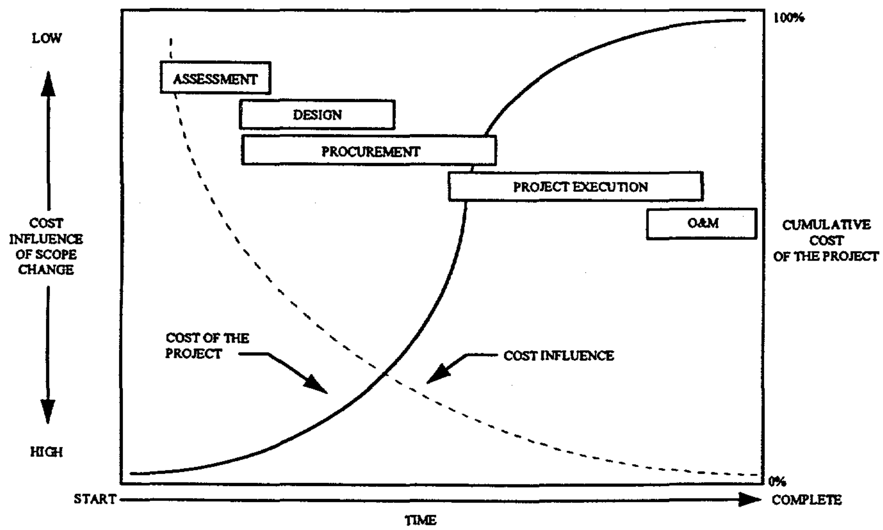


Figure 6-1. Effect of Scope Changes on Cost Over Project Lifestyle.

To ensure the success of the project definition process, project definition efforts must focus on achieving:

- enhanced emphasis on planning,
- a graded approach to recognizing and managing uncertainty,
- early stakeholder and regulator involvement, and
- early agreement on a course of action or remedy.

6.3 STRATEGIC PLANNING

INSTALLATION-WIDE PLANNING PROVIDES A SOUND FOUNDATION FOR SUCCESSFUL PROJECT DEFINITION

It cannot be overemphasized that foremost to any individual project planning effort is installation-wide or comprehensive master planning. It is from this type of strategic planning at the installation level that sound project definition flows. To ensure that accurate planning for a project can occur during the conceptual design phase, the facility should have previously implemented installation-wide screening analysis of all similar projects at the facility. Installation-wide planning includes a site-wide analysis of relevant current and historical data, site-wide health risk assessments, identification of the most likely courses of action, development of presumptive remedies, and site-wide cost estimates. These activities will give the Program Manager the ability to prioritize the projects according to risk and cost. **Without knowledge of these aspects, the conceptual design cannot accurately present the mission need and project justification.**

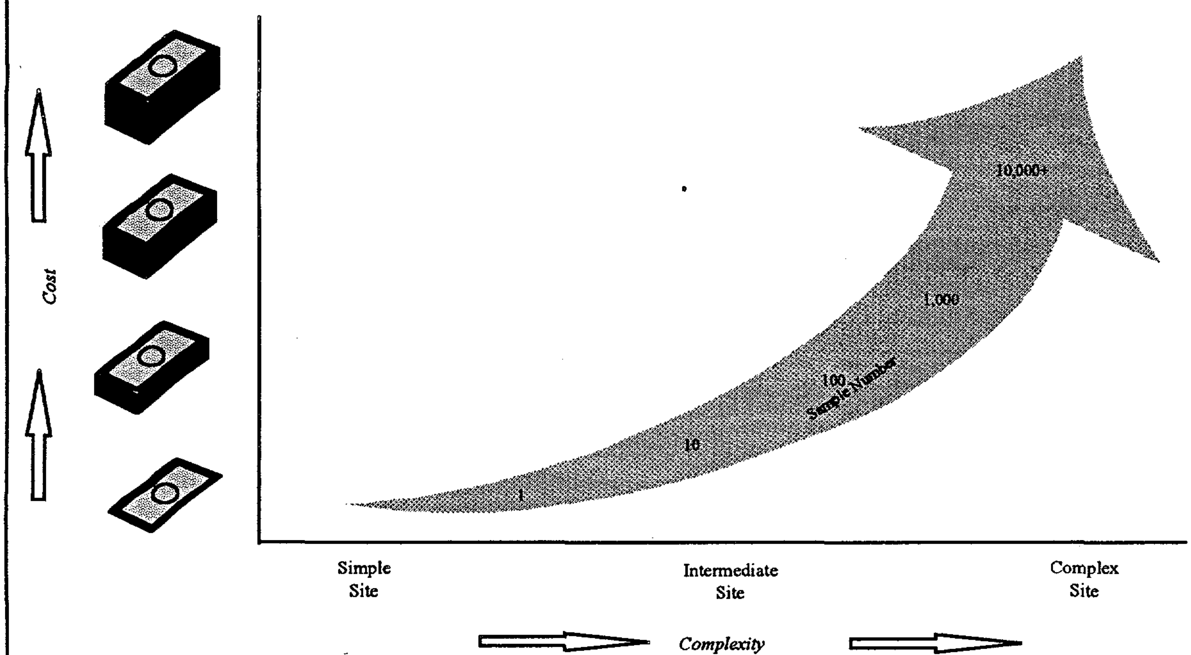
Information obtained from the installation-wide planning will enable fast-tracking of all approved projects by making available much of the data required for the development of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection (SI) and Remedial Investigation (RI) reports. Installation-wide planning will also facilitate the use of a graded approach to project definition and early convergence and concurrance on a course of action.

6.4 GRADED APPROACH

TAKE A GRADED APPROACH TO MANAGING UNCERTAINTY

The key to the graded approach is to determine the acceptable level of knowledge necessary for making project definition decisions appropriate for the size, complexity, and risk of the project. The goal of a graded approach to ER projects is not to fully understand the nature and extent of every problem but to establish the boundary of probable conditions. A graded approach (Figure 6-2) requires an understanding and quantification of the level of information necessary to make a decision. The determination of key decision points and the information necessary to make these decisions should begin upon project conception, include the input of key stakeholders (especially regulators), and be in place before data collection is complete.

By performing only the amount of project definition necessary to



Source: United States Air Force. USAF Installation Restoration Program Remedial Project Manager's Handbook. December 1993

Figure 6-2. Graded Approach to Site Characterization.

successfully complete and control a project based on its complexity (i.e., by taking a graded approach to project definition), project planners can achieve cost and schedule savings as well as ensure the most efficient use of DOE resources. Graded approach principles should be applied during all phases of the process as outlined in Chapter 4 and used while making project decisions. The more uncertainty (thus greater risk) associated with a project, the greater the characterization information and control requirements. By establishing the quality and quantity of data required for decision-making by linking data collection with problem resolution prior to data-gathering efforts, project planners can create time and cost savings while maintaining a high probability of project success.

The Project Manager must assume ultimate responsibility for determining the appropriate level of knowledge necessary for sound project definition and for justifying the choice to upper management and other concerned parties.

6.5 PRESUMPTIVE REMEDIES

Accurate, efficient planning and project tracking can be streamlined and supported by the development of presumptive remedies. In evaluating potential remedial alternatives, presumptive remedies are those proven solutions commonly used on particular types of media and contamination. To promote Project Managers using this type of management approach, installations at the ER program level can evaluate and group potential remedies for similar sites that permanently

REGULATORS MUST BE INFORMED EARLY OF PROBLEMS AND POSSIBLE SOLUTIONS.

and significantly reduce the threat to public health, welfare, and the environment. While selecting technology groupings, careful consideration should be given to the technology's short- and long-term effectiveness, ease of implementation, ability to be modified with changing conditions, and cost. Project Managers can then focus their remediation approach and project planning system evaluation process for each technology.

6.6 EARLY CONVERGENCE ON A COURSE OF ACTION

Early, consistent, and continual regulator and stakeholder input is essential to improving the project definition process by fast-tracking the process for ER projects to complete full project definition before the Record of Decision (ROD) or well in advance of formal approval to commence project execution. Early stakeholder/regulator involvement allows for consensus on a course of action prior to development of engineering plans or project execution plans. This not only minimizes work conducted on unnecessary options but mitigates the potential for schedule delays caused by rework or backtracking should the groups disagree with or reject the work traditionally presented to them only after its completion. The earlier regulators are involved with and informed of a project's direction the less likely they will be to object to any decisions, and earlier planning efforts can be focused. Regulator and stakeholder acceptance can also be promoted by obtaining "buy-in" on presumptive remedies (Section 6.5). Regulator and community concurrence is cultivated by involving stakeholders and regulators in the earliest stages of project development, thereby creating a sense of project ownership.

Communication with all major regulatory bodies that might affect the project is encouraged throughout the project definition process and should begin upon project need identification to help project planners anticipate new regulations that could be promulgated during the lifecycle of the project.

The Project Manager should act as a champion for stakeholder and regulatory involvement, pointing out the need for and benefits of such communication, not only to the Project Team and senior management but to the community and regulators. Mechanisms the Project Manager may employ to encourage and ensure regulator and stakeholder involvement are outlined in Chapter 3, Section 3.1. The Project Manager should also function as a facilitator and, if necessary, translator to ensure the effectiveness of stakeholder/Project Team cummunication.

6.7 REARRANGEMENT OF TRADITIONAL PROCESSES

In an effort to reduce the amount of resources (time, cost, personnel, etc.) used to evaluate unnecessary options and alternatives and ensure that accurate technical, cost, and schedule baselines are finalized before the ROD, the Project Manager can consider rearranging the traditional EPA CERCLA process. This requires an innovative and proactive approach by the Project Manager so that regulatory and community buy-in is achieved early-on and project planning actions, including design effort can be streamlined.

The goal of the improved project definition process for ER projects is to have sufficient engineering design and/or remedial design finalized prior to the ROD so that justifiable, accurate baselines are established. Meeting this goal will decrease scope, schedule, and cost changes due to insufficient data; stakeholder reservations; complications in design completion; or material, labor, and equipment identification and acquisition delays. Traditionally, an alternative remediation action is not selected until the latter stages of the FS, and design of that alternative is not initiated until after the ROD is approved (leaving 15 months for NPL sites to implement the approved Remedial Action). To accommodate the project definition process goals and give the Project Manager adequate time to develop a Remedial Design, the Project Manager would have to shift the following elements into an earlier phase of project planning:

- Identify the most probable remediation alternative for the site based on characterization information obtained and any installation presumptive remedies

- Reach a consensus on an alternative among the stakeholders, community, regulators, and Project Team

- Identify risks and associated strategies for contingencies

- Institute engineering and design efforts (conceptual and preliminary) prior to creating baselines at the ROD

An added benefit of this rearrangement is that the Project Manager has sufficient time to conduct careful planning of regulatory milestones and focus resources on achieving them. How much earlier in the CERCLA process the Project Manager can move these activities should be based on the complexity of the site, historical information, and relative project risk. In other words, the Project Manager should institute the graded approach when determining if the project can be accelerated.

It cannot be overstated that the ability of the Project Manager to conduct work on this accelerated schedule depends upon the regulatory environment he or she works in. The more proactive the Project Manager is on initiating stakeholder involvement early in the planning process, the greater the possibility he or she can accelerate the process. If the Project Manager has succeeded in this type of accelerated effort, he or she should communicate this to other Project Managers in the ER program so that they can **capitalize on the experience of success.**

6.8 PROCESS INTEGRATION

INTEGRATION OF DOE DIRECTIVES WITH SIMILAR INTENT WILL INCREASE EFFICIENCY

ER projects are at times required to follow criteria from multiple sets of directives, such as DOE Order 4700.1 Project Management System (PMS) and CERCLA or RCRA. These directives contain sequential steps of informational development that follow the broad components of project definition: conceptual development, preliminary project definition, and full project definition. However, they often require different documentation and are performed at different times in the process. Nevertheless, since the elements of the directives share similar intent, integration into a fundamental project definition process can be achieved.

Common to all of these directives is the concept of key, or critical, decision points, at which a decision is made to proceed to the next step, to stop (no further action), or to return to an earlier step to obtain additional and necessary information/data. The Project Manager must know when these milestones are scheduled and ensure all informational requirements necessary to make the decision have been addressed.

6.8.1 Approach

To facilitate the integration of multiple directives into one project definition process, Project Managers should conduct the following activities at the initiation of each new project:

SUCCESSFUL PROJECT COMPLETION RESULTS IN CUSTOMER SATISFACTION

- Map out and define the specific products that must be developed under each directive
- Consider, within the framework of the project development process, those products of each directive that require similar information
- Propose to focus the project effort by combining required products with supplemental information to meet DOE project definition specifications
- Identify potential problems that may impact project development and establish mitigation plans or strategies for contingency

Effective integration of applicable directives produces the immediate benefits of eliminating duplication of effort, reduces required documentation, and enhances project definition by delineating and coordinating the elements of all relevant directives in the early stages of project development. Early identification of potential "pitfalls" allows for pre-planning to mitigate or avoid those pitfalls.

