

Air Pollution Engineering Manual

SECOND EDITION



**Air & Waste
Management Association**

**Edited by
Wayne T. Davis**



Contents

Foreword	ix	Chapter 5 Odors	
Acknowledgment	xi	<i>William H. Prokop</i>	136
Contributor List	xiii		
Chapter 1 Introduction	1	Chapter 6 Ancillary Equipment for Local Exhaust Ventilation Systems	
Air Pollution Control Engineering		<i>Howard D. Goodfellow</i>	143
<i>Wayne T. Davis, Anthony J. Buonicore, and Louis Theodore</i>	1	Chapter 7 Combustion Sources	191
Regulatory Aspects of Air Pollution Control in the United States	8	Coal	
<i>Leo H. Stander, Jr.</i>		<i>Arijit Pakrasi and Wayne T. Davis</i>	191
		Fuel Oil	
Chapter 2 Control of Gaseous Pollutants	22	<i>Arijit Pakrasi</i>	221
Absorption		Natural Gas	
<i>Robert Jennings Heinsohn</i>	22	<i>Arijit Pakrasi</i>	230
Adsorption		Wood Waste	
<i>Kenneth E. Noll</i>	37	<i>Arijit Pakrasi and Anthony J. Buonicore</i>	234
Condensation		Internal Combustion Sources	
<i>Anthony J. Buonicore</i>	44	<i>Michael J. Barboza, Michael J. Cannon, Nicholas J. Charno, and P. Steven Oliver</i>	240
Vapor Incineration		Stationary Gas Turbines	
<i>C. David Cooper</i>	49	<i>Michael J. Barboza, Michael J. Cannon, Nicholas J. Charno, and P. Steven Oliver</i>	242
Biological Control Systems		Reciprocating Internal Combustion Engines	
<i>Sarina J. Ergas and Kerry A. Kinney</i>	55	<i>Michael J. Barboza, Michael J. Cannon, Nicholas J. Charno, and P. Steven Oliver</i>	248
Chapter 3 Control of Particulate Matter	66	Chapter 8 Waste Incineration Sources	257
Cyclones and Inertial Separators		Municipal Waste Combustion	
<i>Timothy J. Herrick and Wayne T. Davis</i>	66	<i>James R. Donnelly</i>	257
Wet Scrubbers		Hazardous Waste	
<i>Michael Pilat and Kenneth E. Noll</i>	73	<i>Mackenzie L. Davis, Clyde R. Dempsey, and E. Timothy Oppelt</i>	268
Electrostatic Precipitators		Sewage Sludge	
<i>James H. Turner, Phil A. Lawless, Toshiaki Yamamoto, David W. Coy, Gary P. Greiner, John D. McKenna, and William M. Vatauvuk</i>	86	<i>Calvin R. Brunner</i>	274
Fabric Filters		Drum Reconditioning	
<i>John D. McKenna, Arthur B. Nunn III, and Dale A. Furlong</i>	99	<i>Patricia Kay Rykowski</i>	286
Chapter 4 Fugitive Dust Emissions		Chapter 9 Semiconductor Manufacturing	
<i>John G. Watson, Judith C. Chow, and Thompson G. Pace</i>	117	<i>Peter F. Hess</i>	294

