

DOE G 430.1-1

03-28-97

COST ESTIMATING

GUIDE



U.S. DEPARTMENT OF ENERGY
Associate Deputy Secretary for Field Management

Distribution:
All Departmental Elements

Initiated By:
Associate Deputy Secretary
for Field Management

CONTENTS

LIST OF FIGURES	xvii
LIST OF TABLES	xviii
ACRONYMS AND ABBREVIATIONS	xxi

CHAPTER 1 - INTRODUCTION

1. PURPOSE	1-1
2. BACKGROUND	1-1
3. COST ESTIMATING AND THE PROGRAM/PROJECT MANAGEMENT SYSTEM	1-2

CHAPTER 2 - COST ESTIMATION PACKAGE

1. INTRODUCTION	2-1
2. BEGINNING THE PACKAGE	2-1
3. TECHNICAL SCOPE	2-2
4. COST ESTIMATE	2-2
5. SCHEDULE	2-3
6. DOCUMENTING THE COST ESTIMATION PACKAGE	2-3

CHAPTER 3 - STAGES OF PROJECT DEVELOPMENT

1. INTRODUCTION	3-1
2. RELATIONSHIP OF STAGES OF DEVELOPMENT TO TYPES OF ESTIMATES	3-1
A. Study Stage	3-2
B. Design Stage	3-3
C. Implementation Stage	3-3
D. EM and Conventional Construction Stages	3-3
3. NATIONAL ENVIRONMENTAL POLICY ACT ACTIVITIES	3-3
A. Environmental Assessments	3-4
B. Environmental Impact Statements	3-4
4. STUDY PHASE ACTIVITIES	3-5
A. Pre-Title I Activities	3-6
B. Assessment - Environmental Management	3-6
1. Comprehensive Environmental Response Compensation and Liability Act (CERCLA): Preliminary Assessment/Site Inspection	3-6
2. Resource Conservation and Recovery Act (RCRA): Facility Assessmenß-7	3-7
5. DESIGN ACTIVITIES	3-7
A. Conventional Construction	3-7
1. Title I (Preliminary) Design	3-8

CONTENTS (continued)

2. Title II (Detailed) Design	3-8
B. Environmental Management	3-9
1. CERCLA: Remedial Investigation/Feasibility Study	3-9
2. RCRA Facility Investigation/Corrective Measures Study	3-10
C. Cleanup	3-11
6. IMPLEMENTATION OF DESIGN	3-12
A. Conventional Construction	3-12
B. Environmental Management	3-12
C. Cleanup	3-12
7. PROJECT SUPPORT ACTIVITIES	3-13
A. Project Management	3-13
B. Construction Management	3-15
C. Construction Management for Environmental Management Projects	3-15
D. Project Support	3-16
E. Startup	3-16
F. Construction Engineering	3-16
G. Program Management	3-18
H. Program Support	3-18
I. Activity Management	3-18
J. Environmental Restoration Management Contractor	3-19

CHAPTER 4 - TYPES OF COST ESTIMATES

1. INTRODUCTION	4-1
2. CONSTRUCTION ESTIMATES	4-1
A. Planning/Feasibility Study Estimate	4-2
B. Budget or Conceptual Design Estimates	4-3
C. Title I Design Estimate	4-4
D. Title II Design Estimates	4-5
3. ENVIRONMENTAL RESTORATION ESTIMATES	4-6
A. Assessment Phase	4-6
1. Planning Estimate	4-7
2. Preliminary Estimate	4-7
3. Detailed Estimate	4-7
B. Cleanup Phase	4-8
1. Planning Estimate	4-8
2. Feasibility Estimate	4-8
3. Preliminary Estimate	4-9
4. Detailed Estimates	4-9
4. OTHER ESTIMATES	4-9
A. Government Estimate	4-9
B. Estimates for Minor Projects	4-11

CONTENTS (continued)

C. Current Working Estimates	4-11
D. Independent Cost Estimate	4-11
E. Bilateral (Two-Party) Estimate	4-12
F. Performance versus Forecast	4-12