6.9 SUMMARY

Project definition that is formulated with consideration of the previously discussed factors should result in an ER project that is defined only to the extent necessary for successful project completion, thereby reducing cost and saving resources. Successful project completion is defined as a project that is completed on time and within budget; satisfies regulatory requirements; conforms to or exceeds technical codes, standards, or requirements; and greatly satisfies the customer. Formulation of the project definition without information obtained from previous installation-wide planning, a graded approach to recognizing and managing uncertainty, early and sustained stakeholder/regulator involvement, and early consensus on course of action to be pursued will likely lead to significant scope changes over the lifecycle of the ER project, producing cost and schedule overruns.

CHAPTER 7
PROJECT DEFINITION: WASTE MANAGEMENT

7.1 INTRODUCTION

Waste Management (WM) projects follow the explicit guidelines, approval points, and documentation requirements outlined in DOE Order 4700.1, the Project Management System (PMS). The project definition process outlined in this handbook is an integral and strategic part of planning during the initial phases of the PMS process, and recognition of where the key elements occur relative to the PMS process is essential. As a result of funding approvals necessary to proceed with projects following the 4700.1 guidelines, WM project definition departs from the process defined in the balance of the handbook (Figure 7-1). Following this handbook's project definition process as much as possible will not only enhance the documentation and early planning of WM projects but will aid in ensuring successful project execution. This chapter is intended to provide the reader with general information on the phases of the PMS process that encompass project definition and some practical, feasible actions that can be implemented towards WM project planning process improvement which will create more accurate, reliable baselines.

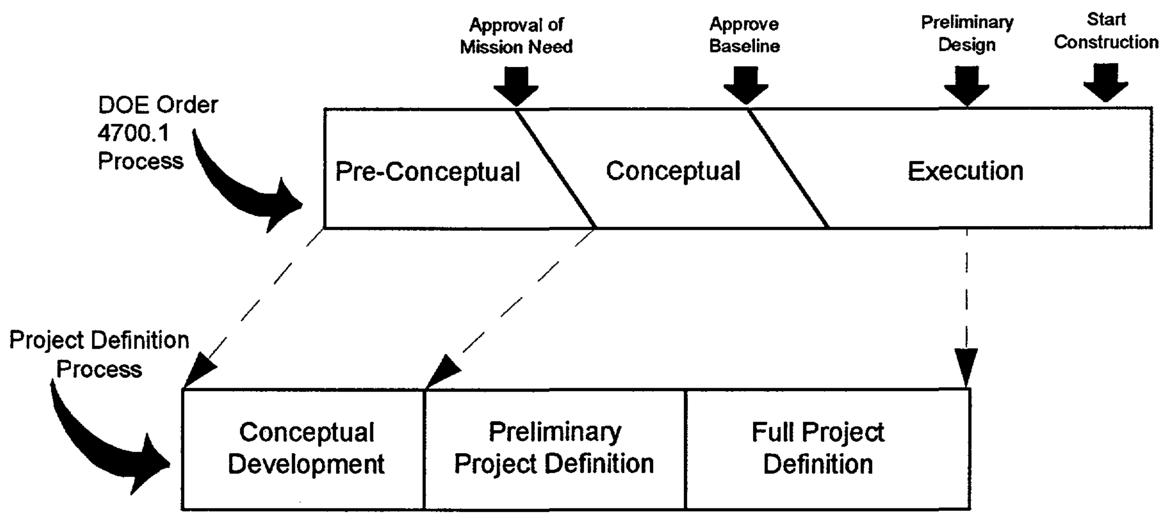


Figure 7-1. Process Comparison.

7.2 WM PROJECT DEFINITION PROCESS

The traditional PMS project planning and implementation process consists of six phases and four key decision points. The first two phases, Pre-conceptual and Conceptual, and the development of the preliminary design during the Execution Phase encompass those elements critical to the formation of project definition. For WM projects, the phases must always occur in this sequence, with the approval and funding to commence the next phase dependent upon successful completion of the previous phase (Figure 7-2). Flexibility in start dates and funding allocations is limited in WM projects as compared to other types of projects, such as environmental restoration, as a result of these Critical Decision points. Critical Decisions in the PMS process are made at the conclusion of each project phase and define and delineate project development during each subsequent phase. The activities conducted in each phase and the placement and nature of the critical decision points are discussed in the following sections.

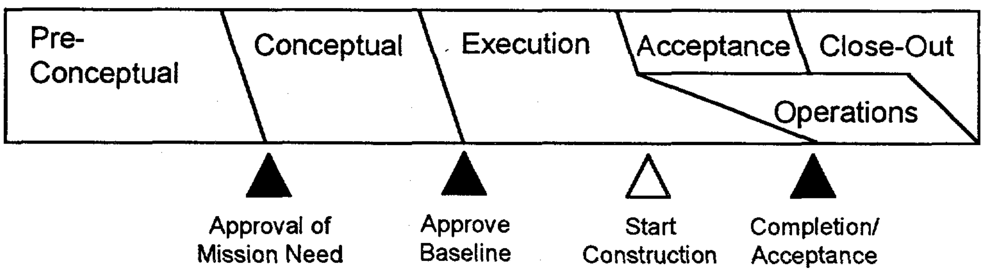


Figure 7-2. Project Management System Process.

7.2.1 Pre-conceptual Phase

The first phase of PMS project planning is the Pre-conceptual Phase. This phase includes those activities outlined in the Conceptual Development Phase of the project definition process (Chapter 4) that occur prior to the formal start of a project such as the identification of mission need and a preliminary evaluation of the project. Once a need or opportunity to support a program or DOE mission is identified, project planners must develop specific Justification of Mission Need documentation that:

- defines the mission need;
- relates the mission need to the DOE strategic plan and the program mission;
- identifies the preliminary functional requirements;
- establishes a preliminary schedule of milestones for the project, denoting the desired start date for fiscal year funding;
- provides a rough estimate of total project costs, including specific estimated costs for the Conceptual Phase;
- describes the preliminary risk assessment for the project and the basis for the assessment;

- provides a preliminary environmental evaluation of the project including waste minimization issues; and

- explains the anticipated results and benefits to be gained from the project.

The Approval of Mission Need is normally made at the program office level after Pre-conceptual activities to justify the project are executed. These activities and others identified in Chapter 4 will complete the Conceptual Development Phase of Project Definition and the Pre-conceptual Phase of the PMS process.

THE PROJECT MANAGER MUST ENSURE SUFFICIENT DESIGN HAS BEEN ACCOMPLISHED TO SUBMIT AN ACCURATE BASELINE

7.2.2 Conceptual Phase

The Conceptual Phase of the PMS process is mainly an enhancement of the elements described during the Pre-Conceptual Phase and commences once mission need and funding are approved. This phase requires a firm identification of necessary resources and project functional and physical requirements from which realistic work scope and technical, schedule, and cost estimates will be developed. It also includes the initial preparation of the project planning documentation.

The first action during the Conceptual Phase is the appointment of a Project Manager (for a discussion of the Project Manager's role and responsibilities, see Chapter 2, Section 2.1.2). The Project Manager oversees the activities and gathering of information which will enable the completion of two key planning documents: the Project Execution Plan (PEP) and the Conceptual Design Report (CDR). It is from all information and planning developed in the PEP and CDR that the technical, cost, and schedule baselines are established and submitted to Congress for approval. These two documents, however, are a detailed analysis and listing of the project's function requirements. The CDR typically does not contain more than 8% design. The result is that baselines are set earlier in the PMS process than what is recommended in the standard project definition process.

To avoid inaccurate baselines, the Project Manager must ensure that sufficient design and definition has been accomplished during the Pre-conceptual and Conceptual phases and documented in the CDR so that an accurate baseline can be approved and submitted to Congress (the project definition process recommends 30% complete). **It is imperative that the CDR and work conducted to support it are accurate, comprehensive, and detailed to create and support the baseline establishment.**

It is important that the program support the project development process through institutional and strategic planning at the site level. Proposing too many projects, with no budget to support them, wastes valuable time and resources. The development of structured, quality CDRs for only those projects commensurate with the program's strategic plan priorities and forecasted budget capabilities gives the Project Manager the ability to invest the resources necessary to accomplish the level of design required for accurate baseline establishment. These baselines for the project will be the basis for measuring the progress of the project and the effectiveness of the management system.

7.2.3 Execution Phase

During the Execution Phase, the project progresses from a concept to a detailed design and subsequently to the desired end product. During this period, preliminary and detailed designs are created and construction actions are completed. The first step in the Execution Phase is the commencement of preliminary design, the equivalent of Title I development. It is this step in the PMS Execution Phase which departs from the recommended project definition process described in this handbook. To resolve this, the Project Manager may consider producing an enhanced CDR which contains more design than traditionally has been conducted. This is not a viable opportunity in all cases, but the Project Manager should recognize that preliminary design is still part of the project definition process.

7.3 PROCESS IMPROVEMENTS

When the traditional PMS project planning and implementation process is placed alongside the basic project definition process outlined in Chapter 4 (Figure 7-1), it becomes apparent that there are two significant differences: funds are not released to commence preliminary design activities until after baselines are set and stakeholder involvement is not required to be initiated at the onset of project planning. While changes to the PMS process are indeed limited by funding realities, planning efforts that are feasible and practical can be initiated which will improve the required PMS process and generate a well-defined project.

7.3.1 Stakeholder Involvement

While the funding schedule associated with the PMS project planning process eliminates any opportunity for pursuing early convergence upon a course of action as recommended for ER projects in Chapter 6, the opportunity still exists to increase effectiveness and decrease delays through earlier stakeholder involvement. The Conceptual Phase of the PMS process includes initiated communications with community and stakeholders and incorporating their input where acceptable, which is a phase later than what is recommended in the basic project definition process (see Chapter 4, Section 4.2.8). The basic project definition process indicates that stakeholder involvement should be initiated as early in the process as possible to increase the effectiveness of early project planning and decrease the possibility of regulator and stakeholder conflict further into the project. To reap the benefits of intense stakeholder involvement, community and stakeholder input should be sought during the Pre-conceptual Phase of the PMS process. Once an idea is formed, stakeholder identification and involvement should be immediate. Movement of stakeholder identification and involvement to the Pre-conceptual phase will result in the ability to develop a stronger argument for Approval of Mission Need (Critical Decision 1) and decrease the chances of reworking schedule, scope, and cost estimates due to stakeholder disagreement.

7.3.2 Design Development

The second and most significant opportunity for process improvement lies in the timing of the preliminary design. Since money is not released for design development until after the PEP and CDR are submitted and baselines are set, project performance is measured against baselines that were established with limited design. The basic project definition process mitigates this risk by initiating preliminary design prior to baseline approval and using information obtained from this design to inform baseline estimates.

Although the WM funding cycle precludes formal design development prior to baseline approval, the WM process can be improved through the enhancement of the CDR, formulated in the Conceptual Phase to include sufficient design and enough information to ensure that proposed baselines are acceptable, viable, realistic, and achievable given project goals and available technology. By expending programmatic resources to do this minimal level of design up front, savings in time and money can be expected during the Execution Phase due to decreased cost overruns and schedule slippage.

7.4 SUMMARY

The preceding text illustrates that even the most restrictive project planning process can benefit from application of the basic project definition process outlined in Chapter 4. These benefits can be obtained while working within the existing framework and do not require major process restructuring; therefore, it can be applied without delay and produce immediate results.

CHAPTER 8
PROJECT DEFINITION: FACILITY TRANSITION

8.1 INTRODUCTION

Deactivation projects are a collection of activities at a surplus facility that are developed and initiated to reduce the associated hazards, risks, and costs until the facilities are ready for decontamination and final disposition. The primary mission of projects conducted through the Office of Facility Transition and Management (EM-60) is to deactivate these surplus facilities in the most timely, cost effective, safe, and fiscally responsible manner. Consequently, EM-60 has developed a deactivation project process that is dynamic, flexible, responsive to lessons learned, and structured to incorporate those crucial aspects of project definition, thereby meeting these objectives presented in Chapter 1. Following the EM-60 guidance and incorporating the project definition elements presented in this handbook during the "initial planning" phases will provide a method for determining realistic schedules and costs and strengthen the overall deactivation effort throughout DOE. As each deactivation project presents unique challenges and its own programmatic need, the EM-60 project planning approach provides managers with a common reference system for viewing, planning, and conducting deactivation activities.

