HANDBOOK OF SOLID WASTE MANAGEMENT SECOND EDITION



- Includes Federal and State regulations
- Covers diverse methods of solid waste management
- Provides an integrated approach to planning and design

CONTENTS

Chapter 1. Introduction George Tchobanoglous, Frank Kreith, and Marcia E. Williams

Waste Generation and Management in a Technological Society / 1.1

Trends in Municipal Waste Generation and Management / 3.1

Making Producers and Retailers Responsible for Waste / 3.16

Appendix: State Solid Waste Regulatory Agencies / 3.28

3.16 Flow Control Legislation: Interstate Movement of Unprocessed and Processed Solid Waste / 3.25

The Waste Reduction Legislation Movement / 3.3

State Municipal Solid Waste Legislation / 3.8

Permitting and Regulation Requirements / 3.9

1.1

Contributors

Preface

1.1

3.1

3.2

3.3

3.5 3.6

3.7

3.8

3.11 3.12

3.15

Introduction / 3.1

3.4 The Effect of Legislation / 3.5

State Planning Provisions / 3.8

3.12 Advanced Disposal Fees / 3.18
3.13 Special Waste Legislation / 3.20
3.14 Market Development Initiatives / 3.21

State Funding / 3.25

References / 3.27

Waste Reduction Legislation / 3.9

3.9 Establishing Waste Reduction Goals / 3.10
3.10 Legislating Local Government Responsibility / 3.12

хì

Issues in Solid Waste Management / 1.2

1.3 Integrated Waste Management / 1.8 1.4 Implementing Integrated Waste Management Strategies / 1.11 1.5 Typical Costs for Major Waste Management Options / 1.13 1.6 Framework for Decision Making / 1.19 1.7 Key Factors for Success / 1.22 1.8 Philosophy and Organization of this Handbook / 1.24 1.9 Concluding Remarks / 1.25 Chapter 2. Federal Role in Municipal Solid Waste Management 2.1 Barbara Foster and Edward W. Repa 2.1 Resource Conservation and Recovery Act / 2.1 2.2 Clean Air Act / 2.22 2.3 Clean Water Act / 2.35 2.4 Federal Aviation Administration Guidelines / 2.38 2.5 Flow Control Implications / 2.38 Chapter 3. Solid Waste State Legislation Kelly Hill and Jim Glenn 3.1

	er 4. Planning for Municipal Solid Waste Management Programs E. Kundell and Deanna L. Ruffer	4. 1
4.2	State Solid Waste Management Planning / 4.1 Local and Regional Solid Waste Management Planning / 4.7 Conclusions / 4.13 References / 4.14	
Chapt	er 5. Solid Waste Stream Characteristics Marjorie A. Franklin	5.1
5.5 5.6	Materials in Municipal Solid Waste by Weight / 5.3 Products in Municipal Solid Waste by Weight / 5.11 Municipal Solid Waste Management / 5.19	
Chapte Part 6	er 6. Source Reduction: Quantity and Toxicity A. Quantity Reduction Harold Leverenz	6.1
6A.2 6A.3 6A.4	Introduction / 6.1 Effects of Source Reduction / 6.2 Involvement by Government / 6.6 Developing a Source Reduction Plan / 6.15 Strategies for Source Reduction / 6.17 References / 6.25	
Part 6	B. Toxicity Reduction <i>Ken Geiser</i>	-
6B.3	Waste Management Policy / 6.30 Product Management Policy / 6.33 Production Management Policy / 6.37	
Chapte	er 7. Collection of Solid Waste Hilary Theisen	7.1
7.1 7.2 7.3 7.4	The Logistics of Solid Waste Collection / 7.1 Types of Waste Collection Services / 7.2 Types of Collection Systems, Equipment, and Personnel Requirements / 7.14 Collection Routes / 7.22	

