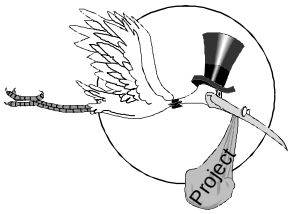
Section 1.4



Life Cycle of Environmental Restoration Projects/ Lessons Learned

1

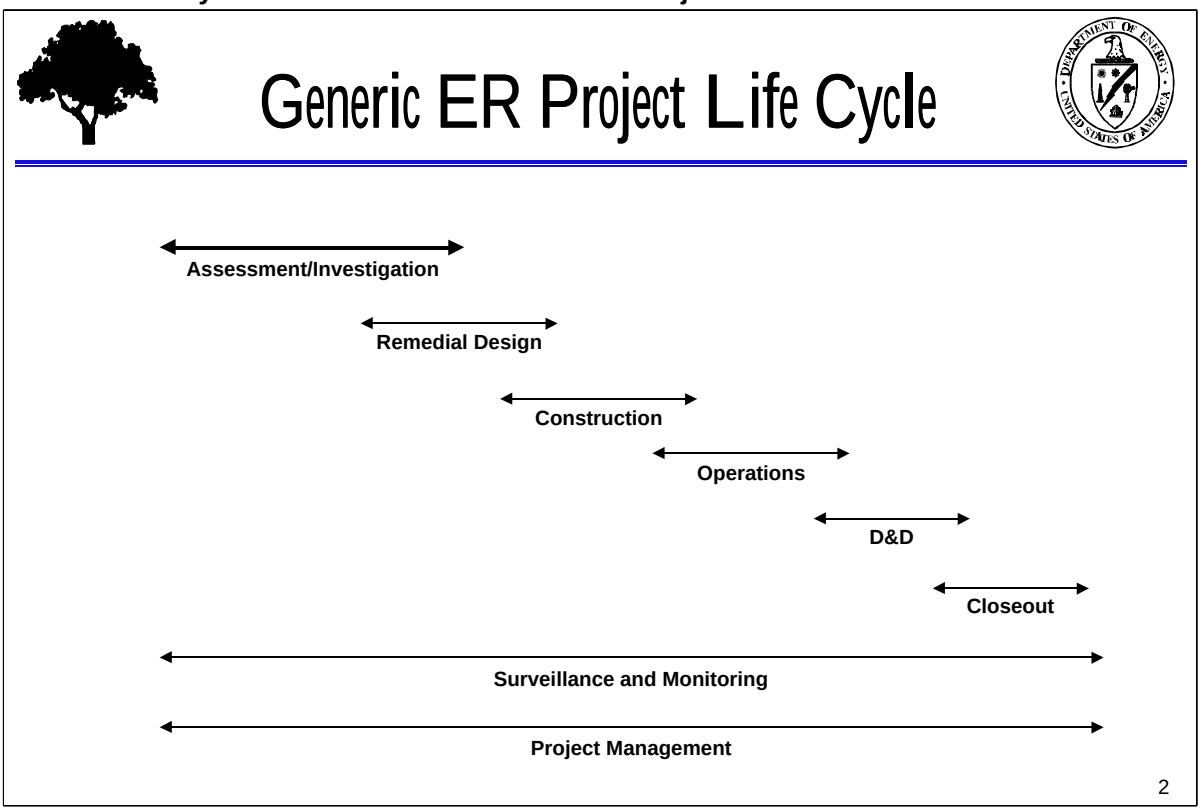
The Life-Cycle Cost Good Practice Guide, GPG-FM-032, defines life-cycle cost as the sum total of all direct, indirect, recurring, nonrecurring, and other related costs incurred or estimated to be incurred in the design, development, production, operation, maintenance, and support of an asset throughout its expected useful life span and through final disposition. Operating revenues such as user fees, salvage receipts, or power revenues should be included as an offset to cost, if they are incidental to the project's mission (e.g., a production reactor might incidentally produce and sell electric power).

Refurbishment and restoration costs should be included in a life-cycle cost estimate if existing sites or facilities are used.

This section will describe the life cycle of Environmental Restoration Projects, life-cycle estimating, and how the two topics relate.

