

Table of Contents

Chapter 1

Introduction

John (Jack) D. Young and Frank M. Wheeler

1.1	Introduction	1
1.2	Key Elements	1
1.3	Design and Construction Risks	2
1.4	Structured Phasing Approach	3
1.5	References	6

Chapter 2

A Risk-Based Approach to Plant Design

Mike Fontaine

2.1	Introduction	7
2.2	Definitions	9
2.3	Risk Management as a Unifying Framework	10
2.4	Risk Allocation among Project Stakeholders	10
2.5	Generic Risk Management Process	11
2.6	Risk Management over the Project Life Cycle	20
2.7	Conclusions	23
2.8	Acknowledgments	23
2.9	References	23

Chapter 3

The Business Case: Defining the Project

Rob Boom, Greg Traquair, and Yasuyuki Tozaki

3.1	Introduction	25
3.2	The Business Case — The Basics	26
3.3	Evolution of the Business Case	28
3.4	Typical Scope of a Business Case	30
3.5	Economic Analysis	33
3.6	The Market Opportunity	36
3.7	Other Relevant Considerations	41
3.8	Case Studies	43
3.9	Conclusions	57
3.10	Acknowledgments	57
3.11	References	57

Chapter 4

Site Selection

Rob Boom, Yasuyuki Tozaki, and Frank M. Wheeler

4.1	Introduction	59
4.2	Proximity to Primary Resources	60
4.3	Proximity to Market	62
4.4	Existing Infrastructure	62
4.5	Primary, Semi-Finished, or Finished Products	62
4.6	Integrated Site or Incomplete Production Chain	63
4.7	National and Regional Considerations	64
4.8	Industry Synergies	65
4.9	Secondary Raw Materials, Energy, and Water	65
4.10	Social License to Operate	67
4.11	Proximity to Urban Areas and Skilled Labour	67

4.12	Climate and Health Conditions	68
4.13	Site Topography and Geotechnical Parameters	68
4.14	Risks from Natural Disasters	69
4.15	Site Arrangement Requirements	70
4.16	Site Contamination	70
4.17	Costing Models	70
4.18	Making the Decision	71
4.19	Industrial Examples and Case Studies.....	72
4.20	Conclusions.....	85
4.21	Acknowledgments	85
4.22	References	86

Chapter 5

Project Development

Randy McMeekin, Chris Twigge-Molecey, and J. Peter Blake

5.1	Introduction	87
5.2	Front End Loading: The Foundation of Project Development.....	88
5.3	The Project Design Basis Document	91
5.4	Progress through Fel Phases.....	98
5.5	The Project Work Breakdown Structure	103
5.6	Conclusions.....	105
5.7	Acknowledgments	105
5.8	References	105

Chapter 6

Managing Technology Risk

Chris Twigge-Molecey and John Peacey

6.1	Introduction	107
6.2	Identifying Project Technology Risk	109
6.3	Managing Technology Risk.....	114
6.4	Test Work and Scale-Up	119
6.5	Approaches to Scale-Up of Test Work.....	125
6.6	Conclusions.....	127
6.7	Acknowledgments	127
6.8	References	127

Chapter 7

Custom Designed Equipment

Michael T. McCaffrey

7.1	Introduction	131
7.2	Defining Custom Equipment.....	132
7.3	Establishing the Need for Custom Equipment	134
7.4	Considerations Specific to Custom Equipment Design	135
7.5	Pilot and Demonstration Testing	139
7.6	Commercial Relationships in the Design and Supply of Custom Equipment	143
7.7	Conclusions.....	148
7.8	Acknowledgments	148
7.9	References	149

Chapter 8

Sustainability in Plant Design

Philip J. Bangerter, Glen D. Corder, Damien Giurco, Ben C. McLellan, and Andrew Murphy

8.1	Defining Sustainability	151
8.2	Metallurgical Plant Design in an Environmental and Social Context	151
8.3	Metallurgical Plant Design and Regulatory Requirements	153