References / 7.27

Chapter 8. Recycling Harold Leverenz, George Tchobanoglous, and David B. Spencer

8.1

8.1 Overview of Recycling / 8.1
8.2 Recovery of Recyclable Materials from Solid Waste / 8.3

7.5 Management of Collection Systems / 7.25
7.6 Collection System Economics / 7.25

8.5	Unit Operations and Equipment for Processing of Recyclables / 8.38 Environmental and Public Health and Safety Issues / 8.70 Recycling Economics / 8.74	
	References / 8.77	
	er 9. Markets and Products for Recycled Material Leverenz and Frank Kreith	9.1
9.1	Sustainable Recycling / 9.1 Recycling Markets / 9.3	
9,3	Market Development / 9.8	
9,4	Trade Issues / 9.16 References / 9.17	
_	er 10. Household Hazardous Wastes (HHW)	
David I	E.B. Nightingale and Rachel Donnette	10.1
	Introduction / 10.1 Problems of Household Hazardous Products / 10.3	
10.3	HHW Regulation and Policy / 10.16	
	Product Stewardship and Sustainability / 10.21 Education and Outreach / 10.26	
	HHW Collection, Trends, and Infrastructure / 10.29	
	References / 10.33	
Part 1	er 11. Other Special Wastes 1A. Batteries <i>Gary R. Brenniman, Stephen D. Casper,</i> n H. Hallenbeck, and James M. Lyznicki	11.1
11A.1	Automobile and Household Batteries / 11.1 References / 11.14	
Part 1	1B. Used Oil Stephen D. Casper, William H. Hallenbeck, and Gary R. Brenniman	
11B.1	Used Oil / 11.15	
Part 1	1C. Scrap Tires John K. Bell	
11C.1	Background / 11.31	
	Source Reduction and Reuse / 11.32 Disposal of Waste Tires / 11.33	
	Alternatives to Disposal / 11.34 References / 11.36	
Part 1	1D. Construction and Demolition (C&D) Debris George Tchobanoglous	
11 D .1		
11D.2 11D.3	Regulations Governing C&D Materials and Debris / 11.42 Management of C&D Debris / 11.42	

8.3 Development and Implementation of Materials Recovery Facilities / 8.10

11E.6	Hazardous Components in Computers and Electronic Waste / 11.50 Disposing of Computers is Hazardous / 11.53 Extended Producer Responsibility and Electronic Toxin Phaseouts / 11.55 Can a Clean Computer Be Designed? / 11.57 What Can You Do As a Computer Owner? / 11.58 Contacts and Resources for Dealing with Computer Waste / 11.58 References / 11.60
Chapte Luis F.	er 12. Composting of Municipal Solid Wastes Diaz, George M. Savage, and Clarence G. Golueke 12.1
12.2 12.3 12.4 12.5 12.6 12.7	Principles / 12.3 Technology / 12.14 Economics / 12.27 Marketing Principles and Methods / 12.33 Environmental, Public, and Industrial Health Considerations / 12.40 Case Study / 12.45 Conclusions / 12.45 References / 12.47 Appendix 12A. Partial Listing of Vendors of Equipment and Systems for Composting MSW and Other Organic Wastes / 12.50 Appendix 12B. Costs for Composting MSW and Yard Wastes / 12.68 or 13. Waste-to-Energy Combustion uction Frank Kreith BA. Incineration Technologies Calvin R. Brunner 13.1
13 A .1	Incineration / 13.3 References / 13.84
Part 13	B. Ash Management and Disposal Floyd Hasseiriis
13B.3 13B.4 13B.5 13B.6 13B.7 13B.8 13.B9	Sources and Types of Ash Residues / 13.85 Properties of Ash Residues / 13.86 Ash Management / 13.93 Landfill Disposal / 13.95 Regulatory Aspects / 13.97 Actual Leaching of MWC Ash / 13.99 Treatment of Ash Residues / 13.100 Environmental Impact of Ash Residue Use / 13.101 Ash Management Around the World / 13.102 Beneficial Use of Residues / 13.104 Analysis of Ash Residue Test Data / 13.109 References / 13.116

11D.4 Specifications for Recovered C&D Debris / 11.44
 11D.5 Management of Debris from Natural and Humanmade Disasters / 11.46

Part 11E. Computer and Other Electronic Solid Waste

References / 11.47

11E.1 Introduction / 11.49

Gary R. Brenniman and William H. Hallenbeck

Part 13C. Emission Control Floyd Hasselriis

13C.2 Emissions from Combustion / 13.124 13C.3 Emission Standards and Guidelines / 13.126 13C.4 Emission Control Devices / 13.132