CHAPTER 5 - COST CODES AND THE WORK BREAKDOWN STRUCTURE

1. INTRODUCTION	5-1
2. DEFINITIONS	5-1
A. Work Breakdown Structure	5-1
B. Code of Accounts	5-1
3. PURPOSE OF SYSTEMS	5-1
A. Work Breakdown Structure	5-3
B. Code of Accounts	5-3
4. INTERFACE OF SYSTEMS	5-3
5. THE WORK BREAKDOWN STRUCTURE	5-4
A. Fundamental Structure of a Work Breakdown Structure	5-4
B. Preparing a Work Breakdown Structure	5-6
1. Understanding of the Scope	5-6
2. Defining the Levels and Elements	5-6
3. Use of the Work Breakdown Structure	5-6
4. Updating the Work Breakdown Structure	5-7
6. THE COST CODE SYSTEM	5-7
Fundamental Structure of a Cost Code System	5-7
7. INTERFACE BETWEEN ASSET TYPES AND CODE OF ACCOUNTS	5-7

CHAPTER 6 - PROJECT FUNCTIONS AND ACTIVITIES DEFINITIONS FOR TOTAL PROJECT COST

1. INTRODUCTION	6-1
2. DEFINITIONS	6-1
A. Total Estimated Cost	6-1
B. Other Project Costs	6-2
C. Total Project Cost	6-2
3. DISCUSSION OF CHARTS	6-2
A. Different Phases of Project Development	6-2
B. Different Functions of Total Estimated Cost and Other Project Cost	6-3
1. Total Estimated Cost	6-3
2. Other Project Cost	6-3
4. COST ALLOCATIONS	6-4
A. Plant and Capital Equipment (PACE) Fund	6-4
B. Operating Expense Fund	6-4

CONTENTS (continued)

C. Usage	6-4
----------------	-----

CHAPTER 7 - DIRECT/INDIRECT COSTS

1. INTRODUCTION	7-1
2. DEFINITIONS	7-1
A. U. S. Department of Energy	7-1
B. American Association of Cost Engineers	7-1
C. Table of Indirect/Direct Costs	7-2
D. Type of Contract Cost Considerations	7-2

CHAPTER 8 - STARTUP COSTS

1. INTRODUCTION	8-1
2. DEFINITION OF STARTUP	8-1
A. Conventional Projects	8-1
B. Environmental Projects	8-1
3. STARTUP COMPONENTS	8-2
A. Startup Transition Plan	8-2
B. Startup Organization	8-2
C. Operating and Maintenance Procedures	8-2
D. Spare Parts Inventory and Training	8-2
E. Testing	8-2
4. ESTIMATING GUIDANCE FOR STARTUP COSTS	8-3

CHAPTER 9 - OPERATING COSTS

1. INTRODUCTION	9-1
2. OPERATING COSTS FOR CONVENTIONAL CONSTRUCTION PROJECTS	9-1
A. Capital Recovery	9-1
B. Utility Costs	9-1
C. Labor Costs	9-2
D. Maintenance	9-2
E. Support Services	9-2
F. Environmental Compliance/Permit Costs	9-3
G. Downtime Allowance	9-3
3. OPERATING COSTS FOR ENVIRONMENTAL REMEDIATION AND RESTORATION PROJECTS	9-3
A. Capital Recovery	9-3
B. Utilities	9-3
C. Labor Costs	9-4
D. Maintenance	9-4

CONTENTS (continued)

E. Support Services	9-5
F. Downtime Allowance	9-5
G. Special Environmental Remediation/Restoration Project Costs	9-5

CHAPTER 10 - ESCALATION

1. INTRODUCTION	10-1
2. EXAMPLE OF USE OF ESCALATION	10-1
3. ESCALATION RELATIONSHIPS	10-4
A. Historical Escalation	10-4
B. Predictive Escalation	10-4
C. Escalation Application	10-4
4. ESCALATION INDICES	10-5
A. Developing Escalation Indices	10-5
B. Escalation Indices Published by DOE	10-5
5. USE OF DOE ESCALATION INDICES	10-5
A. How to Select an Index	10-5
B. How to Apply an Index	10-6
C. Limitations	10-6

