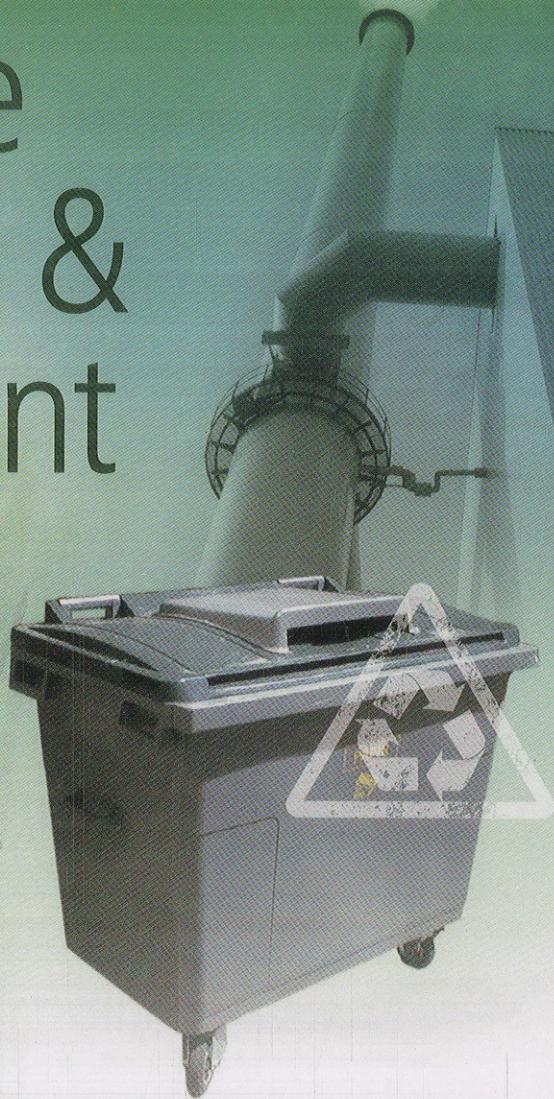


Editor
Thomas H. Christensen

Solid Waste Technology & Management

Volume 2



iwwg
International waste working group

 **ISWA**
International Solid Waste Association

 **WILEY**

2

Contents

Preface	xii
List of Contributors	xiii
VOLUME 1	
1 INTRODUCTION	
1.1 Introduction to Waste Management	3
<i>Thomas H. Christensen</i>	
1.2 Introduction to Waste Engineering	17
<i>Thomas H. Christensen</i>	
1.3 Introduction to Waste Economics	29
<i>Hanna Merrill and Thomas H. Christensen</i>	
1.4 Introduction to Waste Legislation and Regulation	52
<i>Peter Pagh and Henrik Wejdling</i>	
2 WASTE GENERATION AND CHARACTERIZATION	
2.1 Waste Characterization: Approaches and Methods	63
<i>Anders Lagerkvist, Holger Ecke and Thomas H. Christensen</i>	
2.2 Residential Waste	85
<i>Thomas H. Christensen, Thilde Fruergaard and Yasushi Matsufuji</i>	
2.3 Commercial and Institutional Waste	97
<i>Thomas H. Christensen and Thilde Fruergaard</i>	
2.4 Industrial Waste	100
<i>Thomas H. Christensen</i>	
2.5 Construction and Demolition Waste	104
<i>Thomas H. Christensen and Lizzi Andersen</i>	
3 LCA OF WASTE MANAGEMENT SYSTEMS	
3.1 LCA in Waste Management: Introduction to Principle and Method	113
<i>Michael Hauschild and Morton A. Barlaz</i>	

3.2 Application of LCA in Waste Management	137
<i>Anna Björklund, Göran Finnveden and Liselott Roth</i>	
3.3 LCA Modeling of Waste Management Scenarios	161
<i>Thomas H. Christensen, Federico Simion, Davide Tonini and Jacob Møller</i>	
4 WASTE MINIMIZATION	
4.1 Waste Prevention and Minimization: Concepts, Strategies and Means	183
<i>Stefan Salhofer, Nicole Unger and Bernd Bilitewski</i>	
4.2 Waste Prevention and Minimization: Cases	193
<i>Stefan Salhofer and Nicole Unger</i>	
5 MATERIAL RECYCLING	
5.1 Recycling of Paper and Cardboard	203
<i>Thomas H. Christensen and Anders Damgaard</i>	
5.2 Recycling of Glass	211
<i>Thomas H. Christensen and Anders Damgaard</i>	
5.3 Recycling of Plastic	220
<i>Thomas H. Christensen and Thilde Fruergaard</i>	
5.4 Recycling of Metals	234
<i>Anders Damgaard and Thomas H. Christensen</i>	
5.5 Recycling of Construction and Demolition Waste	243
<i>Thomas H. Christensen and Harpa Birgisdottir</i>	
6 COLLECTION	
6.1 Waste Collection: Equipment and Vehicles	253
<i>Per Nilsson</i>	
6.2 Waste Collection: Systems and Organization	277
<i>Per Nilsson and Thomas H. Christensen</i>	
6.3 Source Segregation and Collection of Source-Segregated Waste	296
<i>Thomas H. Christensen and Yasushi Matsufuji</i>	
6.4 Waste Transfer Stations	311
<i>Thomas H. Christensen</i>	
7 MECHANICAL TREATMENT	
7.1 Mechanical Treatment: Unit Processes	321
<i>Bernd Bilitewski</i>	