THE DEACTIVATION PROJECT PROCESS IS DYNAMIC AND FLEXIBLE AND IS USED TO DEACTIVATE SURPLUS FACILITIES IN A TIMELY, COST EFFECTIVE, SAFE, AND RESPONSIBLE MANNER

8.2 FACILITY TRANSITION PROCESS

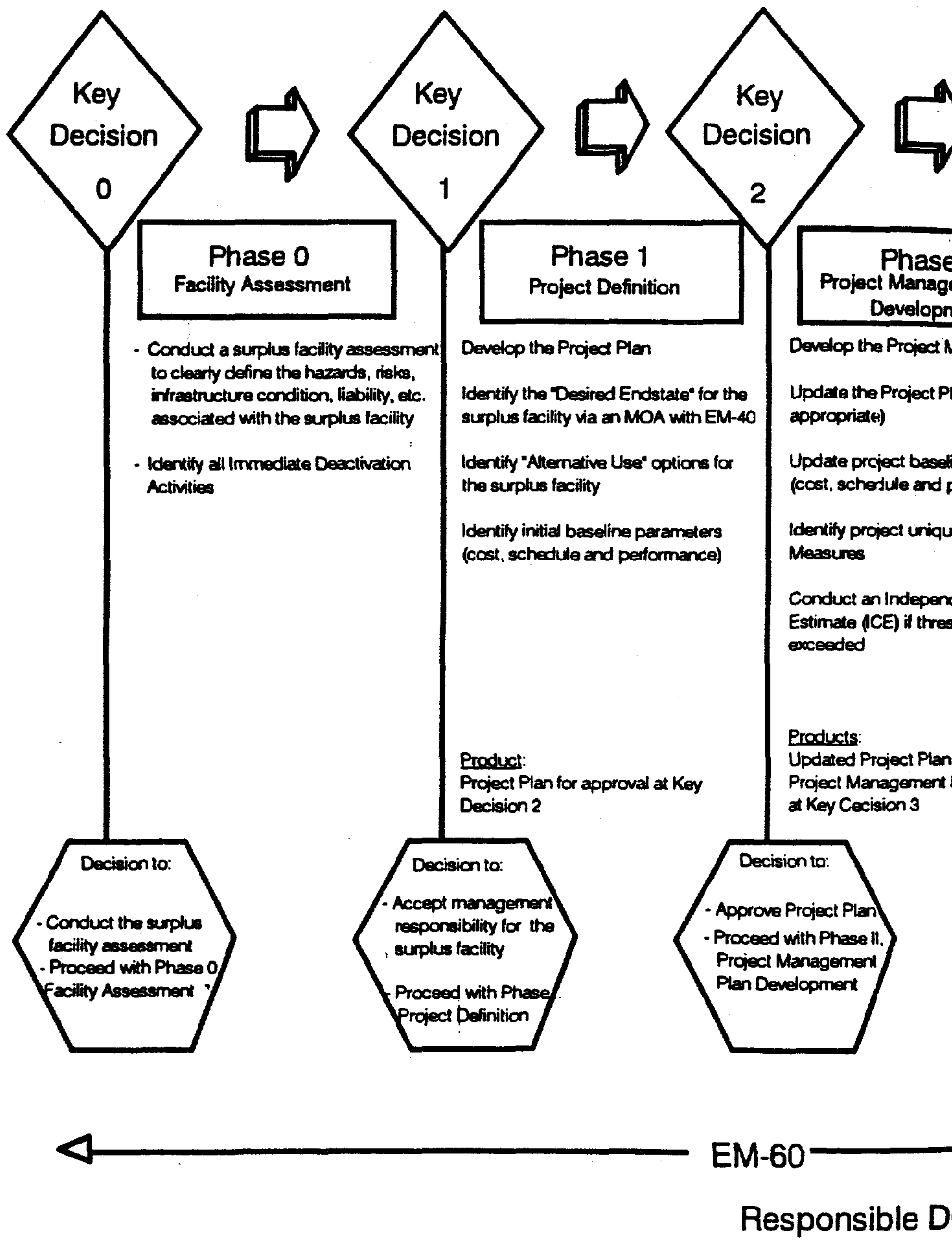
The deactivation process outlined in this chapter is a streamlined management approach for deactivating surplus facilities and is divided into five phases of project management. Figure 8.1 provides a detailed illustration of the deactivation process presenting how the phases are structured to support the "real world" needs associated with this type of project. The project definition process as outlined in this handbook is parallel to and should be considered part of the first three phases of the EM-60 process: facility assessment, project definition, and project management development.

The overall deactivation project process was created to employ the following key project management elements:

1) Mutually supporting responsibilities for Headquarters and Field organizations for planning, managing, and conducting deactivation activities

2) Auditable records of key programmatic decisions and issues are produced

EM-60 Deactivation Proj



t / Baseline Development Process

DRAFT

Key Decision 3

Key Decision 4

Key Decision 5

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Phase 3
Project Execution

Execute project in accordance with:
Project Plan
Project Management Plan

Monitor project progress and adherence to established plans. Monitoring will include comparison of project progress against the approved project baselines. Use of PTS with variance analysis (cost, schedule and performance) will be employed.

Title III services (if necessary)

Product:
Deactivated facility with minimum Surveillance & Maintenance costs

Facility will be placed in a "Deactivated State" at Key Decision 4

Phase 4
"Deactivated Site"

Maintain facility as "Deactivated Site" (i.e., cheap to keep) until final disposition is identified.

Surveillance & Maintenance costs have been reduced to minimum appropriate levels.

Final disposition may be transfer to EM-40 for D&D, or retention in the deactivated state for an undetermined time period.

Phase 5
Decontamination & Decommissioning

- Decontamination & Decommissioning conducted in accordance with EM-40 plans

Decision to:
- Update the Project Plan
- Approve the Project Management Plan
- Proceed to Phase III "Project Execution"

Decision to:
- Maintain facility in a "Deactivated State" until final disposition is identified

Decision to:
Transfer management responsibility for the deactivated facility to EM-40

EM-40

E Headquarters Office

September 29, 1994

3) Clear, quantifiable measures of project performance are established, measured, monitored, and used in the project management decision-making process

As in the DOE 4700.1 PMS process that was used as a model for the process, the EM-60 process has decision points, Key Decisions, at the end of each phase to review past performance, assess future and planned activities, and provide formal management approval to proceed with the expenditure of resources. These Key Decisions are documented in the Key Decision Memorandum which is intended to formally record and communicate major decisions made during the Key Decision process. These Key Decisions combined with the project phases provide a logical method to progressively identify, define, and carryout deactivation activities with the depth and scope of the activities occurring in each phase to be tailored and determined on a project-by-project basis by the Project Manager. As a minimum, however, the Project Manager must ensure the following core elements are included as part of the deactivation process:

KEY DECISIONS ASSIST WITH REVIEWING PAST PERFORMANCE AND ASSESSING FUTURE AND PLANNED ACTIVITIES.

- Key decisions and deactivation phases
- Projected dates for each key decision
- Total project cost in the form of a funding profile identifying yearly budget and reporting code estimates for the life of a project
- Individual project performance measures including an earned value determination system required by the EM-60 process
- Formally defined "desired endstate" that must be approved by the Key Decision Authority

An outline of the activities, which encompass the project definition process and the placement and nature of the critical decision points, conducted in each phase is discussed in the following sections.

8.2.1 Phase 0: Facility Assessment

The first phase of the facility transition process commences after the approval of Key Decision 0 is granted. This initial Key Decision ensures that any following actions and activities will adequately identify the facility for the purpose of developing and defining a deactivation project. Some of the items that must be clearly understood before a deactivation project can be defined in Phase 1 include location of the facility boundaries; the number of buildings comprising the facility; descriptions of the types of operations and/or processes that took place at the facility including specific dates, the materials that were used, the types of waste that were generated; and the types of potential contamination. Key Decision 0 marks the initial, formal interaction between the Office of Facility Transition and Management (EM-60) and the owner of the transferring surplus facility.

The Project Manager must use his resources during Phase 0 to conduct a Surplus Facility Assessment that will formally assess the present condition, risks, hazards, and liabilities of the facility. Specifically, the Project Manager must ensure the following actions are accomplished to determine the scope of the surplus facility deactivation effort:

- Identification of the existing infrastructure condition, hazards, risks, and liabilities associated with the facility
- Review of historical information on unusual occurrence reports including information relative to leaks, spills, or inadvertent releases
- Review of contamination survey records, maintenance records, and supplemental material that might include test, drawings, specifications, and maps showing geographic boundaries, elevations, and supporting ancillary facilities
- Interview former employees to gain further historical information regarding the facility

8.2.2 Phase 1: Deactivation Project Definition

ACTIVITIES FOR INCLUSION IN THE PROJECT PLAN CHECKLIST ARE IDENTIFIED IN THE PHASE I PROJECT PLAN.

Although the EM-60 process has identified this phase alone as project definition, it corresponds to only one phase (preliminary project definition) of the three phases in the basic project definition process described in this handbook. The Project Manager must be aware that information gathered during the phases preceding this phase are also critical to and part of the project definition process; the accuracy, detail, and depth of the information provided in these phases will be instrumental to executing a successful project. Phase 1 of the deactivation process requires gathering information that will provide a clear understanding and definition of the future deactivation project. Work conducted toward accomplishing this effort can only be commenced after approval from Key Decision 1 is granted. This decision point ensures that the risks, hazards, and liabilities associated with the facility were sufficiently addressed in the Surplus Facility Assessment. During the Key Decision 1 meeting, activities that must be included in the Phase 1 Project Plan are identified and documented for inclusion in the Project Plan Checklist. Some actions and activities that may be appropriate for this list include:

- NEPA activities
- Worker considerations

- Contracting strategies
- Strategy for early stakeholder involvement
- Surveillance and maintenance reduction goals
- S/RIDs considerations
- Cost analysis and independent cost estimates
- Programmatic risk considerations
- Special regulatory considerations

Once this checklist is developed and approval is received to commence Phase 1 work, activities should be scheduled by the Project Manager to accomplish the following:

- Development of a Facility Endstate Determination that clearly defines the objectives of the deactivation project to be structured
- Identification of all feasible alternatives and their incorporation in the Project Plan
- Development of the Project Plan
- Development of baseline objectives for cost, schedule, and performance
- Evaluation of the project's funding and schedule baseline objectives with Headquarter's plan for further year budget resources to accomplish an affordability assessment

8.2.3 Phase 2: Deactivation Project Management Plan Development

The information documented in the Project Plan is reviewed during Key Decision 2 to confirm that development of the Deactivation Project Management Plan starts with the best possible definition of the future deactivation project. Once approval from the Key Decision Authorities is granted, the Project Manager must schedule activities appropriately to accomplish the development of the Deactivation Project Management Plan based on the information outlined and presented in the Deactivation Project Plan. The Project Management Plan provides the details of the project organization, activities comprising the project, management organization and responsibilities, a work breakdown structure, and a critical path schedule. At this time, project baseline information should be updated with more detailed cost, schedule, and performance information. The performance measures established by the Project

Manager must be compatible with the current EM-60 Performance Plan and incorporate the use of an earned value system. The earned value system management technique will enhance the Project Manager's ability to maintain a greater level of control and visibility of the project. When baselines are established and performance measures are generated, the project definition of the deactivation project is completed and ready for execution.

8.3 EARNED VALUE PRINCIPLE

A major element of the Deactivation Project Management approach is the use of an Earned Value System. Earned Value is a widely-accepted management technique to enhance the Project Manager's ability to maintain a greater level of control and visibility of the project. The critical informational elements of an earned value system are:

EARNED VALUE IS A WIDELY-USED MANAGEMENT TECHNIQUE

1) **Budgeted Cost of Work Schedule (BCWS)** - This is simply the amount of resources, usually a dollar figure, that is expected to be consumed to accomplish a specific task. The BCWS is also known as a "spending plan" or "cost estimate" and as such has been a standard part of project management for some time. By integrating the BCWS into the Earned Value System, the emphasis is placed on achieving the closest possible correlation between the scope of work to be completed against the amount of resources actually required.

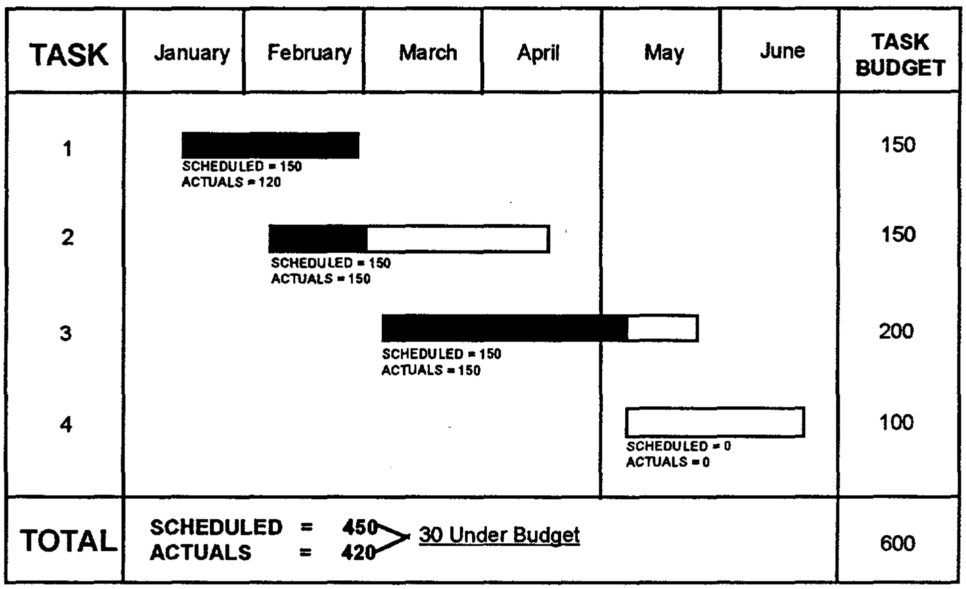
2) **Actual Cost of Work Performed (ACWP)** - The ACWP is the amount of resources, again usually a dollar figure, that was expended in accomplishing a specific task. The ACWP has also been known as the actual or incurred cost or "actuals" and has also been a long-standing project management tool. With integration of the ACWP into the Earned Value System, the emphasis is placed on coordinating the expenditure of resources to the scope of work and the two being completed at the same time.