Notes / Discussion Points / Lessons Learned: _____

Section 1.4: Life Cycle of Environmental Restoration Projects/Lessons Learned



The diagram portrays the ER Project Life Cycle and relates it to critical decisions, DOE project phases, ER phases, and key ER deliverables.

- These are the general phases of the project life cycle. Not all projects will have all of these phases.

- Generic life cycle is applicable to both CERCLA-based and RCRA-based work. RCRA terminology is a little different than the CERCLA terms used in the slide. Comparison of CERCLA and RCRA phases are shown on Page 7.

Notes / Discussion Points / Lessons Learned: _____

Project Life-Cycle Cost Estimating

- **Development of cost estimates overlaps project life-cycle planning**
- **Cost estimates become more detailed as projects progress**

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Discussion Leader/Facilitator Notes: Refer to the life-cycle chart when discussing this slide.

- As a DOE project manager, you will likely see more than one cost estimate and schedule for any particular project you manage because the development and analysis of cost estimates and schedules is iterative. Estimates and schedules are revised or refined as more information becomes available or as internal and/or external forces (e.g., availability of funds) warrant.

- Every project — regardless of its stage in the project life cycle — will have some sort of cost estimate attached. Even the inception of projects will likely have some rough, order-of-magnitude-type estimate (e.g., the project will cost $5 million and, assuming that it begins in fiscal year 1996, will take 2 years to complete).

Notes / Discussion Points / Lessons Learned: _____

Project Life-Cycle Cost Estimating

- **Cost estimates reflect the total direct and indirect, recurring and nonrecurring costs**
- **They may address one or more of the major phases of a project**
- **They encompass all costs over the expected life span of the project**
- **They are iterative in nature**

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Discussion Leader/Facilitator Notes: An example of a Life-Cycle Dictionary is provided in Appendix B.

- Life-cycle cost estimates evaluate the total direct and indirect, recurring and nonrecurring costs.
- Life-cycle estimates encompass all project costs (i.e., a CERCLA/RCRA project would include remedial design, construction, operation, deactivation and disposition, close out, surveillance and monitoring, and project management **over the expected life span of the project**, including postclosure and verification activities).
- DOE project managers are required to develop a life-cycle cost estimate at the outset of all projects.
- A life-cycle project cost estimate is required for every future work scope at each point where a critical decision/scope change will affect life-cycle cost.

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Notes / Discussion Points / Lessons Learned: _____

- Current working estimates reflect the following:
  - The latest cost and design data available,
  - Estimated costs to complete, and
  - Allowance for contingency based on current detailed risk analysis.
- Revised estimates are incorporated into the cost baseline through prescribed change control procedures.

Notes / Discussion Points / Lessons Learned: _____

Project Life-Cycle Cost Estimating

Why is Life-Cycle Cost-Estimating Important?

- **It forecasts future project costs**
- **It forecasts future resource needs**
- **It influences decision-making**
- **It supports strategic planning/budgeting**
- **It is comprehensive**