Chapter 10 Evaporative Emissions and Surface Coatings	301	Terephthalic Acid	
Organic Liquid Storage Tanks		<i>Ronald D. Bell, Alan J. Mechtenberg, and Kevin McQuigg</i>	434
<i>Mark A. Morris</i>	301	Natural Fiber Textile Industry	
Evaporative Loss Sources, Organic Solvent Cleaning Operations		<i>Anthony J. Buonicore</i>	440
<i>Mohamed A. Serageldin, Paul Almodovar, and Susan Miller</i>	311	Thermoplastic Resins	
Surface Coating		<i>John A. Fey and J. Mitchell Jenkins III</i>	447
<i>Ashok Kumar and Taramati Shenoy</i>	321	Thermosetting Resins	
		<i>John A. Gannon</i>	451
Chapter 11 Graphic Arts Industry	333	Chapter 13 Food and Agricultural Industry	455
Nonheatset Web Printing		Bread Baking	
<i>H. Wilson Cunningham and C. Nelson Ho</i>	333	<i>Peter F. Hess</i>	455
Heatset Web Offset		Coffee Processing	
<i>Robert M. Birkland, Gerald Bender, William Schaeffer, and C. Nelson Ho</i>	337	<i>Taken from AP-42 U.S. EPA</i>	460
Graphic Arts Industry: Flexography		Grain Handling And Processing	
<i>Doreen M. Monteleone and John D. Serafano</i>	341	<i>Dennis Wallace (with updated by Editor)</i>	463
Sheetfed Offset Printing		Distilled Spirits	
<i>Jerry Bender, C. Nelson Ho, David Johnson, Frank Little, and William Schaeffer</i>	348	<i>(Adapted from Section 9.12.3 AP-42)</i>	473
Gravure Printing		Wines and Brandy	
<i>Gregory Tyszka</i>	350	<i>(Adapted from Section 9.12.2 AP-42)</i>	477
Screen Printing		Fish Processing	
<i>Marcia Y. Kinter</i>	356	<i>Anthony P. Bimbo</i>	481
Chapter 12 Chemical Process Industry	360	Livestock Feedlots	
Acrylonitrile		<i>John M. Sweeten, Calvin B. Parnell, Brent W. Auvermann, Bryan W. Shaw, and Ronald E. Lacey</i>	488
<i>Ronald D. Bell and Alan V. Mechtenberg</i>	360	Rendering Plants	
Carbon Black		<i>William H. Prokop</i>	497
<i>Barry R. Taylor</i>	365	Chapter 14 Metallurgical Industry	511
Charcoal/Activated Carbon		Primary Aluminum Industry	
<i>William D. Byers and Mark P. Cal</i>	368	<i>Maurice W. Wei (with updated by Editor)</i>	511
Chlor-Alkali		Metallurgical Coke	
<i>Kenneth S. Walborn</i>	371	<i>Kelly R. Carmichael, Allen Ellis, George Bradley, John Carson, Thomas W. Easterly, Stefan P. Shoup, and Dennis P. Kaegi</i>	527
Ethylene Oxide		Copper Smelting	
<i>R. Scott Huebner, Kevin S. McLeary, George P. Partridge, Jr., William M. Stayer, and James F. White</i>	378	<i>Jacques Moulins, Editor (with updated by James R. Donnelly)</i>	545
Explosives		Ferroalloy Industry Particulate Emissions	
<i>Institute of Makers of Explosives</i>	385	<i>Steven Sasko</i>	554
Phosphoric Acid Manufacturing		Steel Industry	
<i>Gordon F. Palm (with updated by Editor)</i>	390	<i>Bruce A. Steiner</i>	560
Phthalic Anhydride		Miscellaneous Fugitive Emission Sources	
<i>Herbert P. Dengler</i>	398	<i>Robert E. Sistek and Frank Pendleton (with update by Editor)</i>	563
Printing Inks		Blast Furnace	
<i>Templeton A. Elliott, Jr.</i>	402	<i>Marek S. Klag</i>	565
Soaps and Detergents		Basic Oxygen Furnace Shops	
<i>Richard C. Scherr (with updated by Editor)</i>	407	<i>S. S. Felton, E. Cocchiarella, and M. S. Greenfield</i>	573
Sodium Carbonate		Electric Arc Furnaces/Argon-Oxygen Decarburization Process	
<i>Michael J. Barboza, Stephen T. Coldwell, and Neil M. Haymes</i>	413	<i>Manfred Bender</i>	579
Sulfur		Casters	
<i>Bruce Scott</i>	418	<i>Manfred Bender</i>	588
Sulfuric Acid		Ladle Metallurgy Vacuum Degassing	
<i>Thomas Muller</i>	423	<i>Edward Cocchiarella</i>	589
Synthetic Rubber		Fluxed Iron Ore Pellet Production	
<i>Excerpted from AP-42, U.S. Environmental Protection Agency</i>	432	<i>Gus R. Josephson</i>	594