3) **Budgeted Cost of Work (BCWP)** - The BCWP is the amount of work actually accomplished, stated in terms of a percent of the budget assigned to that specific task. The work accomplished is converted to a "dollarized" data element and becomes the focal point of all status and analysis activities that follow. The BCWP is the only new data element required when working with the Earned Value approach.

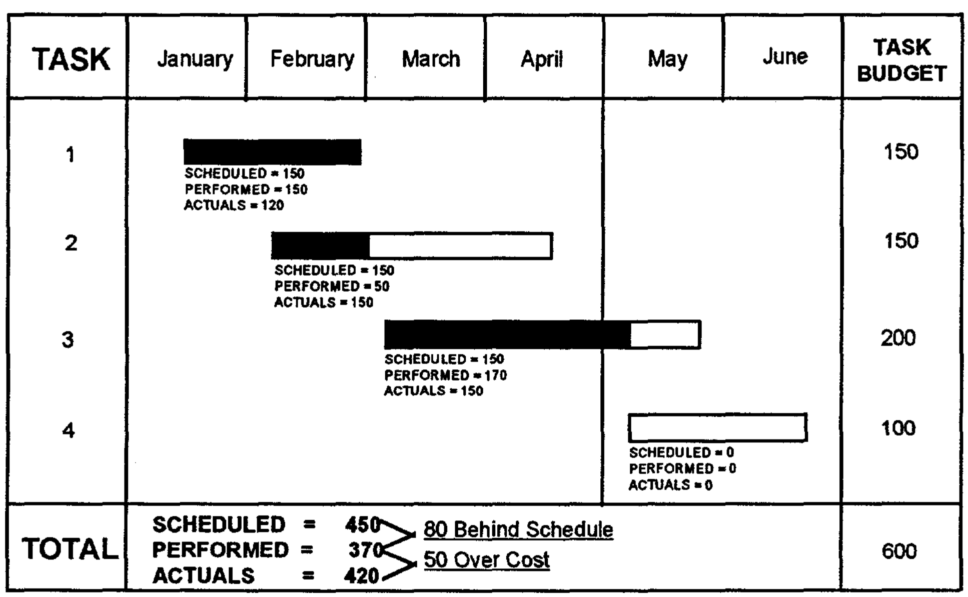
4) **Schedule Variance (SV)** - This is a formal, objective expression of project progress expressed in terms of work units. The SV provides a measure of project progress ahead or behind schedule.

5) **Cost Variance (CV)** - This is a formal, objective expression of project cost expressed in terms of work units. The CV provides a measure of project progress over or under cost.

The Earned Value approach presents a complete, objective picture of a project's status. Figures 8-2 and 8-3 provide an example project using a project management timeline schedule versus actual progress with an Earned Value approach timeline. The Earned Value approach presents a different picture of the project and (in the example given in the figures) identifies the project as being "over cost" and "behind schedule."



Project Tracking Without the Earned Value Approach



Project Tracking Using the Earned Value Approach

Figure 8-2. Earned Value Principle Example.

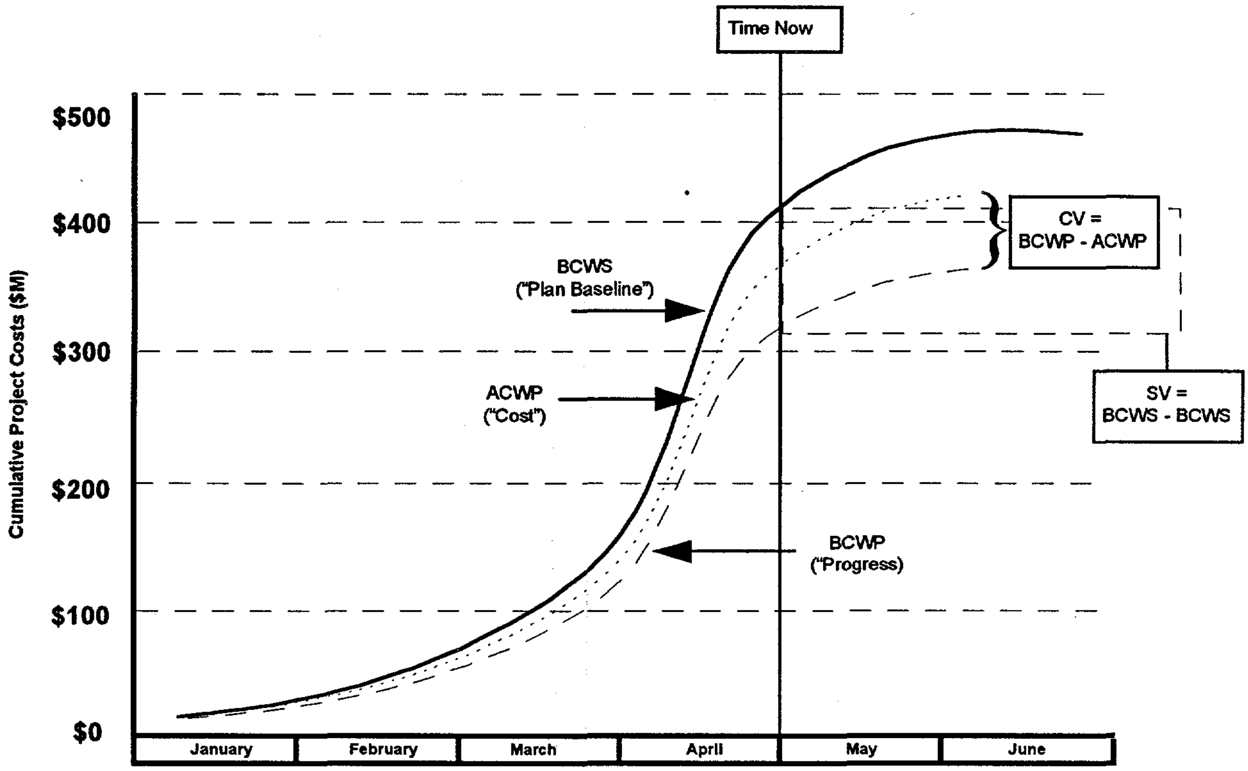


Figure 8-3. Earned Value Principle Curve.

8.4 SUMMARY

The preceding text is not a comprehensive description of all the activities that are unique to and required by the deactivation project process; therefore, the Project Manager must familiarize himself or herself with further policies and requirements. Although there are objectives and activities that are strictly unique to deactivation, the process can benefit from application of and appropriate concepts of the project definition process presented in this handbook. Simultaneously following the two processes will result in project definition that is consistent, controllable, and measurable and will reduce project risks inherent in deactivation projects.

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PROJECT DEFINITION: REFERENCES

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APPENDIX A: TOOLS

A.1 COST ESTIMATING CHECKLIST

__ 1. Choose the basis for the assessment cost estimate. Is the estimate is traceable and supportable, and have the principal regulatory deliverables been defined (e.g., Remedial Investigation Report)?

__ 2. The estimates are determined for each characterization phase. If preliminary project definition work indicates much more/less contamination than anticipated, plan how to modify full project definition.

__ 3. Determine all items to be included in the cost estimates. These items will become increasingly detailed as more information is collected at the different project stages. Some of the items that may be required in a project are:

- ___ labor, equipment, and materials (prime and subcontractors including the prime's markups on subcontractors);
- ___ sampling activities(soils, sediment, water, air, etc.);
- ___ R&D costs (if any);
- ___ well installations;
- ___ data analysis and documentation;
- ___ analytical laboratory services;
- ___ indirect costs (overhead, G&A, fees, taxes, licenses, bonds): engineering/design/inspection; prototypes and models;
- ___ project management;
- ___ mobilization/demobilization;
- ___ utilities;
- ___ warehousing;
- ___ security;
- ___ service roads and temporary buildings;
- ___ spares and rework;
- ___ testing and cold-start-up;
- ___ as-built drawings;
- ___ escalation;
- ___ OSHA and other training requirements;
- ___ impacts of other health and safety requirements;
- ___ health physicists (if any);
- ___ impacts of and costs for outside reviews and coordinations;
- ___ building and other codes such as nuclear codes;
- ___ QA requirements;
- ___ climatic, geologic and geographic impacts, and other unique requirements.

__ 4. Determine whether and how indirect costs (overhead, G&A, fees) can be reduced at any stage of estimating/project evolution. In addition, especially during the preliminary project definition stage, value engineering and other cost efficiency studies should be undertaken.

__ 5. Have the cost estimate examined by the DOE contractor and the DOE field office. Schedule independent scope, cost, and schedule review of the project. These reviews may be conducted for the joint information of the DOE officials and the prime contractor's project managers of separately for each group depending on management's choice. The reviews are necessary to provide additional information about project characteristics, strengths, risk areas, quality, implementation strategies, and readiness to proceed to the succeeding stages. Some of the questions to ask in an independent review might be:

- ___ Are the estimating techniques that were used appropriate for the level of design definition?
- ___ Are the estimates (cost and schedule) realistic?
- ___ Is there a traceability from the estimates to the project documents and throughout the project stages?
- ___ Were the estimating techniques applied appropriately, e.g., escalation applied logically and consistently, overhead charges applied appropriately, etc.?

__ 6. Estimate documentation should include enumeration of all ground rules and assumptions about anything that will affect the cost and schedule outcome of the project. Included are references to the:

- ___ design basis/documents;
- ___ assumptions about contract types;
- ___ labor and materials availability;
- ___ escalation rates;
- ___ agreements with regulatory bodies;
- ___ funding availability, etc.

_ 7. Documentation should also include:

- ___ sources of unit prices;
- ___ vendors quotes;
- ___ equations used;
- ___ factor-ratios used;
- ___ other analytical back-up data;
- ___ the name(s) of who prepare the estimate;
- ___ who reviewed the estimate;
- ___ the signature of the person approving the estimate.

__ 8. The estimates for labor must address whether local labor (and rates), non-local (and rates, including relocation costs) and/or a mix will be used. This will be preceded by an evaluation of labor-critical skill categories locally, and if necessary, nation-wide.

__ 9. Labor productivity must be evaluated relative to its applicability to any requirements for the project at hand that might vary from the productivity factors being used.

__ 10. An additional area of cost impact relative to labor is security requirements such as when laborers are required to have security clearances and/or are to work in secure areas requiring addition time for check-in and check-out.

__ 11. A contingency analysis should be conducted using the graded approach that provides for varying degrees of uncertainty in the estimate.

__ 12. Develop a contracting strategy (i.e., Fixed Price, Government Furnished Equipment/Materials, Cost Plus Fixed Fee, Cost Plus Award Fee, etc.) for contracts and major cost items.

__ 13. Cost estimates for equipment and other materials should be supported by current vendor quotes or recent actual experience. Labor estimates should reflect union agreement, where applicable. Cost estimates for bulk materials should reflect local conditions where applicable and also reflect current prices.

__ 14. Does pricing reflect code, scheduling, climatic, geographic, and other unique requirements?

__ 15. If unitized pricing has been applied, are the raw materials and labor costs, equations and other backup data provided or available?

__ 16. Information sufficient for material takeoffs and detailed estimates follow design evolution. As material quantities can be established, they provide the best basis for the estimates (compared to factor-ratios estimates or parametric estimates.) Factor-ratios and parametric estimates may be useful for estimate screening or reviews.

A.2 COMMUNITY RELATIONS CHECKLIST

__ 1. If your site has a Site-Specific Advisory Board (SSAB), discuss specific project plans, response actions, and/or any proposed with membership early on.

__ 2. Appoint a person (Public Affairs Representative (PAR)) to act as a spokesperson for community relations and public affairs aspects of the project plan.

__ 3. Ensure community has received sufficient time to review and comment on project documents. Ensure the PAR has also had sufficient time to review the documents and can have any questions he/she may have answered.

__ 4. Coordinate news releases, responses to media queries, and briefings.

__ 5. Notify civic leaders and spokespersons for local interest groups (e.g., the Mayor, Lions Club, City Manager).

__ 6. Identify and include special interest groups (i.e. representatives who work on environmental justice issues, demographics, etc.)

__ 7. Prepare community impact briefing at preliminary and final design stages.

__ 8. Develop questions and answers and fact sheets for general distribution.

__ 9. Inform surrounding communities of project process through the local media (e.g., newspaper, radio).

__ 10. Provide a time period of appropriate length for public comment on any proposed project actions once the surrounding communities have been notified via local media.

__ 11. Include community relations actions in support of the project in an administrative record.

__ 12. Maintain a list of qualified speakers.

__ 13. Conduct community interviews. (Include comminity elected officials in community interviews or advisory boards.

__ 14. Prepare written, site-specific community relations plans for remedial and removal actions, construction activities, etc.

__ 15. Help prepare a Responsiveness Summary (summary of public comments and the response) suitable for inclusion in the final decision package, or similar package required for other project types.