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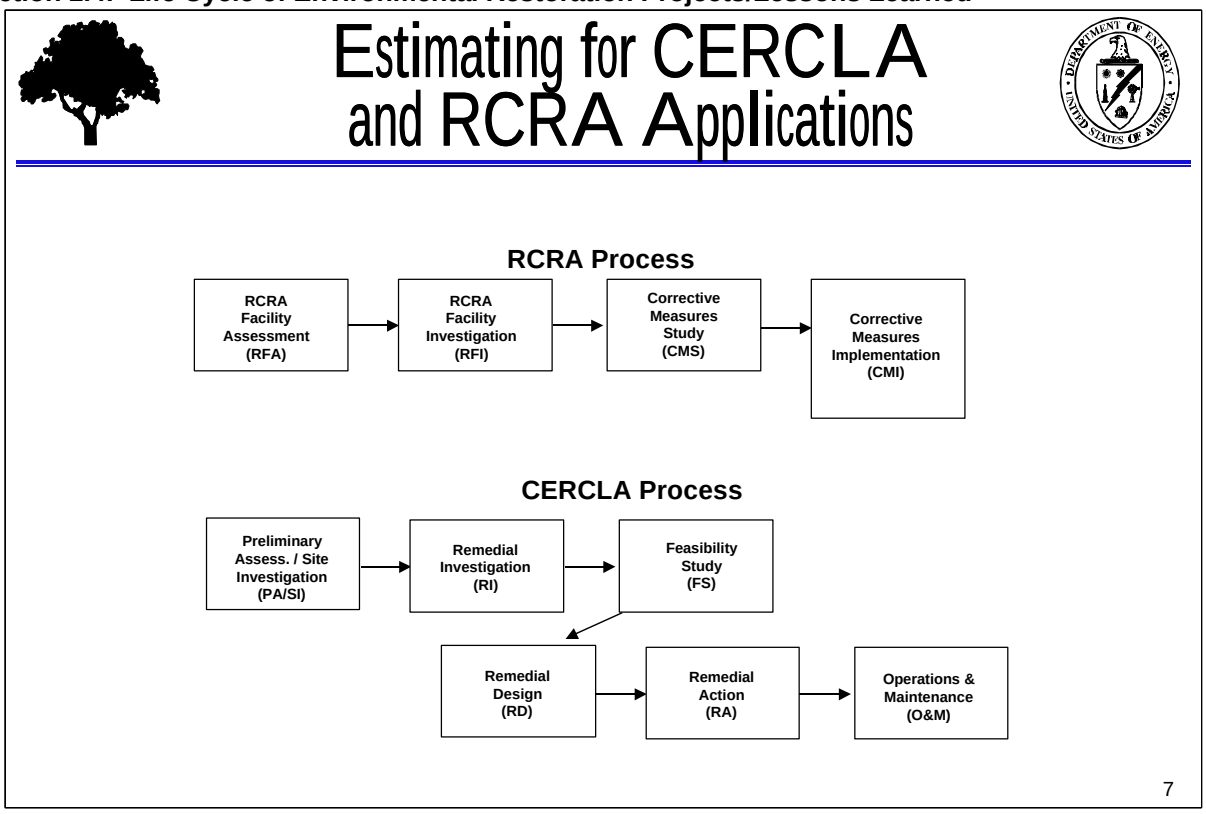
- Limitations of life-cycle costing include the following:
  - The degree of accuracy has a broad range early in the life of a project.
  - The high cost to perform the life-cycle cost analysis may make use of this estimating approach inappropriate for some projects.
  - It is highly sensitive to changing requirements.

- Common errors of project life-cycle costing include the following:
  - Omission of data
  - Lack of a systematic structure or analysis
  - Misinterpretation of data
  - Faulty or misused estimating techniques
  - A concentration on wrong or insignificant facts
  - Failure to assess uncertainty
  - Failure to check work
  - Estimating the wrong items
  - Using incorrect or inconsistent escalation data