7.2 Mechanical Treatment: Material Recovery Facilities	349
<i>Thomas H. Christensen and Bernd Bilitewski</i>	
8 THERMAL TREATMENT	
8.1 Incineration: Process and Technology	365
<i>Tore Hulgaard and Jürgen Vehlow</i>	
8.2 Incineration: Flue Gas Cleaning and Emissions	393
<i>Jürgen Vehlow and Søren Dalager</i>	
8.3 Incineration: Mass Balances	421
<i>Søren Dalager and Dieter O. Reimann</i>	
8.4 Incineration: Solid Residues	430
<i>Ole Hjelmar, Annette Johnson and Rob Comans</i>	
8.5 Incineration: Utilization of Residue in Construction	463
<i>Maria Arm, T. Taylor Eightmy and Thomas H. Christensen</i>	
8.6 Incineration: Co-combustion	476
<i>Helmut Rechberger</i>	
8.7 Incineration: RDF and SRF – Solid Fuels from Waste	486
<i>Susanne Rotter</i>	
8.8 Pyrolysis and Gasification	502
<i>Thomas Astrup and Bernd Bilitewski</i>	
VOLUME 2	
9 BIOLOGICAL TREATMENT	
9.1 Composting: Process	515
<i>Edward Stentiford and Marco de Bertoldi</i>	
9.2 Composting: Technology	533
<i>Uta Krogmann, Ina Körner and Luis F. Diaz</i>	
9.3 Composting: Mass Balances and Product Quality	569
<i>Alessio Boldrin, Thomas H. Christensen, Ina Körner and Uta Krogmann</i>	
9.4 Anaerobic Digestion: Process	583
<i>Irini Angelidaki and Damien John Batstone</i>	
9.5 Anaerobic Digestion: Technology	601
<i>Jes la Cour Jansen</i>	
9.6 Anaerobic Digestion: Mass Balances and Products	618
<i>Jacob Møller, Thomas H. Christensen and Jes la Cour Jansen</i>	

9.7	Mechanical Biological Treatment	628
	<i>Bernd Bilitewski, Christiane Oros and Thomas H. Christensen</i>	
9.8	Emerging Biological Technologies: Biofuels and Biochemicals	639
	<i>Dimitar Karakashev and Irini Angelidaki</i>	
9.9	Use of Compost in Horticulture and Landscaping	651
	<i>Morten Carlsbæk</i>	
9.10	Utilization of Biologically Treated Organic Waste on Land	665
	<i>Peter E. Holm, Lars Stoumann Jensen and Michael J. McLaughlin</i>	
10	LANDFILLING	
10.1	Landfilling: Concepts and Challenges	685
	<i>Thomas H. Christensen, Heijo Scharff and Ole Hjelmar</i>	
10.2	Landfilling: Environmental Issues	695
	<i>Thomas H. Christensen, Simone Manfredi and Peter Kjeldsen</i>	
10.3	Landfilling: Hydrology	709
	<i>Peter Kjeldsen and Richard Beaven</i>	
10.4	Landfilling: Geotechnology	734
	<i>R. Kerry Rowe and Jamie F. VanGulck</i>	
10.5	Landfilling: Mineral Waste Landfills	755
	<i>Ole Hjelmar and Hans A. van der Sloot</i>	
10.6	Landfilling: Reactor Landfills	772
	<i>Thomas H. Christensen, Simone Manfredi and Keith Knox</i>	
10.7	Landfilling: MBP Waste Landfills	788
	<i>Rainer Stegmann</i>	
10.8	Landfilling: Bottom Lining and Leachate Collection	800
	<i>Thomas H. Christensen, Simone Manfredi, Peter Kjeldsen and Robert B. Wallace</i>	
10.9	Landfill Top Covers	830
	<i>Charlotte Scheutz and Peter Kjeldsen</i>	
10.10	Landfilling: Gas Production, Extraction and Utilization	841
	<i>Hans Willumsen and Morton A. Barlaz</i>	
10.11	Landfilling: Leachate Treatment	858
	<i>Hans-Jürgen Ehrig and Howard Robinson</i>	
10.12	Landfilling: Planning, Siting and Design	898
	<i>Roberto Raga, Raffaello Cossu and Anders Lagerkvist</i>	

10.13 Landfilling: Operation and Monitoring	914
<i>Nicole D. Berge, Eyad S. Batarseh and Debra R. Reinhart</i>	
10.14 Landfill Closure, Aftercare and Final Use	932
<i>Heijo Scharff</i>	
11 SPECIAL AND HAZARDOUS WASTE	
11.1 Healthcare Risk Waste	951
<i>Ole Vennicke Christiansen and Peder Bisbjerg</i>	
11.2 Waste Electrical and Electronic Equipment	960
<i>Marianne Bigum and Thomas H Christensen</i>	
11.3 Preservative Treated Wood	971
<i>Ina Körner, Jenna Jambeck, Hans Leithoff and Volker Lenz</i>	
11.4 Hazardous Waste	982
<i>Joan Maj Nielsen and Jørn Lauridsen</i>	
11.5 Other Special Waste	991
<i>Line Brogaard and Thomas H. Christensen</i>	
Index	1001