8.4	Sustainable Plant Design and Regulatory Approval	158
8.5	Sustainable Development Principles as a Framework for Project Development.....	160
8.6	Social License to Operate.....	163
8.7	New Technologies.....	164
8.8	Embedding Sustainability in Project Design Activities	165
8.9	Frameworks and Tools in the Market	168
8.10	Future Directions in Mining, Metallurgy, and Sustainable Design	173
8.11	Conclusions.....	176
8.12	Acknowledgments.....	177
8.13	References.....	177

Chapter 9

Design for Safety

Chris Twigge-Molecey and Philip J. Bangerter

9.1	Introduction.....	181
9.2	Tools for Process Safety Design.....	184
9.3	Fail-Safe Design.....	189
9.4	Clean Plant Design	190
9.5	Safety Considerations During Commissioning and Startup	199
9.6	Design for Safety Auditing and Review.....	202
9.7	Conclusions.....	202
9.8	Acknowledgments.....	202
9.9	References.....	202

Chapter 10

Plant Layout and Logistics

Frank M. Wheeler and Jeffrey T. McGinty

10.1	Introduction.....	205
10.2	The Context of Plant Layout and Logistics	206
10.3	Plant Layout and Logistics Requirements	207
10.4	Information Required for Layout Development.....	209
10.5	Key Factors in Plant Layout Development	209
10.6	Clean Plant Design	215
10.7	The Human Factor in Plant Design.....	216
10.8	Plant Aesthetics	216
10.9	Developing and Depicting Layouts.....	217
10.10	Case Study of Plant Layout Development.....	219
10.11	Assessing the Viability of Plant Layout Options.....	221
10.12	Using Simulation to Assess Plant Design — Real World Examples	229
10.13	Conclusions.....	239
10.14	Acknowledgments	240
10.15	References.....	240

Chapter 11

Project Implementation

Randy McMeekin, Chris Twigge-Molecey, and J. Peter Blake

11.1	Introduction.....	241
11.2	Key Considerations in Implementing the Design	242
11.3	Project Organization and Responsibilities.....	244
11.4	Procurement.....	246
11.5	Engineering Work Packages.....	247
11.6	Developing the Design.....	247
11.7	Design Reviews	253
11.8	Engineering Deliverables	255
11.9	Design for Pre-Assembly and Modularization	258

11.10	Quality Management	260
11.11	Information Management	260
11.12	Design Tools	261
11.13	Design Change Management.....	261
11.14	Project Implementation from Design into Construction.....	262
11.15	Training in Preparation for Commissioning and Startup.....	264
11.16	Plant Commissioning and Startup.....	265
11.17	Conclusions.....	268
11.18	Acknowledgments	269
11.19	References	269

Chapter 12

Looking to the Future

Chris Twigge-Molecey

12.1	Introduction	271
12.2	The Aluminerie Alouette Story	273
12.3	In Conclusion, What Next?	277
12.4	Acknowledgments	277
12.5	References	278

Appendix 1

Key Design Activities, FEL1 through FEL3	APP-I
--	-------

Appendix 2

Notes on Management of Ionizing Radiation	APP-XI
---	--------

Author Biographies

Philip Bangerter	APP-XIII
J.P. (Peter) Blake.....	APP-XIII
Rob Boom	APP-XIII
Glen Corder.....	APP-XIV
Michael (Mike) Fontaine	APP-XIV
Damien Giurco	APP-XV
Michael T. McCaffrey	APP-XV
Jeffrey T. McGinty	APP-XV
Ben McLellan	APP-XVI
Randy McMeekin	APP-XVI
Andrew Murphy.....	APP-XVII
John Peacey	APP-XVII
Yasuyuki Tozaki.....	APP-XVIII
Greg Traquair	APP-XVIII
Chris Twigge-Molecey.....	APP-XIX
Frank M. Wheeler.....	APP-XIX
John (Jack) D. Young.....	APP-XIX

Technical Editor Biographies

Janice M. Burke.....	APP-XXI
Barry G. Clegg	APP-XXI

Glossary

.....	APP-XXIII
-------	-----------

Index

.....	APP-XXV
-------	---------