__ 16. Coordinate and publicize public meetings.

__ 17. Should an Information Repository Center (IRC) be established by the site, keep updated project docuemnts for public access. A local library or other easily accessable location can substitute.

__ 18. Announce the availability of the Administrative Record and reports as they are added to the Information Repository.

__ 19. Repeat the public comment period if significant changes are made to the preferred alternative response action.

__ 20. Maintain and update the mailing list throughout the life of project activities.

__ 21. Write and distribute a fact sheet about the final engineering design of the proposed project. This type of informatino should also be readilty available at the Information Repository.

__ 22. When appropriate coordinate the message, and report and draft letters of transmittal for release of the project findings.

**SOURCE: DOE PROJECT CONTROL TOOLS CHECKLIST*

A. 3 PROJECT VALIDATION GUIDANCE CHECKLIST

The objective project validation is to examine the planning, technical/ cost/schedule baselines and project management to ensure that the project is ready to proceed and the baselines are consistent with programmatic needs, goals, and legal requirements. This also ensures the funds being requested for the project are commensurate with the scope and schedule being proposed.

General

__ 1. Where necessary, has agreement been reached between the program division, field office, and/or operating contractor on the facility operating (performance) requirements?

__ 2. Are facility requirements defined in terms of real property requirements, process definition, arrangement, system layout, operations, maintenance, utility supply, distribution, and cost?

__ 3.a. Has DOE Order 6430.1A been used in developing the Conceptual Design Report (CDR)?

__ 3.b. For areas not covered by DOE Order 6430.1A, what criteria are used?

__ 3.c. Has the intention to conduct a DOE 6430.1A compliance analysis and review been expressed? (Required per DOE Order 5481.1B, Safety Analysis & Review System).

__ 4.a. Have safeguards and security requirements been considered in the development of the CDR?

__ 4.b. Have they been reviewed and accepted by safeguard and security personnel, and are they in accordance with the latest Master Safeguards and Security Agreement?

__ 5.a. A site plan(s) of the project shall be forwarded for review by the validator. Is the project location predetermined by existing facilities or is site selection necessary?

__ 5.b. What is the basis for the site selection and what alternatives were considered?

__ 5.c. Is the project site shown on the current approved baseline Five-Year Plan from the Technical Site Information as described in DOE Order 4320.1B of 1-7-92?

__ 5.d. If not, has an Engineering Control Change to the baseline Five-Year Plan been completed, approved by the Department of Energy (DOE) Field Offices, and distributed to Headquarters?

__ 5.e. If land acquisition is required, has the implementation of DOE Order 4300.1 been initiated?

__ 6.a. Are function of structures, systems, and major components defined?

__ 6.b. Have value engineering techniques been utilized to analyze these functions?

__ 7. Has the procurement strategy been coordinated with Headquarters Procurement Operation staff?

__ 8.a. Have facility demands been matched with site utilities, roads and support facilities?

__ 8.b. Will utilities, roads and/or support facilities require future upgrades/modification to match infrastructure demand?

__ 9. Have requirements for initial complement of equipment been defined?

__ 10. Are quality levels and program requirements established?

__ 11. With present knowledge of the proposed facility, can emissions and wastes be treated or disposed of in compliance with Federal and State standards?

__ 12. Have State, local or national codes and standards applicable to the work and operation of the facility been defined; can the facility operate within these codes and standards?

__ 13. Does facility provide office space for operating staff and does the amount of space conform to guidelines issued by General Services Administration?

__ 14.a. Are space requirements in addition to current space available, or is it replacement for substandard space?

__ 14.b. What is the disposition of the building/space being replaced, demolished, converted, etc.?

__ 15. Do projects meet the SEN-15-90, NEPA requirements, or have Environmental Assessment (EA), been prepared, as required by the Assistant Secretary for Environment, Safety and Health?

__ 16. Have the requirements been met for ensuring that new DOE facilities demonstrate new or emerging energy efficient technologies as presented in DOE notice 4330.0?

__ 17. Have Construction Project Data Sheets been submitted for "Operation Expense Funded" projects over $1.5 Million and, in particular, those that are listed as Major System Acquisitions (replaced by Strategic Systems)?

Design (Conceptual, Title I, Title II)

__ 1. What is the status of the design? The engineering must be developed to the point of establishing initial scope, cost, and schedule baselined at CDR. The following should be included as part of the design documents:

- ___ site development plans including utilities
- ___ building layouts
- ___ major equipment arrangement
- ___ piping and instrumentation diagrams
- ___ process and heating, ventilating, and airconditioning layouts
- ___ electrical single-line diagrams
- ___ major mechanical, electrical, and experimental equipment list with sizing and codes, standards, Quality Assurance (QA), and other principal special provisions
- ___ most reasonable utility supply option selected
- ___ utility requirements impacts; availability of outside sources; the most reasonable utility supply option selected
- ___ DOE 6430.1A compliance analysis and review

__ 2.a. Have there been any scope changes since the last validation?

__ 2.b. If so, have rationale, costs and schedule impact been identified?

__ 3. Are site conditions understood (e.g., legal encumbrances and restrictions, soil borings, water table, borrow and spoil areas, railroad bridge and road access, utility sources and routing restrictions, construction site layout and limitations)?

__ 4. Have safety hazards and risks been determined and have appropriate safety evaluations been performed?

__ 5. Has the design undergone a value engineering study, and if so, have design alternatives been incorporated which are life-cycle cost effective?

__ 6.a. Has an environmental assessment been performed?

__ 6.b. What is the status of environmental documentation?

__ 7. Has Research and Development (R&D) prerequisite to facility design and construction been identified, scoped, scheduled and funded?

__ 8. Have all those who could influence the design participated in development/preparation and approval of the concept?

__ 9.a. What are major areas of uncertainty (e.g., R&D, design feasibility, schedule, etc.)?

__ 9.b. Has this been factored into the risk assessment to determine the contingency?

__ 10. Has the Energy Conservation Report as required by DOE Order 6430.1A been prepared as a part of the design?

__ 11. For applicable buildings, or building areas, does design meet Title 10, Code of Federal Regulation Part 435, Energy Conservation Voluntary Performance Standards for Commercial and Multi-Family High Rise Residential Buildings, mandatory for new Federal Buildings?

__ 12. Have maintainability considerations been built into the design, and does the design contain a good maintainability checklist specifically oriented to this project? The maintainability concerns that should be addressed are:

___ a. accessibility
___ b. operator/user friendly
___ c. documentation
___ d. standardization/interchangeability
___ e. flexibility
___ f. desirable levels of quality

Schedule

Have the following factors been considered in developing the schedule:

___ effects of weather and season
___ resource loading and leveling
___ milestone responsibilities (AE, program, project, contractor)
___ budget cycle timing
___ contractor selection durations
___ Headquarters reviews and approvals (including NEPA and Safety)
___ prerequisite R&D schedule constraints
___ dependency upon timing and amount of operating funds

___ historical experience on design, procurement, construction, technical reviews, National Environmental Policy Act documentation etc.

___ development of environmental documentation

___ procurement lead times for equipment (particularly reflecting vendor quotes)

___ ogical sequence of design, procurement, and construction

___ realistic obligation and costing rates

___ workplace space constraints

___ exposure constraints

___ *operational constraints*

___ maintainability reviews and deliverables

___ milestone dictionary

Cost Estimate

Details provided should be consistent with complexity, scope, nature (first-of-a-kind vs. repetitive), and status of the design (conceptual, Title I/II, etc.). Cost estimates and summaries should be understandable and be provided in a single volume if possible. Computerized CS^2 reports are not acceptable. Provide assumptions, basis of the estimate and narrative as required to furnish complete explanations. For major technical projects, the following estimating practices are pertinent:

General

__ 1.a. When was estimate prepared?

__ 1.b. Are estimates provided in both base year and then year dollars?

__ 2. Basis of estimate: vendor quotes, similar projects, engineering calculations, etc.

__ 3. Are estimates traceable and supportable, where necessary, with vendor quotes?

__ 4.a. Do contingency and escalation reflect the guidance issued (Cost Estimating Guide for Application of Contingency, Note Contingency Guideline Implementation, paragraph 5.b.)?

__ 4.b. Does contingency reflect level of confidence in scope of work, development features, pricing methodology and complexity of project?

__ 4.c. Does contingency analysis provide for varying degrees of certainty in the estimate?

__ 5.a. What escalation rates are being used?

__ 5.b. What documentation or analysis was used to support these assumptions?

__ 5.c. Have they been included and applied in a logical and consistent manner?

__ 5.d. What changes in estimates have occurred as a result of changes in escalation assumptions used in previous estimates?

__ 5.e. Have program-related changes been identified and crosswalked (schedule, technical, scope, or economic condition)?

__ 6.a. Have there been independent reviews of the project estimate?

__ 6.b. When was the estimate updated?

__ 6.c. How was the estimate updated (i.e., trends "bottoms-up," only changed work, etc.)?

__ 6.d. When was last "bottoms-up" estimate performed?

__ 7. Where unique construction or fabrication practices are required, has pricing advice been obtained from experienced firms knowledgeable in the field?

__ 8. Where attempts are made to use estimating guides based on conventional construction items, have they been properly interpreted with required geographic, quantity, and complexity adjustments?

__ 9.a. Are indirect costs, profit, fees, etc., included?

__ 9.b. Are reasonable rates used?

__ 9.c. Have these been audited?

__ 10. In the case of Title I/II design estimate, were all the specification and drawings available for development of the cost estimate?

__ 11. Are all required experimental components included in estimate?

__ 12. Has a procurement strategy been developed, i.e., Government Furnished Equipment, Cost Sharing, Cost-Plus-Fixed-Fee, Cost-Plus-Award-Fee, etc., for contracts and major cost items?

__ 13. Are materials and systems selections, especially as they concern maintainability, based on life cycle costs rather than first costs identified?

__ 14.a. Have Total Estimated Cost and Total Project Cost definitions been properly applied?

__ 14.b. Do the estimates reflect proper financial management practices and procedures?

Construction

__ 1. Were bulk material quantities, established by takeoffs from conceptual drawings, based on engineering estimates or factored from pervious work?

__ 2. Are allowances for quantity growth needed or provided?

__ 3. Is bulk material pricing current and reflecting local conditions where appropriate?

__ 4.a. Is labor estimated using local rates, including applicable fringe benefits, travel allowance, and reasonable crew or craft mix?

__ 4.b. Was the availability of construction labor critical skill categories in the local labor
market considered?

__ 5. Is pricing of equipment supported by current vendor quotes or recent actual experience?

__ 6. Have indirect construction costs been included for normal support, field engineering, temporary construction, mobilization, warehousing, etc.?

__ 7. Is labor productivity based on historical experience adjusted or appropriate for site or unusual facility features?

__ 8.a. If labor availability would be a problem, have allowances been included for attracting adequate work force?

__ 8.b. Have construction of classified projects been addressed relative to cleared work force?

__ 9. Does pricing reflect code, QA, scheduling, climatic, geographic, and other unique specification requirements?

__ 10. If unitized pricing has been applied, are the raw material and labor cost, equations and other backup data provided or available?

__ 11. Are operational cost estimates and basis for overhead cost included and explained?

__ 12. Has a transition plan from construction to operations been developed along with procedures for controlling costs?

Engineering and Management

__ 1. Do the Engineering, Design, and Inspection (ED&I) Costs follow the guidance, The Definition and Treatment of Engineering, Design, and Inspection Costs, August 23, 1985?

__ 2. Are contractor project management and engineering costs appropriately chargeable to the project included?

__ 3. Was ED&I built up by assessment of drawings, specifications, analysis, comparable experience, or a percentage of construction?

__ 4. Are Title III inspection, QA, and QC costs included for Architect/Engineer, operator and construction, as appropriate?

__ 5.a. Is the management system organized and planned reasonable and responsive to project/program needs?

__ 5.b. Is authority at the proper levels?

__ 5.c. Are there duplicative or overlapping responsibilities?

__ 5.d. Is a cost and schedule deviation evaluation system in place?

__ 6.a. Is an effective baseline change control system in place including board charters and responsibilities?

__ 6.b. Are project baselines change procedures and process defined and understood?

Finding and Cost Status

__ 1.a. What is the basis for the planned authorization, appropriation, and costing schedule?

__ 1.b. What alternatives were considered?

__ 2. What are the other associated project costs? See Item 12 of Project Data Sheet for details desired.

__ 3.a. Is the proposed annual funding consistent with a realistic project schedule?

__ 3.b. Is it based on an evaluation of planned contract awards delivery lead times, and logical critical path activity sequencing?

__ 4. Have alternatives been considered in the event of a Continuing Resolution or reduced funding? Impacts?

__ 5. Are any of the fixed-price construction contracts in the project incrementally funded?

__ 6. Has the funding by client or consultant agencies been identified?

__ 7. Have any reductions in project funding or fundings requests resulted in the elimination or reduction of energy conservation or maintainability items?

Additional Specific Guidance for EM-40 Projects

The following is additional information relevant to the EM-40 validation process:

__ 1. A team approach will be used for the validation of EM-40 projects. The team will usually consist of members from GC/EH/PR/CR and contractor technical support personnel.