CHAPTER 11 - CONTINGENCY

1. INTRODUCTION	11-1
2. CONTINGENCY DEFINITIONS	11-1
A. General Contingency	11-1
B. Buried Contingencies	11-2
3. SPECIFICATIONS FOR CONTINGENCY ANALYSIS	11-2
A. Construction Projects	11-3
1. Project Complexity	11-3
2. Design Completeness or Status	11-4
3. Market Conditions	11-4
4. Special Conditions	11-5
B. Environmental Restoration Projects	11-7
1. Assessment Phase	11-7
2. Remediation/Cleanup Phase	11-8
C. Contingency Tools - Monte Carlo Analyses Methodology	11-9

CHAPTER 12 - THE SCHEDULE

1. INTRODUCTION	12-1
2. SCHEDULE ELEMENTS/BASIC REQUIREMENTS	12-1
A. Activities	12-1

CONTENTS (continued)

B.	Durations	12-1
C.	Sequence	12-1
D.	Critical Path	12-2
3.	SCHEDULE PORTRAYAL	12-2
A.	Bar Chart	12-2
B.	List	12-2
C.	Network	12-2
D.	Programmed Evaluation and Review Technique	12-2
4.	KEY DECISIONS	12-3
A.	Key Decision 0 (KD-0) - Approval of Mission Need	12-3
B.	Key Decision 1 (KD-1) - Approval of New Start	12-4
C.	Key Decision 2 (KD-2) - Approval to Commence Title II, or Final/Detailed Design	12-4
D.	Key Decision 3 (KD-3) - Approval to Commence Construction or Enter Full- Scale Development	12-5
E.	Key Decision 4 (KD-4) - Approval to Commence Operation/Production ..	12-5
5.	FUNDING PROFILE	12-5
A.	Definition	12-5
B.	Developing Costs for the Activities	12-6
6.	BUDGETARY CONSIDERATIONS	12-6

CHAPTER 13 - CHECK ESTIMATES AND INDEPENDENT COST

1.	INTRODUCTION	13-1
2.	CHECK ESTIMATES	13-1
A.	General Definitions	13-1
B.	Check Estimate Procedures	13-1
1.	Review Background Data and Conditions	13-2
2.	Review Check Estimate Coverage and Scope	13-2
3.	Evaluate the Estimate Methodology	13-2
4.	Identify Uncertainties	13-2
5.	Complete Estimate Review Checklist	13-2
3.	INDEPENDENT COST ESTIMATES	13-2
A.	General Definition	13-2
B.	Independent Cost Estimate Types	13-3
1.	Documentation Review (Type I)	13-3
2.	Reasonableness Review (Type II)	13-3
3.	Parametric Estimating Technique (Type III)	13-3
4.	Sampling Technique (Type IV)	13-4
5.	Bottoms-up Estimating Technique (Type V)	13-4
6.	Independent Cost Estimate Content	13-4
4.	DOUBLE CHECKING THE ESTIMATE	13-5

CONTENTS (continued)

CHAPTER 14 - PROJECT CONTROLS

1.	INTRODUCTION	14-1
2.	COST ESTIMATION PACKAGE USAGE BY PROJECT CONTROLS	14-1
A.	Technical Scope	14-1
B.	Schedule	14-1
C.	Work Breakdown Structure	14-2