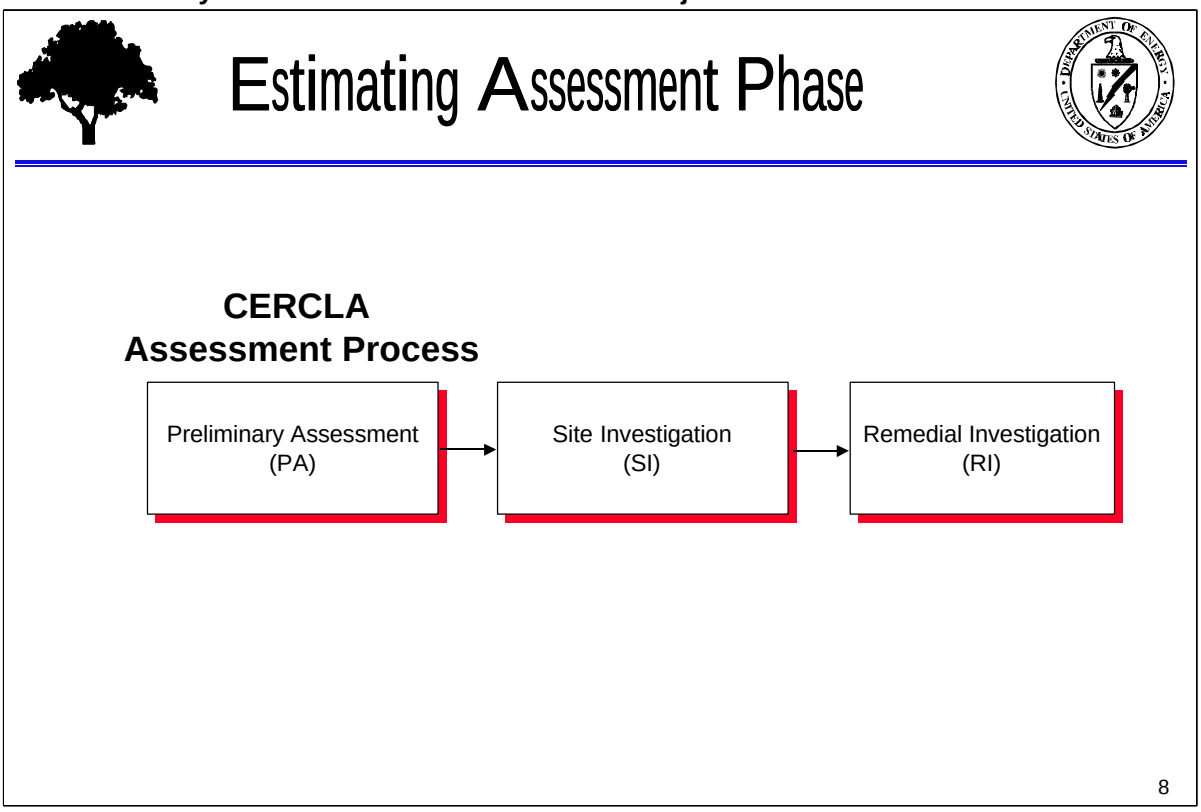
Notes / Discussion Points / Lessons Learned: _____



- Environmental Restoration estimates should be developed using a structure that compliments the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA) program phase divisions.

- The use of a standardized Hazardous, Toxic, and Radiological Waste (HTRW) Work Breakdown Structure (WBS) compliments the required phases of remediation activities and enhances the consistency of estimate development across the complex.