__ 2. Validation material should be provided in a concise fashion, preferably in a single bound volume to all of the members of the validation team. Voluminous computer automated cost and schedule control system output reports are not accepted alternatives to a fully documented cost estimate report, which logically and coherently states all assumptions, basis for the estimate, and explanatory narrative.

__ 3. One of the primary areas of emphasis during the project validation reviews shall be the requested funding for the project. The validation teams shall examine Current Fiscal Year (FY), budget year (FY+1), and requested year (FY+2) for the project. The team will pay particular attention to both Budget Authorization (BA), obligations and cost accrual cumulative funding and funding carry-over (both unobligated BA and uncosted obligations). All funding profiles shall address both TEC and Other Project Cost (OPC) to obtain the Total Project Cost.

A.4 WORK SCOPE DEFINITION CHECKLIST

**Source: DOE Project Control Tools Checklist*

Work scope definition involves ensuring the project does all the work required and only the work required. The work scope definition includes scope planning, scope definition, scope management and scope change control. The degree of scope definition will increase with each successive project phase.

Scope Planning

__ 1. Project Scope Statements (Project Plan, Charter, Justification of Need) have been developed.

__ 2. Statements of work and functional design criteria have been developed.

__ 3. The Project Management Plan has been developed.

__ 4. Major project deliverables are identified as a part of the project scope statements.

__ 5. Project objectives that must be met for the project to be successful are included as port of the project scope statements.

Scope Definition - Work Breakdown Structure

__ 1. Work Breakdown Structure (WBS) templates have been identified that can be used to develop the WBS for the project.

__ 2. The WBS Dictionary describes the elements that make up the technical, schedule, and cost baseline.

__ 3. The project has been divided into a number of more manageable parts that will support the planning of future project activities.

__ 4. Project elements are sufficiently detailed to support the development of project cost and schedule requirements commensurate with the phase of project development.

Scope Management

__ 1. A plan for managing scope has been defined.

The scope management plan includes approaches for addressing:

__ a. Technical Baseline
__ b. Cost Baseline
__ c. Schedule Baseline

Scope Change Control

__ 1. A change control process is defined for the project.

The scope change control process addressed the methods used to manage:

__ a. Technical Baseline
__ b. Cost Baseline
__ c. Schedule Baseline

A. 5 ROLES & RESPONSIBILITIES IDENTIFICATION CHECKLIST

**SOURCE: DOE PROJECT CONTROL TOOLS CHECKLIST*

The roles and responsibilities checklist will assist the project manager in the development of the project organization, the identification of the staff required to plan and complete the project, and the implementation of the processes to group individual skill needed to perform and coordinate the project activities.

Project Plan

__ 1. The methodology for applying a graded approach to the development of project controls is defined.

__ 2. The Project Plan is developed consistent with the requirements defined in the graded approach.

The Project Plan includes:

- ___ Mission Needs and Objectives
- ___ Project Charter
- ___ Technical Plan
- ___ Risk Assessment
- ___ Project Management Structure
- ___ Acquisition Strategy
- ___ Project Schedule
- ___ Resources Plan
- ___ Controlled Items/Baseline
- ___ Work Breakdown Structure
- ___ Project Controls Description
- ___ Technical Documentation Control System
- ___ Correspondence Control System
- ___ Quality Assurance Plan
- ___ Procurement Program
- ___ Configuration Management Plan
- ___ Systems Engineering Management
- ___ Natural Phenomena Hazards
- ___ Contingency Plan
- ___ Utility Services
- ___ Environmental, Safety and Health Protection Plan
- ___ Advance Acquisition Plan
- ___ Construction Project Data Sheet
- ___ Systems Approach
- ___ Performance Criteria
- ___ Test and Evaluation
- ___ Security Documentation
- ___ Organizational Planning

__ 3. Project interfaces have been identified.

__ 4. Project team staffing requirements, consistent with the needs of the project phase, complexity, and size, have been identified.

__ 5. External interfaces and limitations impacting the use of staff have been identified.

Staffing Acquisition

__ 1. Staffing plan has been developed.

__ 2. Staff availabilities have been determined.

- ___ DOE
- ___ Other government organizations
- ___ Contractors

__ 3. Methods for assigning staff to the project have been defined.

- ___ Staffing pool identified
- ___ Staff available from other DOE groups
- ___ Contracting and procurement process in place

__ 4. Project Team Roster/Chart defined.

__ 5. Team development approach has been defined.

__ 6. Baseline Change Control process is in place.

A. 6 COST ESTIMATING CHECKLIST

*SOURCE: DOE PROJECT CONTROL TOOLS CHECKLIST

Project cost estimating includes the processes that are used to determine the costs of the resources needed to complete project activities. The cost estimating checklist identifies areas that are required to develop the project cost estimates for the various project phases (i.e. conceptual, preliminary and definitive design, and construction bid packages).

__ 1. Cost estimating tools are defined for the project.

__ 2. Cost estimate scope has been defined.

__ 3. Historical cost records for similar projects are available to support the cost estimating process.

__ 4. Commercial cost estimating databases are available to support the cost estimating process.

__ 5. Cost estimate base rates have been identified.

___Resource rates
___Duration estimates

__ 6. Cost estimate Chart of Accounts has been defined.

__ 7. Project related risks that can impact project cost have been identified and documented.

__ 8. Cost estimates have defined contingency requirements consistent with identified risks.

__ 9. The organizations/personnel responsible for the development of the estimates have been defined.

__ 10. Budget cost estimate for the Pre-Conceptual phase completed.

__ 11. Government estimate prepared for use in evaluating proposals or bids for the next project phase or stage.

__ 12. Technical Baseline established/updated.

__ 13. Schedule Baseline prepared/updated.

__ 14. Independent Cost Estimate is available for review by the project manager.

__ 15. Activity based cost estimated prepared for the operations portions of the project.

*SOURCE: DOE PROJECT CONTROL TOOLS CHECKLIST

A. 7 COST BASELINE DEVELOPMENT CHECKLIST

The Cost Baseline is developed from the cost estimate that is linked to the Technical Baseline. The Cost Baseline is time-phased in accordance with the Schedule Baseline as defined by the project schedule. This checklist identifies the elements that the Project Manager should consider at the time the Cost Baseline is established.

__ 1. The project schedule has been developed and incorporates the activities and logic that reflects the plan for the project.

__ 2. Project durations reflect the resource availabilities that have been developed for the project.

__ 3. The Cost estimate scope statement, assumptions, and exclusions have been formally documented.

__ 4. The cost estimate backup material is collected and filed.

__ 5. Estimate backup data includes:

- ___ Vendor Quotations
- ___ Labor Rates
- ___ Contracting Basis/Assumptions
- ___ Overhead/Markup Calculation
- ___ Manpower Estimates
- ___ Productivity Factors/Basis
- ___ Contingency Analysis

__ 6. The Cost Baseline has been reviewed and accepted.

__7. Budgets are established that reflect the requirements and assumptions that were used in the development of the Cost Baseline.

__ 8. The Project Baselines are integrated together and reflect the total project requirements.

- ___ Technical with Schedule
- ___ Technical with Cost
- ___ Cost with Schedule

A. 8 FUNDS MANAGEMENT CHECKLIST A

*SOURCE: DOE PROJECT CONTROL TOOLS CHECKLIST

Funds management tools are used to manage the flow of money needed to pay project expenses. This checklist will assist the Project Manager to address cash flows.

__ 1. The Approved Funding Program (AFP) as detailed in the internal DOE budget summary document is available.

__ 2. The preliminary schedule established in the preconceptual stage of the project identifies the time for first funding and the fiscal year when the project will become operational.

__ 3. The methodology to perform a monthly update of the AFP is established.

__ 4. Cash flows are prepared periodically for the project.

__ 5. The performance measurement system is defined and can be used to track progress against the Cost Baseline.

__ 6. Project Budget Log that is used to track changes in constituent elements of the approved budget has been established.

__ 7. A formal Total Allocated Budget Log has been established.

__ 8. Controls are established for using contingency allowances and management reserve.

**Source: DOE Project Control Tools Checklist*

A. 9 FUNDS MANAGEMENT CHECKLIST B

Accounting tools are used to formally collect cost information and use that information to develop reports and records that are employed in the evaluation of project performance against baseline.

__ 1. Accounting cost collection tools have been identified for the project.

__ 2. Accounting data collection methodology has been established.

__ 3. The accounting reports used in the management of the project have been defined.

__ 4. The methodology the project will use to collect and then allocate indirect costs to project activities is defined.

__ 5. Methodology to periodically audit the project cost records is defined.

A.10 WORK AUTHORIZATION CHECKLIST

**Source: DOE Project Control Tools Checklist*

Work Authorization is the process used to release work for specific projects. Work Authorization is accomplished through Program Evaluation Guidance (PEG). The Work Authorization Checklist assists the Project Manager to ensure the documentation needed to authorize work is developed and available for use.

__ 1. Procedures for controlling work and funding authorization are prepared and approved for use.

__ 2.The Program Execution Guidance documents have been prepared.

__ 3.The Program Manager has prepared the Work Authorization Memorandum.

__ 4.The Work Authorization Letter for the current fiscal year has been prepared and transmitted to the Project Contractors.

*SOURCE: DOE PROJECT CONTROL TOOLS CHECKLIST

A.11 REPORTING CHECKLIST

Progress reporting provides the Project Manager and project stakeholders with the information needed to understand the project. This checklist assists the Project Manager in establishing status reports (where the project stands) and performance reports (what the project has accomplished).

__ 1. Report Distribution Matrix developed.

Reports include:

___ Summary Reports
___ Milestone Status
___ Baseline Funding/Budget Status
___ Performance Measurement
__Cost
__Schedule

___ Major Procurements
___ Engineering Status
___ Construction Status
___ Problems/Concerns/Solutions
__Accomplishments

___ Technical Accomplishment or Changed Approach
___ Budget Forecast
___ Schedule Forecast

APPENDIX B: GLOSSARY

Accountability. Being answerable for, but not necessarily personally responsible for, something (e.g., a task, work, etc.) Accountability can be shared, but not delegated.

Account Code Structure. The system by which summary numbers are assigned to work breakdown structure elements and account numbers are assigned to specific work packages.

Activity. A task or element of work that takes place in a specified period of time and that is required to complete a project.

Allowances. Additional resources included in cost estimates intended to cover known, but undefined requirements associated with particular activities, work items, or accounts.

Applicable or Relevant and Appropriate Requirements (ARARs). (1) Those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental, State environmental, or facility citing laws that must be met when complying with CERCLA. Only those State standards that are identified by the State in a timely manner and that are more stringent than Federal requirements may be applicable. (2) Requirements promulgated under Federal or State law that specifically address the circumstances at a Superfund site. (3) A requirement that environmental laws, other than those under CERCLA, may be either "applicable" or "relevant and appropriate", but not both. Identification of ARARs must be done on a site-specific basis and involves a two-part analysis: first, a determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is nevertheless both relevant and appropriate.

Arrow Diagram. A network or logic diagram using arrows to represent activities.

Assessment. A determination of project system acquisition condition based on a review of project cost, schedule, technical status, and performance in relation to program objectives, approved requirements, and baseline project plans. Assessments are made by the responsible managing or advocate program organization, or independently by the Office of Project and Facilities Management. In all cases, assessments must be based on knowledge of the actual project status, performance, problems, and significant development in the actual execution activities as well as required institutional approval, licensing, review and environmental processes.

Baseline. A quantitative expression of projected costs, schedule, and technical requirements. Baseline establishment should include criteria to serve as a base or standard for measurement during the performance of an effort. It is the data plan against which the status of resources and the progress of a project can be measured.

Baseline Change Control Board. A multidisciplinary, functional body of representatives designated and chartered by the appropriate management level to ensure the proper definition, coordination, evaluation, and disposition of all changes to baselines for projects within a chartered jurisdiction.

Baseline Change Proposal. The instrument/document prepared to provide a complete description of the proposed change and its resulting impacts on project baselines.

Capital Projects. Those projects/expenditures that exceed $5000 and are expected to last/operate for a period of more than two years.

Characterization. The determination of waste contents and properties by review of process knowledge or sampling and analysis.

Closure. (1) Operational Closure: Actions taken upon completion of operations to prepare the disposal site or disposal unit for custodial care (e.g., addition of cover, grading, drainage, erosion control). (2) Final Site Closure: Actions taken as part of a formal decommissioning or remedial action plan for the purpose of achieving long-term stability of the disposal site, and to eliminate, to the extent practical, the need for active maintenance so that only surveillance, monitoring, and minor custodial care are required.

Code of Federal Regulations (CFR). (1) A codification of the general and permanent rules published in the Federal Register by the departments and agencies for the Federal government. The Code is divided into 50 titles that represent broad areas subject to Federal regulation, and is issued quarterly and revised annually. (2) All Federal regulations in force are published annually in codified form in the CFR.