CHAPTER 15 - ESTIMATING METHODS

1.	INTRODUCTION	15-1
2.	ESTIMATING METHODS	15-1
A.	Bottoms-Up Technique	15-1
B.	Specific Analogy Technique	15-1
C.	Parametric Technique	15-2
D.	Cost Review and Update Technique	15-2
E.	Trend Analysis Technique	15-2
F.	Expert Opinion Technique	15-2
3.	DATA COLLECTION AND NORMALIZATION	15-2
4.	HOW TO ESTIMATE DIRECT COSTS	15-3
A.	Material Takeoff	15-3
B.	Pricing the Material and Equipment	15-3
C.	Construction Equipment	15-3
D.	Labor	15-4
E.	Special Conditions	15-4
F.	Government Furnished Equipment	15-5
G.	Sampling and Analysis Costs	15-5
H.	Transportation and Waste Disposal	15-5
I.	Environmental Management Considerations	15-5
5.	HOW TO ESTIMATE INDIRECT COSTS	15-6
A.	Each Indirect Cost Account	15-6
B.	Percentage	15-6
C.	Government Furnished Equipment	15-7
D.	Special Considerations	15-7
6.	GUIDELINES FOR MANAGEMENT COSTS	15-8
A.	Construction Management	15-8
B.	Project Management	15-8
C.	Construction Coordination	15-8
D.	Quality Engineering	15-8
E.	Health and Safety	15-9
F.	Environmental Restoration Management Contractor	15-9

CONTENTS (continued)

G. Program Management	15-9
-----------------------------	------

CHAPTER 16 - EXAMPLE COST CODES FOR CONSTRUCTION PROJECTS

1. INTRODUCTION	16-1
2. OUTLINE OF THE LEVEL 1 COST CODES FOR CONSTRUCTION PROJECTS	16-1
A. Land and Land Rights (400)	16-2
B. Improvements to Land (460)	16-2
C. Buildings (501)	16-2
D. Other Structures (550)	16-2
E. Utilities (600)	16-3
F. Special Equipment/Process Systems (700)	16-3
G. Improvements for Others (800)	16-3
H. Demolition (810)	16-3
I. Tunneling (820)	16-3
J. Drilling (830)	16-4
K. Standard Equipment (860)	16-4
3. OUTLINE OF LEVEL 1 AND LEVEL 2 COST CODES	16-4
4. DESCRIPTION OF LEVEL 2 COST CODES	16-7
A. 400 Land and Land Rights	16-7
1. 4010 Land	16-7
2. 4020 Land Rights	16-8
3. 4030 Minerals	16-8
4. 4040 Timber	16-8
B. 460 Improvements to Land	16-8
1. 4601 Site Preparation	16-8
2. 4602 Drainage	16-9
3. 4603 Landscaping	16-10
4. 4605 Railroads	16-10
5. 4606 Port Facilities	16-11
6. 4700 Roads, Walks, and Paved Areas	16-12
7. 4800 Fences and Guard Towers	16-13
8. 4900 Other Improvements to Land	16-13
C. 501 Buildings	16-13
1. 5011 Excavation and Backfill	16-13
2. 5012 Concrete	16-14
3. 5013 Masonry	16-15
4. 5014 Metals	16-16
5. 5015 Wood and Plastic	16-17
6. 5016 Finishes	16-18
7. 5017 Special Construction	16-21

CONTENTS (continued)

8.	5018 Mechanical	16-22
9.	5019 Electrical	16-24
D.	550 Other Structures	16-27
1.	5501 Excavation and Backfill	16-27
2.	5502 Concrete	16-27
3.	5503 Masonry	16-27
4.	5504 Metals	16-27
5.	5505 Wood and Plastic	16-27
6.	5506 Thermal and Moisture Protection	16-27
7.	5507 Special Construction	16-29
8.	5508 Mechanical	16-29
9.	5509 Electrical	16-30
E.	600 Utilities	16-30
1.	6100 Communications Systems	16-30
2.	6150 Electric Transmission and Distribution Systems	16-30
3.	6210 Alarm Systems	16-30
4.	6250 Gas Transmission and Distribution Systems	16-30
5.	6300 Irrigation Systems	16-30
6.	6400 Sewerage Systems	16-31
7.	6450 Steam Generation and Distribution Systems	16-31
8.	6500 Water Supply, Pumping, Treatment, and Distribution Systems	16-31
9.	6600 Oil Piping and Distribution System	16-31
10.	6900 Other Utilities	16-31
F.	700 Special Equipment/Process Systems	16-31
1.	7010 Vessels	16-31
2.	7020 Heat Transfer	16-31
3.	7030 Mechanical Equipment	16-32
4.	7040 Package Units	16-32
5.	7050 Process Piping	16-32
6.	7060 Electrical	16-32
7.	7065 Instrumentation	16-32
8.	7070 Protective Cover	16-32
9.	7080 Reactor Components	16-32
G.	800 Improvements for Others	16-33
H.	810 Demolition	16-33
I.	820 Tunneling	16-33
J.	830 Drilling	16-33
K.	860 Standard Equipment	16-34
1.	8610 Heavy, Mobile Equipment	16-34
2.	8615 Hospital and Medical Equipment	16-34
3.	8620 Laboratory Equipment	16-34
4.	8625 Motor Vehicles and Aircraft	16-34