Notes / Discussion Points / Lessons Learned: _____



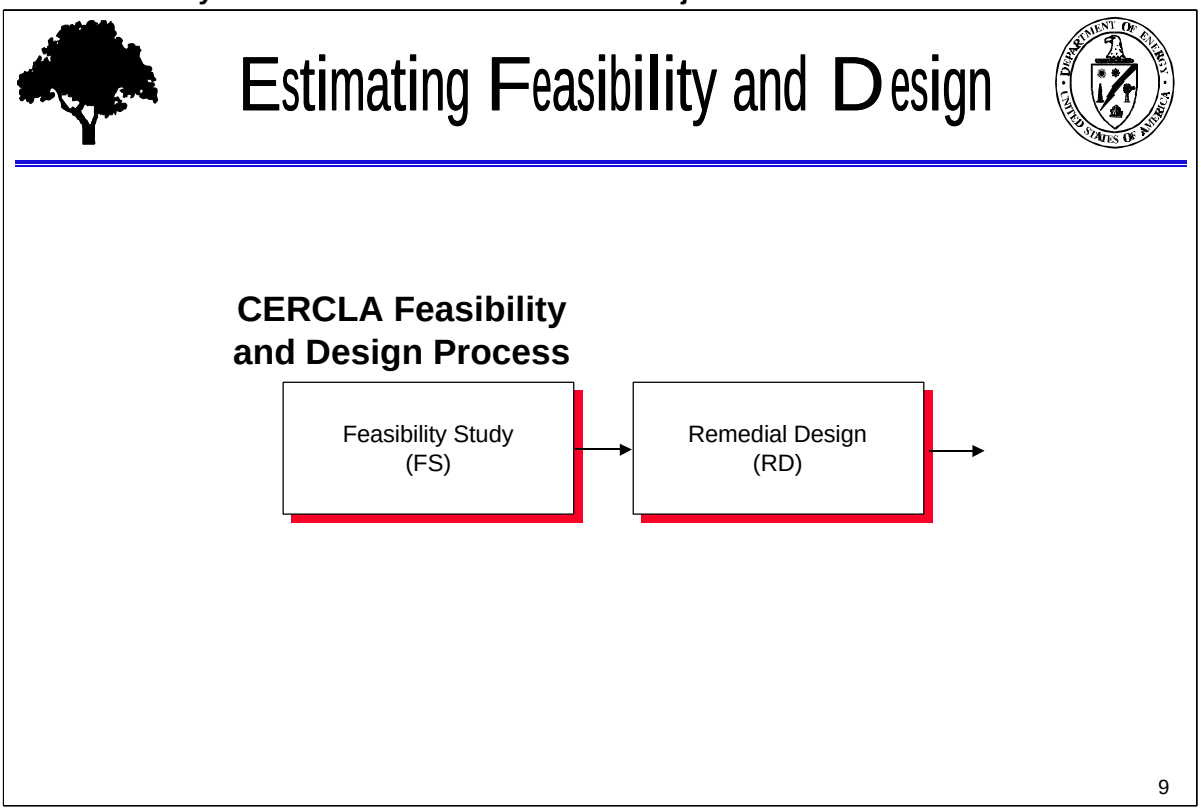
Discussion Leader/Facilitator Notes: Estimate types such as order-of-magnitude or planning estimates are developed with limited project scope definition. A preliminary estimate is developed using preliminary scope information. A definitive or detailed estimate is prepared using well-defined scope information. (See Section 1.5, Types of Cost Estimates).