Compliance Agreement. An agreement between regulators and regulated entities that is legally binding and that establishes schedules and standards for environmental compliance.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). A Federal statute also known as Superfund, that was enacted in 1980 and amended in 1986 by SARA. This act created a special tax that goes into a Trust Fund (Superfund) to investigate and clean up abandoned or uncontrolled hazardous waste sites that pose a potential danger to public health, welfare or the environment. Under the program, EPA can (1) pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work or (2) take legal action to force parties responsible for site contamination to either clean up the site or reimburse the Federal government for cleanup costs. CERCLA establishes the process for undertaking remedial actions at inactive waste sites containing hazardous substances, as well as reporting requirements for releases of hazardous substances.

Conceptual Design. Encompasses:

- project scope to satisfy program needs
- assure project feasibility and attainable performance level
- develop reliable cost estimates and realistic schedules for congressional consideration
- develop project criteria and design parameters; codes and standards; QA/QC requirements; materials of construction; space allowances; energy conservation features; health, safety, safeguards and security requirements; and any other features or requirements necessary to describe the project.

Consent Decree (CD). Legal document, approved and issued by a judge, that formalizes an agreement reached between EPA and PRPs stating that the PRPs will perform all or part of a Superfund site cleanup. The consent decree, which is subject to a public comment period, describes actions that PRPs are required to perform, completely or in part, for a Superfund site cleanup.

Construction. Erection, building, remodeling, improvement, or extension of buildings, structures, or other property.

Construction Management. Relating to management services of a project during pre-design, design, and/or construction phases which include: development of project strategy; design review relating to cost and time consequences; value engineering; budgeting; costing; scheduling; monitoring of cost and schedule trends; procurement; observation to assure compliance with plans and specifications; contract administration; labor relations; construction methodology and coordination; and other management efforts related to the acquisition of construction.

Contingency. The amount budgeted to cover costs that may result from incomplete design, unforeseen and unpredictable conditions, or uncertainties. The amount of the contingency will depend on the status of the design, procurement, construction, and the complexity and uncertainty of the component parts of the project. Contingency is not to be used to avoid making an accurate assessment of expected costs.

Corrective Measures Implementation (CMI). The CMI includes designing, constructing, operating, maintaining, and monitoring selected corrective measures.

Corrective Measures Study (CMS). The portion of a RCRA corrective action that is generally equivalent to the Superfund feasibility study. During the CMS, an evaluation is made of the corrective measures that were identified and recommended by the owner or operator.

Cost-Benefit Analysis. A quantitative evaluation of the costs that would be incurred, versus the overall benefits to society of a proposed action.

Cost-Effective Alternative. The cleanup alternative selected for a site on the NPL based on technical feasibility, permanence, reliability, and cost. Although the EPA is not required to choose the least expensive alternative, if several cleanup alternatives are available that deal effectively with problems at a site, EPA must select the remedy on the basis of permanence, reliability, and cost.

Cost-Effectiveness. A mandate for remedial action that requires a close evaluation of the costs required to implement and maintain a remedy, as well as the selection of protective remedies whose costs are proportional to their overall effectiveness.

Cost (Control) Account. The account at the lowest level of the project's work breakdown structure for which individual costs are summarized and accounted.

Criteria. Rules or tests against which the quality of performance can be measured. They are most effective when expressed quantitatively. Fundamental criteria are contained in policies and objectives, as well as codes, standards, regulations, and recognized professional practices that DOE and DOE contractors are required to observe.

Criteria (Functional). Descriptive or limiting factors used to provide guidance in establishing standards and meeting goals and objectives.

Criteria for Evaluating Alternatives. Measures or standards for comparing alternatives.

Critical Decision. The point at which formal management approval is required. Critical Decisions in the DOE Draft Order, 4700.X *Project Management System*, have replaced the DOE Order 4700.1, *Key Decisions*.

Decommission. To remove (as a facility) safely from service and reduce the residual radioactivity to a level that permits termination for license and release of the property for unrestricted use.

Decommissioning. (1) Actions taken to reduce the potential health and safety impacts of contaminated DOE facilities, including activities to stabilize, reduce, or remove radioactive materials, or to demolish the facilities. (2) Preparations taken for retirement of a nuclear facility from active service, accompanied by the execution of a program to reduce or stabilize radioactive contamination. (3) The process of removing a facility or area from operation and decontaminating and/or disposing of it or placing it in a condition of standby with appropriate controls and safeguards.

Decontamination. The activities (washing, chemical action, mechanical cleaning or other techniques) used to reduce or remove from facilities, soil, or equipment those substances which pose a substantial present or potential hazard to human health or the environment, such as radioactive contamination.

Definitive Work. The effort on which a contractual agreement for the dollar value of the effort has been reached.

Deliverable. A report or product of one or more tasks that satisfies one or more objectives and must be delivered to satisfy contractual requirements.

Department of Energy Site. A DOE-owned or -controlled tract used for DOE operations under terms that afford to DOE rights of access and control substantially equal to those that DOE would possess if it were the holder of the fee (or pertinent interest therein) as agent of and on behalf of the government. One or more DOE operations/program activities are carried out within the boundaries of the described tract.

Discovery. Discovery refers to the notification, observance or detection of a release (or substantial threat of release) or discharge of a hazardous substance or oil into the environment. A discovery may be made through notification or investigation in accordance with statutory requirements, incidental observation by government agencies or the public, or through notifications by permit holders or inventory efforts conducted by Federal, State, or local agencies.

DOE Order 4700.1. Establishes the DOE project management system (PMS); provides instruction, formats, and procedures for implementation; and sets forth the principles and requirements that govern the development, approval, and execution of DOE's outlay program acquisitions as embodied in the PMS.

DOE Orders. (1) Internal requirements that establish DOE policy and procedures for compliance with applicable laws and regulations. (2) An extensive set of directives, developed and implemented by DOE to provide mandatory guidance for its operations.

Energy Systems Acquisition Advisory Board. A multi-functional body of representatives designated by the Acquisition Executive to provide technical and managerial expertise to support the

Acquisition Executive in the review of a Strategic System.

Environment. The sum of all external conditions affecting the life, development, and survival of an organism(s).

Environmental Impact Statement (EIS). A document prepared in accordance with the requirements of 102(2)(C) of NEPA that serves as a tool for decision-making by describing the positive and negative effects of the undertaking and listing alternative actions. The draft document is prepared by the EPA or under EPA guidance, attempts to identify and analyze the environmental impacts of a proposed action and feasible alternatives, and is circulated for public comment prior to preparation of the final environmental impact statement.

(U.S.) Environmental Protection Agency (EPA). An independent agency of the Federal government formed in 1970 by Presidential Executive Order, that combined parts of various government agencies involved with the control of pollution, and responsible for pollution abatement and control programs, including programs in air and water pollution control, water supply and radiation protection, solid and toxic waste management, pesticides control, and noise abatement.

Environmental Restoration (ER). (1) Measures taken to clean up and stabilize or restore, to pre-violation conditions, a site that has been contaminated with hazardous substances during past production or disposal activities. (2) Cleanup and restoration for sites contaminated with radioactive and/or hazardous substances during past production, accidental releases, or disposal activities.

Feasibility Study (FS). A study undertaken by the lead agency to develop and evaluate options for remedial action. The FS emphasizes data analysis and is generally performed concurrently, and in an interactive fashion, with the RI using data gathered during the RI. The RI data are used to define the objectives for the response action, to develop remedial action alternatives, and to undertake an initial screening and detailed analysis of the alternatives.

General Plant Project. A miscellaneous minor new construction project of a general nature that results in a complete and usable facility. These projects are necessary to adapt facilities to new or improved production techniques, to effect economies of operations, and to reduce or eliminate health, fire, and security problems.

Graded Approach. An approach which considers a variety of factors when determining the level of analysis, documentation, and actions that are necessary to comply with a requirement. Some of factors considered are: the relative importance to environmental safety and health, the magnitude of associated risks, the programmatic mission of the project, specific project characteristics, and other relevant factors.

Hazard Ranking System (HRS). The principal screening tool used by EPA to evaluate risks to public health and the environment associated with abandoned or uncontrolled hazardous waste sites. The HRS calculates a score based on the potential of hazardous substances spreading from the site through the air, surface water, or groundwater and on other considerations such as nearby population. This score is the primary factor in deciding if the site should be on the NPL and, if so, what ranking it should have, compared to other sites on the list.

Independent Cost Analysis. Analysis of cost data of any degree of completeness, or available data, by a person or organization not part of the project office, its contract support, or direct advocates of the project. Usually performed to validate, cross-check, or analyze estimates developed by project advocates.

Life-Cycle Cost. The sum total of the direct, indirect, recurring, nonrecurring, and other related costs incurred or estimated to be incurred in the design, development, production, operation, maintenance, support and final disposition of a major system over its anticipated useful life span. The system of project planning anticipates use of existing sites or facilities, and should include restoration and refurbishing costs.

Line Item Projects. Projects which are specifically reviewed and approved by Congress, and have a total project cost greater then $1.2 million.

Major Projects. Systems or projects are defined as major on the basis of certain criteria, one of which is a total cost between $50 to $100 million.

Major System Acquisitions (MSA). Those systems or projects which (1) have a total project cost in excess of $100 million, or (2) are of national urgency, importance, size or complexity.

Member of the Public. Persons who are not occupationally associated with the DOE facility or operations (i.e., persons whose assigned occupational duties do not require them to enter the DOE site).

Milestone. An important or critical event and/or activity that must occur in the project cycle to achieve the project objective(s).

Mission. The function of the project. The mission statement should be brief and focus on the central reason or job to be done.

Mission Need. A required capability within DOE's overall purpose, including cost and schedule considerations. When mission analyses or studies directed by appropriate executive or legislative authority identify a deficiency in existing capabilities or an opportunity, mission need is set forth as justification for system acquisition approvals, planning, programming, and budget formulation.

National Contingency Plan (NCP). Published under 311© of the Federal Water Pollution Control Act or revised pursuant to CERCLA 105.

National Environmental Policy Act (NEPA) Document. An environmental assessment, an environmental impact statement, an environmental impact statement supplement, a finding of no significant impact, a notice of intent, a record of decision, or any other documentation prepared pursuant to a NEPA requirement.

National Priorities List (NPL). A list, compiled by EPA pursuant to CERCLA 105, of the most serious uncontrolled or abandoned hazardous waste sites identified in the U.S. for possible long-term remedial action under Superfund. A site must be on the NPL to receive money from the Trust Fund for remedial action. The list is based primarily on the score a site receives from the Hazard Ranking System. EPA is required to update the NPL at least once a year.

Occupational Safety and Health Administration (OSHA). An agency of the U.S. Department of Labor, established under Public Law 91-596 with major responsibilities to promulgate, prescribe, and enforce occupational safety and health standards.

Other Project Costs (OPC). Other project or operating costs directly related to a project. Such costs may include, but are not limited to, conceptual design, special studies, and costs of training, procedures, etc., during the transition to operations.

Planning Estimates. Developed prior to conceptual design, planning estimates are order of magnitude only and have the least amount of accuracy and lowest confidence level. Care should be exercised in these estimates to assure that order of magnitude is correct, since a tendency exists to avoid changing this estimate, particularly upward.

Potentially Responsible Party (PRP). An individual or company, such as owners, operators, transporters, or generators, potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated.

Program. An organized set of activities directed toward a common purpose or goal and undertaken or proposed to support an assigned mission area. A program is characterized by a strategy for accomplishing a definite objective(s), which identifies the means of accomplishment, particularly in quantitative terms, with respect to manpower, materials, and facilities requirements. Programs are typically made up of technology base activities, projects, and supporting operations.

program management-project management plan

Program Management. Headquarters functions that include planning and developing the overall program; establishing broad priorities; providing program direction; preparing and defending the budget; controlling DOE Headquarters level milestones; integrating all components of the program; providing public and private sector policy liaison; expediting Headquarters interface activities and follow-up actions; and retaining overall accountability for program success. Field functions include implementing these program activities, controlling field-level milestones, and providing major support to the Headquarters programming and budgeting processes. Management responsibility and authority for specific projects will normally be delegated by the Cognizant Secretarial Officer.

Program Manager. An individual in an organization or activity who is responsible for management of a specific function or functions related to program management.

Project. A unique effort that supports a program mission with defined start and end points undertaken to create a unique product, facility, or system with interdependent activities planned to meet a common objective/mission.

Project Design Criteria. Those technical data and other project information developed during project identification, conceptual design, and/or preliminary design phases. They define the project scope; construction features and requirements; design parameters; applicable design codes, standards, and regulations; applicable health, safety, fire protection, safeguard, security, energy conservation, and quality assurance requirements; and other requirements. The project design criteria are normally consolidated into a document which provides the technical base for any design performed after the criteria are developed.

Project Execution Plan. A plan that defines the project and project parameters (cost, schedule, and technical) and identifies thresholds for change control and reporting. The Project Execution Plan encompasses and defines the distinct project management activities; it evolves with the project, adding sections or details to sections, as needed.

Project Management Plan (EM-60). This plan provides the details of the project organization and activities that make up the project. It is produced and approved by the appropriate DOE Field Office. Management organization and responsibilities, work breakdown structure and critical path schedule are among the items included. This plan is tailored for each project.