CONTENTS (continued)

5.	8630 Office Furniture and Equipment	16-34
6.	8635 Process Equipment (for Mfgr.)	16-34
7.	8640 Railroad Rolling Stock	16-35
8.	8645 Reactors and Accelerators	16-35
9.	8650 Portable Security and Protection Equipment	16-35
10.	8655 Shop Equipment	16-35
11.	8660 Reserve Construction Equipment Pool	16-35
12.	8670 Automatic Data Processing (ADP) Equipment	16-35
	13. 8699 Miscellaneous Equipment	16-36
5.	INDIRECT CONSTRUCTION COSTS	16-36
A.	Engineering, Design, and Inspection (ED&I)	16-36
1.	Surveys, Geological Studies, and Tests	16-36
2.	Preliminary Work	16-36
3.	Design	16-36
4.	Consulting Services	16-37
5.	Design of Specialized Equipment	16-37
6.	Expediting or Procurement	16-37
7.	Inspection	16-37
8.	Miscellaneous	16-37
B.	General and Administrative	16-37
1.	Administration	16-37
2.	Superintendence	16-38
3.	Construction Contractor's Engineering	16-38
4.	Accounting	16-38
5.	Procurement	16-38
6.	Personnel	16-38
7.	Legal	16-38
8.	Security	16-38
9.	Office Supplies and Expenses	16-39
C.	Other Indirect	16-39
1.	Payroll Insurance	16-39
2.	Insurance	16-39
3.	Damages not Covered by Insurance	16-39
4.	Payroll Taxes	16-39
5.	Taxes Other Than Payroll	16-39
6.	Holiday and Vacation Pay	16-39
7.	Signup and Termination Pay	16-40
8.	Retroactive Pay	16-40
9.	Reporting Time	16-40
10.	Welding Tests	16-40
11.	Contribution to Welfare Plans	16-40
12.	Transportation of Workers	16-40

CONTENTS (continued)

13. Motor Pool Operations	16-40
14. Aircraft Operation	16-40
15. Medical and First Aid	16-41
16. Safety	16-41
17. Fire Protection	16-41
18. Maintenance of General Construction Plant	16-41
19. Small Tools	16-41
20. Drinking Water and Sanitation	16-41
21. Light and Power	16-41
22. Heat	16-41
23. Compressed Air	16-42
24. Water	16-42
25. General Cleanup	16-42
26. Camp Operation	16-42
27. Camp Operation Costs	16-42
28. Camp Revenues	16-42
29. Recovery of Indirect Costs	16-42
30. Contract Fee	16-42
CHAPTER 17 - EXAMPLE OF ENVIRONMENTAL RESTORATION CODE OF ACCOUNTS	
1. INTRODUCTION	17-1
2. FUNDAMENTAL STRUCTURE OF THE REMEDIATION COST	17-1
3. LEVEL 1 COST CODES FOR REMEDIATION, LIST AND DESCRIPTION .	17-2
A. Preliminary Assessment (100)	17-2
B. Site Inspection (200)	17-2
C. Remedial Investigation (300)	17-2
D. Feasibility Study (400)	17-3
E. Remedial Design (500)	17-3
F. Remedial Action (600)	17-3
4. LIST OF LEVELS 1 AND 2 REMEDIATION COST CODES	17-3
5. LIST OF LEVEL 3 REMEDIATION COST CODES	17-5
CHAPTER 18 - USE OF COST ESTIMATING RELATIONSHIPS	
1. INTRODUCTION	18-1
2. LIMITATIONS	18-1
A. Historical Data	18-1
B. Bounds of the Sample	18-1
C. Different Characteristics	18-2
3. CHARACTERISTICS OF THE ESTIMATING RELATIONSHIP	18-2