Pickling <i>R. M. Hudson (with update by Wayne T. Davis, Editor)</i>	597	Sand and Gravel Processing <i>John Richards and Brian Palm</i>	715
Direct Reduction <i>Murray S. Greenfield</i>	598	Stone Crushing <i>John Richards, Todd Brozell, and Brian Palm</i>	718
Rolling <i>Michael T. Unger</i>	603	Chapter 16 Pharmaceutical Industry	725
Scarfing <i>S. J. Manganello</i>	605	Industry Characterization <i>Michael J. Barboza, Theodore V. Chleboski, Richard V. Crume, and Jeffrey W. Portzer</i>	725
Sinter Plants <i>S. S. Felton and L. M. Stuart</i>	606	Bulk Materials Processing—Bulk Pharmaceutical Production <i>Michael J. Barboza, Theodore V. Chleboski, Richard V. Crume, and Jeffrey W. Portzer</i>	732
Primary Lead Smelting <i>Adapted from AP-42, Compilation of Air Pollutant Emission Factors, U.S. EPA, with update by editor</i>	611	Pharmaceutical Product Formulation <i>Michael J. Barboza and Theodore V. Chleboski</i>	745
Zinc Smelting <i>James R. Donnelly</i>	614	Chapter 17 The Petroleum Industry <i>J. Eldon Rucker and Robert P. Strieter (with update by editor, including adaptations from AP-42, Compilation of Air Pollution Emission Factors)</i>	754
Secondary Aluminum <i>Charles A. Licht</i>	618	Chapter 18 Wood Processing Industry	780
Secondary Brass and Bronze Melting Processes <i>Charles A. Licht</i>	626	Chemical Wood Pulping <i>Arun V. Someshwar and John E. Pinkerton</i>	780
Iron Foundries <i>American Foundrymen's Society Air Quality Committee (10-E)*</i>	631	Mechanical Pulping <i>Arun V. Someshwar and John E. Pinkerton</i>	800
Secondary Lead Smelting <i>Charles A. Licht</i>	634	Recovered Paper Pulping <i>Arun V. Someshwar and John E. Pinkerton</i>	801
Secondary Zinc <i>Charles A. Licht</i>	645	Paper and Paperboard Manufacture <i>Arun V. Someshwar and John E. Pinkerton</i>	802
Steel Foundries <i>Souad A. Benromdhane and Mackenzie L. Davis</i>	651	Chapter 19 Soil/Solid Waste/Water Sources	805
Chapter 15 Mineral Products Industry	657	Groundwater and Soil Treatment Processes <i>Robert D. Fox, Duane K. Root, and Edward S. Alperin</i>	805
Hot Mix Asphalt Mixing Facilities <i>Mark J. Miller, George P. Partridge, Jr., and R. Scott Huebner</i>	657	Drinking Water Treatment <i>Michael J. Barboza and Jack H. van Sciver</i>	812
Portland Cement <i>Walter L. Greer, Ann Dougherty, and Douglas M. Sweeney</i>	664	Municipal Solid Waste Landfill Gas Emissions <i>Michael J. Barboza</i>	818
Ceramic and Brick Manufacturing <i>Dennis A. Brosnan</i>	681	Wastewater Treatment Facilities <i>Michael J. Barboza and Gary Comerford</i>	828
Coal Processing <i>Larry L. Simmons and Lisa E. Lambert (with update by editor and excerpts from AP-42)</i>	690	Chapter 20 Accidental and Catastrophic Releases <i>R. Scott Huebner, Kevin S. McLeary, George P. Partridge, Jr., William M. Stayer, and James F. White</i>	839
Concrete Batching <i>Michael C. Schum, Michael D. Errickson, and John E. Yocom</i>	695	Index	851
Fiberglass Operations <i>Aaron J. Teller and Joseph Y. Hsieh</i>	698		
Glass Manufacturing <i>Aaron J. Teller and Joseph Y. Hsieh</i>	703		
Lime Manufacturing <i>(Adapted from AP-42, Compilation of Air Pollution Emission Factors)</i>	709		