Project Manager. An individual assigned responsibility and authority for successfully accomplishing the goals of a project. The project manager is responsible for planning, controlling, reporting, and managing the project effort.

Project Plan (EM-60). This document provides DOE Headquarters' affordability objectives and performance standards for the Deactivation Project. It is produced jointly with the applicable DOE Field Office and approved at DOE Headquarters. Cost, schedule and performance affordability objectives are among the items included. This plan is tailored for each project and is synonymous with the Project Execution Plan described in DOE Order 4700.1.

Quality Assurance (QA). All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily and safely in service. QA includes quality control.

Quality Control (QC). Those activities that provide a means to control and measure the extent to which a structure, system, or component meets established requirements.

RCRA Facility Assessment (RFA). The RFA is a process by which regulatory agencies will investigate/assess each facility for releases of concern:

- Identify Solid Waste Management Units (SWMUs) and collect existing information on contaminant releases.
- Identify releases or suspected releases needing further investigation.

RCRA Facility Investigation (RFI). The RFI is a process which is initiated when a release(s) or suspected release(s) of material has occurred and warrants further investigation. If a release is verified, further site characterization is conducted and, when appropriate, interim corrective measures may be identified and implemented. Finally, the determination is made whether or not to proceed to a CMS.

Record of Decision (ROD). A document prepared in accordance with the requirements of 40 CFR 1505.2 that provides a concise public record of the Department's decision on a proposed action for which an EIS was prepared, identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced by the Department in making the decision, and mitigation measures and monitoring to minimize harm.

Regulatory Requirement. A requirement to have and/or perform a function at a specified level placed upon a system by a government agency authorized by law to impose such a requirement.

regulatory requirement-site development plan

Resource Conservation and Recovery Act (RCRA). A Federal law passed in 1976 that establishes a system for controlling hazardous waste from generation to disposal. RCRA provides a structure to track and regulate hazardous wastes from the time of generation to disposal and the law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent new uncontrolled hazardous waste sites, and regulates the disposal of solid waste that may not be considered hazardous. The law principally governs the management of "solid waste"and its subset, "hazardous waste."

Risk. A factor, element, constraint, or course of action on a project that introduces an uncertainty of outcome and the possibility of technical deficiencies, inadequate performance, schedule delays, or cost overruns that could impact a Departmental mission. In the evaluation of project risk, the potential impact and the probability of occurrence must be considered.

Risk Management. A management philosophy that matches resources and efforts to risk, as contrasted with compliance-based management, which dictates that functions be performed without regard for the evaluated risk factors involved. Risk-based management is the application of the graded approach to management.

Safe Drinking Water Act (SDWA). Provides for protection of public health by setting standards for water supplied for public consumption and by protecting public drinking water sources. The maximum contaminant levels developed under this Act are used in groundwater monitoring programs.

Scope. In baseline management terminology, the term scope refers to those performance and design requirements, criteria, and characteristics derived from the mission needs that provide the basis for project direction and execution. In budget terminology, the term scope refers to congressionally-approved project parameter/tasks as defined in the Congressional Project Data Sheet.

Site Development and Facility Utilization Plan (Site Development Plan). A formal written document summarizing all of the various data necessary to plan for the most effective utilization, orderly future development, and disposal of facilities at an individual site. Such planning shall be in accordance with site-related program objectives and requirements, and shall represent the consolidated views of the site management, the field organization, and the resource sponsor.

Solid Waste Management Unit (SWMU). Any unit at a facility from which hazardous constituents might migrate, irrespective of whether the unit was intended for the management of solid and/or hazardous waste. Includes, but is not limited to, container storage areas, tanks, surface impoundments, waste piles, land treatment units, landfills, incinerators, injection wells, recycling operations, miscellaneous units, and releases from such units.

Stakeholders. Those persons and/or groups of people and organizations who are affected or perceive they are affected by the DOE waste management program. Stakeholders include DOE management and employees (internal); and executive, legislative, and regulatory groups, public representatives, the general public, intervening groups, special interest groups, contractors, suppliers, and universities (external).

Strategic Systems (formerly Major Systems Acquisition). A single, stand-alone effort within a program mission area that is a primary means to advance the Department's strategic goals. Designation is determined by the Secretary based on cost, risk factors, international implications, stakeholder interest, and/or national urgency.

Superfund Amendments and Reauthorization Act (SARA). The act which in 1986 reauthorized CERCLA. SARA provided additional moneys for the cleanup program, and allowed Congress to strengthen EPA's mandate to focus on permanent cleanups at CERCLA sites, while encouraging states and federally recognized Indian tribes to actively participate as EPA partners. SARA also expanded EPA's research development and training responsibilities and enforcement authority. Changes to the CERCLA process most affected the RI/FS process.

Systems Engineering. A concurrent engineering process using a systematic approach to create a product design that considers all project mission objectives and supporting functional requirements throughout the product life cycle from conception through operations. Systems engineering is a logical sequence of steps transforming an operational need into a description of system performance parameters and a preferred system configuration.

Title I (Preliminary) Design. Continues the design effort utilizing the conceptual design and the project decision criteria as a basis for project development. Title 1 design develops topographical and subsurface data and determines the requirements and criteria that will govern the definitive design. Tasks include preparation of preliminary planning and engineering studies, preliminary drawings and outline specifications, an evaluation of alternative design approaches, life-cycle cost analysis, preliminary cost estimates, and scheduling for project completion. Preliminary design provides identification of long lead procurement items and analysis of risks associated with continued project development. For a detailed description of the services provided during preliminary design, see DOE Energy

Acquisition Regulation (DEAR) 936.605c and 952.236.70.

Title I Design Estimates. Estimates compared upon the completion of the Title I design. Through use of plant engineering and design funds, Title I may be included prior to the inclusion of the project in the budget. If this should occur, the Title I estimate becomes synonymous with the budget estimate.

Title I Design Summary. An overview and record document of preliminary engineering and project management planning, reflecting completed Title I design and usually prepared under architect-engineer services or by the project designer as part of the Title I design summary.

Title II Design. This continues the development of the project based on approved preliminary design (Title I). Definitive design includes any revisions required of the Title I effort; preparation of final working drawings, specifications, bidding documents, cost estimates, and coordination with all parties which might affect the project; development of firm construction and procurement schedules; and assistance in analyzing proposals for bids. Because the cost estimates are based on the definitive design, they are the most accurate and have the highest confidence level of any estimate. For a detailed description of the services provided during definitive design, see DEAR 936.605(c)(3) and (4) and DEAR 952.236.70.

Title III Services. Those activities required to assure that construction is conducted in accordance with the plans and specifications (e.g., construction inspection), and that the quality of materials and workmanship is consistent with the requirements of the project (e.g., materials testing). (See DEAR 936.605(c)(3) and (4) and DEAR 952.236.70.

Total Estimated Cost. Project construction costs, including the costs of land and land rights; engineering, design, and inspections costs; direct and indirect construction costs; contingency and escalation; and initial equipment necessary to place the plant or installation in operation.

Total Project Cost. Total Estimated Cost plus all other costs identifiable and related to the project, especially Other Project Costs. Total Project Cost includes such activities as pre-conceptual design, conceptual engineering, research and development, project support, design and construction, and transition to operations. For environmental restoration projects, all costs should be considered part of the Total Project Cost.

Value Engineering. A systematic approach to analyze the functions of systems, equipment, facilities, services, and supplies to achieve the lowest life cycle cost consistent with required performance, reliability, availability, quality, and safety.

APPENDIX C: ACRONYMS

A

ACWP	Actual Cost of Work Performed
ADS	Activity Data Sheet
ALO	Albuquerque Operations Office
ANL	Argonne National Laboratory
ARARs	Applicable or Relevant and Appropriate Requirements

B

BAC	Budget at Completion
BCWP	Budgeted Cost for Work Performed
BCWS	Budgeted Cost for Work Scheduled
BNL	Brookhaven National Laboratory
B&R	Budget and Reporting

C

CAA	Clean Air Act
CC	Construction Contracts
CCB	Change Control Board
CD	Consent Decree
CDR	Conceptual Design Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CM	Construction Management
CM	Corrective Measures
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
CO	Contracting Officer
COE	Corps of Engineers
COR	Contracting Officer Representative
CPAF	Cost Plus Award Fee Contract
CPFF	Cost Plus Fixed Fee Contract
CPM	Critical Path Method
CPM	Contractor Project Manager
CPR	Cost Performance Report
CSCSC	Cost and Schedule Control System Criteria
CV	Cost Variance
CWA	Clean Water Act
CWBS	Contractor WBS

D

DEAR	DOE Energy Acquisition Regulation
DNFSB	Defense Nuclear Facilities Safety Board
DOD	(U.S.) Department of Defense
DOE	(U.S.) Department of Energy
DOE HQ	(U.S.) Department of Energy Headquarters
DP	Defense Programs

E

EA	Environmental Assessment
EAC	Estimated Cost at Completion
EAG	Exposure Assessment Group
ED&I	Engineering, Design, and Inspection
EF	Early Finish
EF	Exposure Frequency
EIS	Environmental Impact Statement
EM	(Office of) Environmental Management
EMAB	Environmental Management Advisory Board
EM-10	Office of Management and Finance
EM-20	Office of Compliance & Program Coordination
EM-30	Office of Waste Management
EM-40	Office of Environment Restoration
EM-50	Office of Technology and Development
EM-60	Office of Facility Transition & Management
EPA	(U.S.) Environmental Protection Agency
ER	Energy Research
ES	Early Start
ESAAB	Energy System Acquisition Advisory Board

F

FA	Facilities Assessment
FACA	Federal Advisory Committee Act
FAR	Federal Acquisition Regulations
FAST	Functional Analysis of Systems Techniques
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FFA	Federal Facility Agreements
FFCA	Federal Facility Compliance Agreement
FFP	Firm Fixed Price
FM	Field Management

FS	Feasibility Study
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	Fiscal Year
FYWA	Fiscal Year Work Agreement

G

G&A	General and Administrative
GPP	General Plant Projects

H

HEAST	Health Effects Assessment Summary Tables
HQ	Headquarters
HRS	Hazard Ranking System
H&S	Health and Safety
HSWA	Hazardous and Solid Waste Amendment

I

IAG	Interagency Agreement
ICE	Independent Cost Estimate
INEL	Idaho National Engineering Laboratory
IPA	Independent Project Analysis (Corporation)
IRC	Information Resource Center
IROD	Interim Record of Decision

K

KD	Key Decision

L

LANL	Los Alamos National Laboratory
LF	Late Finish
LLNL	Lawrence Livermore National Laboratory
LRE	Latest Revised Estimate
LS	Late Start

M

M-CACES	Micro-Computer Aided Cost Engineering Support System
MMES	Martin Marietta Energy Systems, Inc.
M&O	Maintenance and Operation
M&O	Management and Operating
MSA	Major System Acquisition

N

NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
NRC	(U.S.) Nuclear Regulatory Commission
NVO	Nevada Operations Office

O

OBS	Organizational Breakdown Structure
OMB	Office of Management and Budget
ORNL	Oak Ridge National Laboratory
OPC	Other Project Cost
ORO	Oak Ridge Operations
OSHA	Occupational Safety and Health Administration
OTA	Office of Technology Assessment

P

PA/SI	Preliminary Assessment/Site Inspection
PA	Public Affairs
PAR	Public Affairs Representative
PC	Personal Computer
PCS	Project Control System
PEC	Performance Evaluation Criteria
PEP	Project Execution Plan
PM	Project Manager
PMD	Project Management Division
PMS	Project Management System
PRP	Potentially Responsible Party

PSAR	Preliminary Safety Analyis Report
PSWBS	Project Summary WBS
PSN	Project Summary Network
PWTF	Process Waste Treatment Facility

Q

QA	Quality Assurance
QC	Quality Control
QIT	Quality Improvement Team

R

RA	Remedial Action
RAC	Remedial Action Contractor
RAP	Remedial Action Plan
RAM	Responsibility Assignment Matrix
RAM	Reliability, Availability, and Maintainability Analyses
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
R&D	Research & Development
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
RLO	Richland Operations Office
ROD	Record of Decision
RPM	Remedial Project Manager
RRA	Roles, Responsibilities, and Lines of Authority

S

SARA	Superfund Amendments and Reauthorization Act
SCEES	Superfund Cost Estimating Expense System
SDWA	Safe Drinking Water Act
SI	Site Inspection
S&M	Surveillance and Maintenance
SNL	Sandia National Laboratories
SOW	Scope of Work
Sq. ft	Square Foot (Feet)
SRD	Systems Requirements Document
S/RID	Standards/Requirements Identification Document

SRO	Savannah River Operations Office
SSAB	Site Specific Advisory Board
SV	Schedule Variance
SWMU	Solid Waste Management Unit

T

TAB	Total Allocated Budget
TEC	Total Estimated Cost
TPC	Total Project Cost
TRC	Technical Review Committee
TSCA	Toxic Substances Control Act

U

UMTRA	Uranium Mill Tailings Remediation Action Project
UMTRAP	Uranium Mill Tailings Remedial Action Program

V

VAC	Variance at Completion
VE	Value Engineering

APPENDIX D: INDEX

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