CONTENTS (continued)

Reasonableness	18-2
4. HARDWARE CONSIDERATIONS	18-6
5. JUDGMENT IN COST ESTIMATING	18-6

CHAPTER 19 - DATA COLLECTION AND NORMALIZATION FOR THE DEVELOPMENT OF COST ESTIMATING RELATIONSHIPS

1. INTRODUCTION	19-1
2. DATA COLLECTION	19-1
A. Examining the Historical Data for Selection	19-1
B. Sources for Historical Data	19-2
C. Developing Data from Model Estimates	19-3
D. Historical Data Versus Model Developed Cost Estimating Relationships ..	19-4
3. DATA NORMALIZATION	19-4
A. Accounting Differences	19-5
B. Physical and Performance Considerations	19-5
C. Nonrecurring and Recurring Costs	19-5
D. Price-Level Changes	19-6
E. Cost-Quantity Adjustments	19-6
F. Escalation	19-6
G. Regional Differences	19-6
H. Other Possible Cost Normalizations	19-6
4. DEVELOPING COST ESTIMATING RELATIONSHIPS	19-7
A. Simple Averages	19-7
B. Detail of Cost Estimating Relationships	19-7
C. Enhanced Cost Estimating Relationship Program	19-7

CHAPTER 20 - ESTIMATING SPECIALTY COSTS

1. INTRODUCTION	20-1
2. RESEARCH AND DEVELOPMENT COSTS	20-1
A. Personnel Costs	20-2
B. Equipment Costs	20-2
C. Prototypes and Pilot Plants	20-2
D. Scaled Models	20-2
E. Computerized Models	20-3
F. Cost Estimating Methods for Research and Development Projects	20-3
1. Scoping Estimate	20-3
2. Scaling Factors	20-3
3. Detailed Estimate	20-5

CONTENTS (continued)

4.	Level of Effort	20-5
3.	REGULATORY COSTS	20-5
A.	Environmental Compliance Costs	20-5
B.	Health and Safety Compliance Costs	20-7
C.	Compliance Costs and Scheduling	20-8
4.	SPECIALTY EQUIPMENT	20-8

CHAPTER 21 - LEARNING CURVE

1.	INTRODUCTION	21-1
2.	THE CURVE	21-1
3.	LEARNING CURVE FROM SINGLE-UNIT DATA	21-3
A.	Unit Curve	21-3
B.	Cumulative Total Curve	21-3
C.	Cumulative Average Curve	21-4
4.	EFFECTS OF DOUBLING PRODUCTION	21-5
5.	LEARNING CURVE TABLES	21-5
6.	LEARNING CURVE FROM GROUPED DATA	21-5
7.	APPLICATION OF THE LEARNING CURVE	21-6

CHAPTER 22 - COST MODELS AND COST ESTIMATING SOFTWARE

1.	INTRODUCTION	22-1
2.	DEFINITION OF A COST MODEL	22-1
A.	Types of Cost Models	22-2
1.	Advantages	22-3
2.	Limitations	22-4
B.	Model Maintenance	22-5
C.	Computerized Cost Models	22-6
3.	ESTIMATING SOFTWARE	22-8
A.	Survey of Available Software	22-8
B.	DOE-Owned Software Packages	22-9
1.	The Enhanced Cost Estimating Relationship Program	22-9
2.	The Historical Cost Data Base Management Program	22-13
3.	The Independent Cost Estimating Contingency Analyzer (ICECAN)	22-13
4.	Detailed Cost Estimating Programs	22-14
C.	Commercial Software	22-16

CONTENTS (continued)**CHAPTER 23 - LIFE CYCLE COST ESTIMATE**

1.	INTRODUCTION	23-1
2.	LIFE-CYCLE COST ANALYSIS	23-1
A.	Definition	23-1
B.	Process	23-2
C.	Limitations	23-3
D.	Common Errors Made in Life-Cycle Cost Analysis	23-3
E.	Typical System Profile	23-3
F.	Life-Cycle Cost Analysis Methods	23-4
G.	Example Life-Cycle Cost Analysis	23-5