13C.5 Controlled and Uncontrolled Emission Factors / 13.154

13C.1 Introduction / 13.121

	Variability of Emissions / 13.160 Dispersion of Pollutants from Stack to Ground / 13.161 Risk Assessment / 13.165	
13C.9	Calculation of Municipal Waste Combustor Emissions / 13.168 Conversions and Corrections / 13.171 References / 13.174	
Chapte	er 14. Landfilling Philip R. O'Leary and George Tchobanoglous	14.
14.1	The Landfill Method of Solid Waste Disposal / 14.2	
	Generation and Composition of Landfill Gases / 14.10	
	Formation, Composition, and Management of Leachate / 14.30	
	Intermediate and Final Landfill Cover / 14.47	
	Structural and Settlement Characteristics of Landfills / 14.54	
	Landfill Design Considerations / 14.58	
14./	Landfill Operation / 14.69 Environmental Quality Monitoring at Landfills / 14.77	
14.0	Landfill Closure, Postclosure Care, and Remediation / 14.84	
14.7	References / 14.88	
Chant	or 15 - Citing Municipal Colid Wasta Facilities <i>Devid Laure Laurence</i>	Succkind
	er 15. Siting Municipal Solid Waste Facilities David Laws, Lawrence son Corburn	Susskind, 15.
and Ja		Susakind, 15.
15.1 15.2	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1	Susskind, 15.
15.1 15.2 15.3	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4	Susskind, 15.
15.1 15.2 15.3 15.4	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8	Susskind, 15.
15.1 15.2 15.3 15.4	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16	Susskind, 15.
15.1 15.2 15.3 15.4	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8	Susskind, 15.
15.1 15.2 15.3 15.4 15.5 Chapt	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16	15,
15.1 15.2 15.3 15.4 15.5 Chapt	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16 References / 15.17 Ter 16. Financing and Life-Cycle Costing of Solid Waste Managemetrs S. Artz, Jacob E. Beachey, and Philip R. O'Leary	15, ent Systems
15.1 15.2 15.3 15.4 15.5 Chapt Nichol	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16 References / 15.17 Ter 16. Financing and Life-Cycle Costing of Solid Waste Managemetrs S. Artz, Jacob E. Beachey, and Philip R. O'Leary Financing Options / 16.2	15, ent Systems
15.1 15.2 15.3 15.4 15.5 Chapt Nichol	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16 References / 15.17 ser 16. Financing and Life-Cycle Costing of Solid Waste Managemeters S. Artz, Jacob E. Beachey, and Philip R. O'Leary Financing Options / 16.2 Issues in Financing Choices / 16.5	15, ent Systems
15.1 15.2 15.3 15.4 15.5 Chapt <i>Nichol</i> 16.1 16.2 16.3	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16 References / 15.17 ser 16. Financing and Life-Cycle Costing of Solid Waste Managemeters S. Artz, Jacob E. Beachey, and Philip R. O'Leary Financing Options / 16.2 Issues in Financing Choices / 16.5 Steps to Secure System Financing / 16.8	15, ent Systems
15.1 15.2 15.3 15.4 15.5 Chapt <i>Nichol</i> 16.1 16.2 16.3 16.4	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16 References / 15.17 Ter 16. Financing and Life-Cycle Costing of Solid Waste Managemetrs S. Artz, Jacob E. Beachey, and Philip R. O'Leary Financing Options / 16.2 Issues in Financing Choices / 16.5 Steps to Secure System Financing / 16.8 Life-Cycle Costing / 16.10	15, ent Systems
15.1 15.2 15.3 15.4 15.5 Chapt <i>Nichol</i> 16.1 16.2 16.3 16.4	Introduction / 15.1 Understanding the Sources of Public Concern / 15.1 A Typical Siting Chronology / 15.4 Building Consensus on Siting Choices / 15.8 Conclusions / 15.16 References / 15.17 ser 16. Financing and Life-Cycle Costing of Solid Waste Managemeters S. Artz, Jacob E. Beachey, and Philip R. O'Leary Financing Options / 16.2 Issues in Financing Choices / 16.5 Steps to Secure System Financing / 16.8	15, ent Systems