- During the preliminary assessment phase, information is gathered on the types and amount of contamination expected at a project site.

- The life-cycle project estimate in this phase of the project will usually be a planning/order-of-magnitude estimate (see Section 1.5, Types of Cost Estimates) based on assumed future scope/schedule. A planning estimate is completed with limited project scope definition and assists in the preliminary evaluation and planning of the project. The basis for the planning estimate is very limited because a large amount of information is unknown and/or highly uncertain.

- A more detailed (definitive) estimate for the assessment phase can be completed after some basic information is available from a preliminary assessment or site inspection. This information may also provide better definition for total project costs. However, even though a detailed estimate may be prepared for the assessment phase, the entire project life-cycle estimate will probably remain planning/order-of-magnitude or possibly preliminary (see Section 1.5, Types of Cost Estimates).

Notes / Discussion Points / Lessons Learned: _____

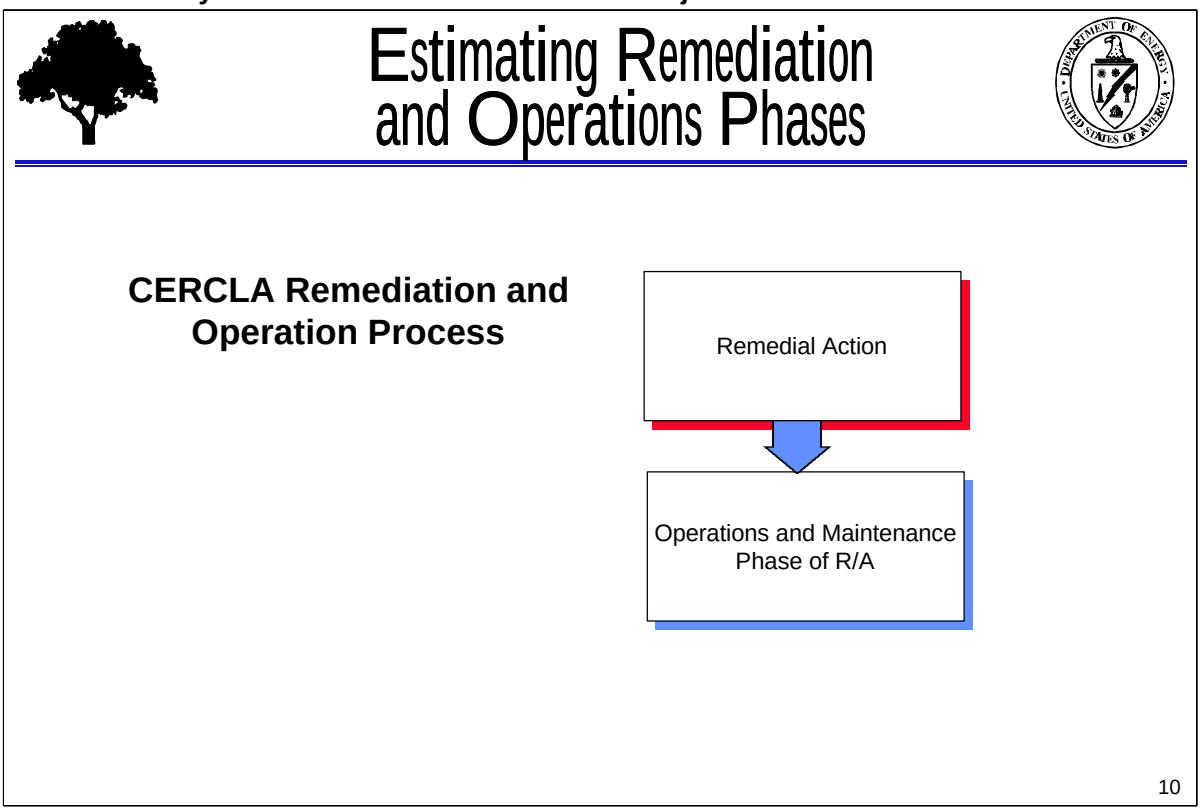


- The feasibility study requires that evaluation of cost be considered in analysis and selection of remediation alternates. Feasibility estimates are prepared on each proposed remediation alternative. By EPA guidance, the CERCLA Feasibility Study estimates shall have an accuracy of at least +50% to -30%. This is an order-of-magnitude estimate. These estimates perform two functions: (1) they present a total project life-cycle cost for each alternative being considered, and (2) they provide a logical, traceable framework for comparing alternatives.

- After a remediation alternative is selected and the project moves into the design phase, life-cycle estimates are usually prepared throughout the design phases as part of the 30%, 60%, and 90% design packages.

- At the end of remedial design, a detailed estimate is prepared for remediation and all other subsequent/concurrent project phase. This may be the government estimate if the work is subcontracted. If the work is not subcontracted, the estimate shall be of sufficient detail that it can be used as the project control tool for performance measurement.

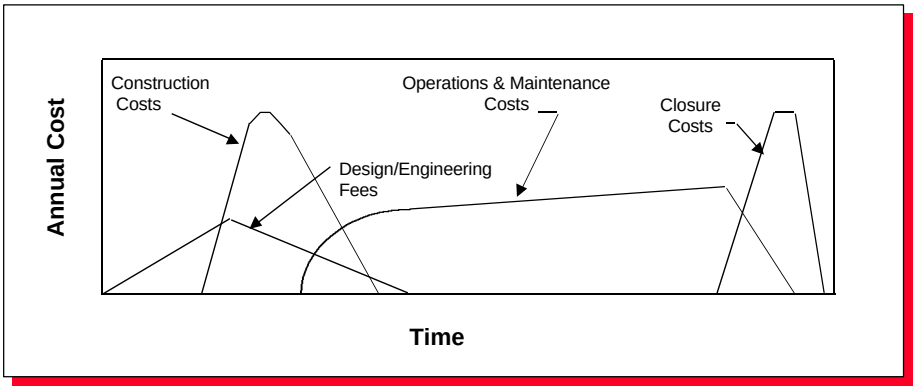
Notes / Discussion Points / Lessons Learned: _____



- The Remediation Phase of the project includes the final detailed design of selected remediation technology. This phase includes writing the Site Safety Health Plan, obtaining all site/work permits, and all other activities necessary to begin construction.
- Mobilization of construction crews, construction equipment, engineered equipment, and the physical construction of the plant necessary to support selected remediation activities are also included in the remediation phase.
- At this phase of the project, estimates are detailed and baselined and used to monitor and control execution of the remediation.
- Remediation also includes all start-up activities to ensure that constructed facilities are functional and acceptable for operation and maintenance.
- The Operations and Maintenance Phase of R/A includes the materials and labor necessary to operate the Environmental Restoration remediation systems. This phase includes facility operations, preventative maintenance, and maintenance not requiring a cost project to implement.
- Operations also includes any routine and nonroutine maintenance activities and process enhancements that cost project to implement and complete.