CHAPTER 24 - ACTIVITY BASED COSTING

1.	INTRODUCTION	24-1
2.	ACTIVITY BASED COSTING METHODOLOGY	24-1
A.	Activity Based Costing Definition	24-1
B.	Use of Activity Based Costing Methodology	24-2
C.	Identification of Activities	24-2
D.	Example of an Activity Based Costing Estimate	24-2
3.	APPLICATION OF ACTIVITY BASED COSTING	24-4

CHAPTER 25 - GUIDELINES FOR ENGINEERING, DESIGN, & INSPECTION COSTS

1.	INTRODUCTION	25-1
2.	ENGINEERING, DESIGN, AND INSPECTION COSTS ACTIVITIES	25-1
3.	WAYS TO ESTIMATE ENGINEERING, DESIGN, AND INSPECTION COSTS	25-2
A.	Count Drawings and Specifications Method	25-2
B.	Full Time Equivalent Method	25-3
C.	Percentage Method	25-3
D.	Documenting Engineering, Design, and Inspection Costs	25-3
E.	Considerations When Estimating	25-5
1.	Comprehensiveness of the Functional/Operational Requirements	25-5
2.	Quality Level	25-5
3.	Design Planning Tabulation	25-5
4.	Design Layout	25-6
5.	Engineering Calculations	25-6
6.	Drafting	25-6
7.	Specification Preparation	25-6
8.	Checking	25-6
9.	Cost Estimating	25-6
10.	Design Reviews	25-7

CONTENTS (continued)

11.	Safety Analysis Report	25-7
12.	Reports	25-7
13.	Government Furnished Equipment	25-7
14.	Off-Site A/E	25-7
15.	Inspection	25-7
16.	Duration	25-8
17.	Labor Density	25-8
18.	Complexity	25-8
19.	Overtime	25-8
20.	Adequacy of Plans and Specifications	25-8
21.	Offsite Fabrications	25-8
22.	Location of the Job	25-9
23.	Guideline	25-9
24.	Performance Specification	25-9
F.	Engineering	25-10

APPENDIX A - DICTIONARY

APPENDIX B - REFERENCES

APPENDIX C - EXAMPLES OF COST ESTIMATION PACKAGES

LIST OF FIGURES

1-1	Major System Acquisition Process	1-3
5-1	Typical Work Breakdown Structure	5-2
5-2	Work Breakdown Structure Extended to Cost Account and Work Package Levels Indicating Cross Walk to Code of Accounts	5-5
11-1	Contingency as a Function of Project Life	11-6
11-2	Contingency Data Results	11-11
12-1	Bar Chart Example	12-3
12-2	Example of a Funding Profile	12-6
15-1	Idaho National Energy Laboratories Indirect Costs (1988)	15-7
18-1	Scaling Curve Cost	18-3
18-2	Cost Versus Project Variable	18-4
18-3	Cost Comparison of Analogous Equipment	18-5
20-1	Application of "Six-Tenth-Factor" Rule to Costs for Shell-and-Tube Heat Exchangers	20-5
20-2	Growth of Health and Environmental Protection Laws	20-6
21-1	Curve Appearance	21-1
21-2	Data on Log-Log Paper	21-2
21-3	Curves on Log-Log Paper	21-4
22-1	Simplified Cost Model Flow Diagram	22-11
23-1	Stages of LCC	23-2
23-2	Actions Affecting LCC	23-4
23-3	LCC Profile for System Acquisition	23-5

LIST OF TABLES

3-1	EM and Conventional Construction Terminology Crosswalk	3-2
3-2	Comparison of EM Project Phases	3-14
4-1	Degrees of Accuracy	4-14
6-1	TPC and TEC Guidance and Clarification Inclusion of Detailed Activities in TPC and/or TEC	6-5
6-2	Recommended Cost Allocation Matrix	6-12
7-1	Recommended Categories for Direct/Indirect Cost Elements	7-3
10-1	Example of Five-Year Project Requiring Escalation Calculations	10-2
11-1	Contingency Allowance Guide by Type of Estimate	11-3
11-2	Contingency Allowances for Current Working Estimates	11-5
11-3	Contingency Guidelines for Environmental Restoration Projects	11-8
21-1	Production Data	21-3
22-1	Equations Analyzed by the ECER Program	22-12

ACRONYMS AND ABBREVIATIONS

A/Es	architect/engineer
ABC	Activity Based Costing
ACM	Asbestos Containing Material
ADP	Automatic Data Processing
ADS	Activity Data Sheet
AES	Automated Estimating System
BA	Budget Appropriation
BM	Bill of Material
BO	Budgetary Outlay
CACES	Corps of Engineers' Computer-Aided Cost Engineering System
CAD	Computer-aided Drafting
CC	Construction Contractors
CCMD	Committee for Cost Methods Development
CDR	Conceptual Design Report
CER	Cost Estimating Relationship
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFO	Chief Financial Officer
CM	Construction Management
CM	Construction Management
CMD	Cost Methods Development
CMI	Corrective Measures Implementation
CMP	Configuration Management Plan
COA	Code of Accounts
CPDS	Construction Project Data Sheet
CSI	Construction Specification Institute Code
CWBS	Contract Work Breakdown Structure
D&D	Decontamination and Decommissioning
DOE	Department of Energy
DOS	Disk Operating System
DPT	Design Planning Tabulation
EA	Environmental Assessment
ECER	Enhanced Cost Estimating Relationship
ED&I	Engineering, Design, and Inspection
EIS	Environmental Impact Statement
EM	Environmental Management
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
ERMC	Environmental Restoration Management Contractor
ESAAB	Energy System Acquisition Advisory Board
ESAARs	Energy System Acquisition Advisory Reviews
F/O	Functional/Operational
FA	Facility Assessment

ACRONYMS AND ABBREVIATIONS

(continued)

FI/CMS	Facilities Investigation/Corrective Measures Study
FI	Facility Investigation
FM	Field Management
FM-50	Office of Infrastructure Acquisition, Office of the Associate Deputy Secretary for Field Management
FONSI	Finding of No Significant Impact
FS	Feasibility Study
FSR	Feasibility Study Report
FTE	Full Time Equivalent
GFE	Government Furnished Equipment
H&N	Holmes & Narver (H&N)
HRS	Hazard Ranking System
ICE	Independent Cost Estimate
ICECAN	Independent Cost Estimating Contingency Analyzer
JMN	Justification of Mission Need
KD	Key Decision
LANL	Los Alamos National Laboratory
LCC	Life-cycle costs
M&O	Management and Operating
NCR	Non-Conformance Report
NEPA	National Environmental Policy Act
OMB	Office of Management and Budget
OPC	Other Project Cost
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
PA/SI	Preliminary Assessment/Site Inspection
PA	Preliminary Assessment
PACE	Plant and Capital Equipment
PC	Personal Computer
PDS	Project Data Sheet
PD&E	Planning Design and Engineering
PERT	Programmed Evaluation and Review Technique
PL	Public Law
PM	Project Management
PM	Project Manager
PMP	Project Management Plan
POPR	Potential for an Occurring or past Release
PSAR	Preliminary Safety Analysis Report
PSD	Prevention of Significant Deterioration
PSO	Project Support Officer (Chapter 13)
PSO	Project Secretarial Officer (chapter 5)
PSWBS	Project Summary Work Breakdown Structure

QA	Quality Assurance
QC	Quality Control
R&D	Research and Development
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act of 1986
SER	Safety Evaluation Report
SI	Site Inspection
SWMU	Solid Waste Management Unit
TEC	Total Estimated Cost
TPC	Total Project Cost
UCR	Uniform Capital Recovery
UMTRA	Uranium Mill Tailings Remedial Action
UMTRAP	Uranium Mill Tailing Remedial Action Project
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
WBS	Work Breakdown Structure