Notes / Discussion Points / Lessons Learned: _____

Life-Cycle Costs



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- A project's life cycle extends from the Concept Phase through the Close-Out Phase, and, as applicable, includes separate costs estimates for each major project phase.
- DOE Order 430.1, *Life-Cycle Asset Management*, requires that DOE program/project managers use a systems engineering approach to project planning and execution. A key component to the systems engineering approach is to provide the technical solutions to functional requirements that minimize costs over the life of the project. The purpose of doing life-cycle cost estimates is the same: find the least costly alternative over the life of the project. As was stated earlier, operations, maintenance, and decontamination and decommissioning should be considered when evaluating all design alternatives.

Note:
Life-cycle costs include the decontamination, decommissioning, and restoration costs.

Notes / Discussion Points / Lessons Learned: _____

Project Life-Cycle Cost-Estimating Summary

- **Cost estimates serve as backup documentation and justification for baselines.**
- **Life-cycle project estimating constitutes the major effort necessary to ensure that a project cost is complete and comprehensive.**
- **The cost planning is for the life of the project rather than for an arbitrary time span.**

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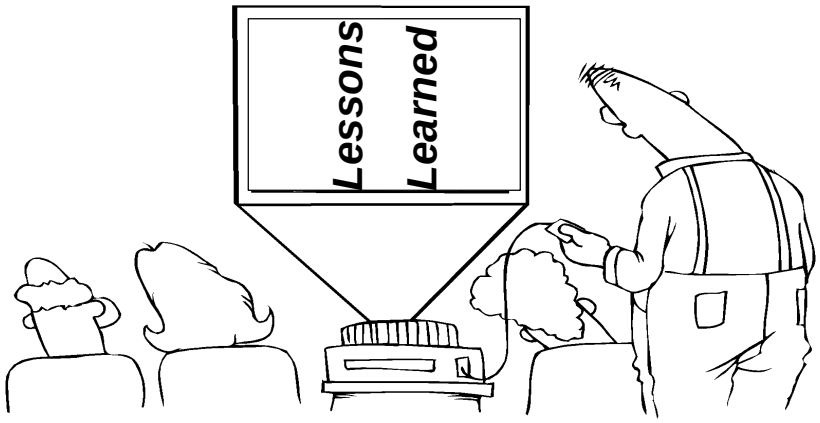
Notes / Discussion Points / Lessons Learned:

Lessons Learned



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1. Common errors of project life-cycle costing include the following:
   - Omission of data
   - Lack of a systematic structure or analysis
   - Misinterpretation of data
   - Wrong or misused estimating techniques
   - A concentration on wrong or insignificant facts
   - Failure to assess uncertainty
   - Failure to check work
   - Estimating the wrong items
   - Using incorrect or inconsistent escalation data

   What other errors have you encountered?

2. What was done to alleviate these errors?

3. How are problems/errors such as these addressed when they are learned?

4. What if the error was made long ago?

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Notes / Discussion Points / Lessons Learned: _____

5. What steps are being taken to ensure that similar mistakes do not occur?

6. Is there any confusion in what the life cycle of a project includes and how cost-estimating should be performed?

7. Has the new Life-Cycle DOE Order confused or helped clarify things?

   Are there places where improvements could be made?

8. Does anyone have problems or issues that arise in moving through the cycles of a project?

   Is it clear when you transition from one phase to the other?

   How do you document those changes?

   What parameters or changes do you make to the data or techniques and methods?

   When do you transition to the next phase?

9. What problems have been experienced in defining what the project life should be? What is the "useful life span?"

10. How does the cost estimate ensure that life-cycle items such as user fees, salvage receipts, and power revenues are included?

11. How is long-term surveillance/maintenance addressed? What is a better approach?

12. Are life cycle cost estimates always required? When should they not be required? Are they always generated? If not, why?

Notes / Discussion Points / Lessons Learned: _____