

CONTENTS

	Preface	xvii		
PART 1	BASIC KNOWLEDGE AND PRACTICES			
Chapter	Effect of Wastes on Streams and Waste-Water Treatment Plants	3		
	Effects on Streams	3		
1.2	Effects on Sewage Plants	7		
1.2	Differences between industrial and municipal wastes	10	Chapter 7	Strength Reduction
1.4	Environmental impact statements of industrial wastes		7.1	Process changes
Chapter 2	Stream Protection Measures	19	7.2	Equipment modifications
	Standards of stream quality	19	7.3	Segregation of wastes
2.2	Stream quality control	21	7.4	Equalization of wastes
2.3	Effluent guidelines	26	7.5	By-product recovery
Chapter 3	Computation of Organic Waste Loads on Streams	57	7.6	Proportioning wastes
3.1	Streeter-Phelps formulations	57	7.7	Monitoring waste streams
3.2	Thomas method for determining pollution-load capacity of streams	60	7.8	Accidental spills
3.3	Churchill method of multiple linear correlation	68	Chapter 8	Neutralization
Chapter 4	Stream Sampling	75	8.1	Mixing wastes
Chapter 5	Economics of Waste Treatment	81	8.2	Limestone treatment for acid wastes
5.1	Benefits of pollution abatement	83	8.3	Lime-slurry treatment for acid wastes
5.2	Measurement of benefits	84	8.4	Caustic-soda treatment for acid wastes
5.3	A proposed method for resource allocation	84	8.5	Using waste boiler-flue gas
5.4	Costs of waste treatment	93	8.6	Carbon-dioxide treatment for alkaline wastes
PART 2	THEORIES		8.7	Producing carbon dioxide in alkaline wastes
Chapter 6	Volume Reduction	101	8.8	Sulfuric-acid treatment for alkaline wastes
6.1	Classification of wastes	101	8.9	Acid-waste utilization in industrial processes
			Chapter 9	Equalization and Proportioning
				121

B.1	Type of municipal sewage treatment	240			
B.2	Characteristics of industrial waste	240			
B.3	Receiving-stream water quality	241			
B.4	Volume ratio of industrial to municipal waste	241			
B.5	Economics of alternatives	241			
16.	Industrial use of municipal sewage plants	242			
16.2	Municipal ordinances	244			
16.3	Sewer-rental charges	248			
16.4	Existing situation	252			
16.5	Stream survey	253			
16.6	Composite waste sampling	261			
16.7	Composite waste analyses	262			
16.8	Laboratory pilot-plant studies	264			
16.9	Literature survey	267			
16.10	Conclusions from study	268			
16.11	Overall planning study conclusions	269			
16.12	Solids handling	274			
16.13	Final design of the Gloversville-Johnstown joint sewage treatment plant	275			
16.14	Estimated costs and financing	277			
16.15	Application of the plan in practice	278			
Chapter 17	Joint Treatment of Partially Treated Industrial Wastes and Domestic Sewage				
17.1	Ascertaining present plant capacity	281			
17.2	Reducing the incoming load	282			
17.3	Reevaluation of present plant and suggestions for additions	283			
Chapter 18	Discharge of Completely Treated Wastes to Municipal Sewer Systems	287			
18.1	The sampling program	288			
18.2	Analyses of wastes	288			
18.3	Plant-production study	289			
18.4	Suggested in-plant changes to reduce waste	289			
18.5	City wastewater treatment plant	293			
18.6	Toxic limits for metals	294			
18.7	Treatment of industrial wastes	295			
Chapter 19	Complete Treatment Followed by Discharge to Receiving Watercourse—Moench Tannery and Closing of Glue Plant				301
19.1	History of problem				301
19.2	Waste character and treatment				302
19.3	Preliminary and primary treatment				303
19.4	Existing treatment plant efficiency				303
19.5	Cattaraugus Creek pollution situation				305
19.6	Corporate relationship in the community				305
19.7	In-plant studies				306
19.8	Biodegradability of glue-plant wastes				309
19.9	Pilot-plant experimental data				310
19.10	Preliminary design				311
19.11	Final decision of glue plant				312
19.12	Characteristics of Tannery Wastes				312
19.13	Laboratory prototype results				313
19.14	Field pilot plant results				313
19.15	Treatment solution and methods selected				314
19.16	Design and performance of treatment plant				314
19.17	Significant design and operation considerations				316
Chapter 20	Discharge of Partially Treated Industrial Waste Directly to Streams				319
20.1	Procedure				320
20.2	River studies				321
20.3	Pilot-plant results				324
20.4	Substitution of soluble sizing				327
Chapter 21	Discharge of Completely Treated Wastes to Streams or Land				333
21.1	The problem				333
21.2	Stream studies				335
21.3	State decision				335
21.4	Poultry-waste characteristics				336
21.5	The solution				338
21.6	Results				340
21.7	An example				345
Chapter 22	Complete Treatment of Industrial Waste Plus Effluent Reuse				353

22.	Introduction to Mathura Refinery problem	353	25.3	Final waste treatment	403
22.2	Manufacturing processes	353		<i>Tannery Wastes</i>	
22.3	Effluents and characteristics	353	25.4	Origin and characteristics of tannery wastes	409
22.4	Effluent treatment facilities	356	25.5	Treatment of tannery wastes	411
22.5A	Process description: alkaline waste	356		<i>Laundry Wastes</i>	
22.5B	Oily water	356	25.6	Origin and characteristics of laundry wastes	416
22.6	River standards	359	25.7	Treatment of laundry wastes	417
22.7	Effluent disposal	359	25.8	Dry cleaning wastes	419
Chapter 23	Combined Industrial and Municipal Wastes for Treatment and Effluent Recharge into Groundwater for Land Preservation	363	Chapter 26	Food Industries	421
23.	Problem: the rivers Jala and Spreca	363	26.1	Introduction	421
23.2	Data available	364		<i>Cannery Wastes</i>	
23.3	A review of legal regulations and the categorization of the Jala watercourse	367	26.2	Origin of cannery wastes	422
23.4	Alternative solutions	369	26.3	Characteristics of cannery wastes	422
23.5	Laboratory studies	369	26.4	Treatment of cannery wastes	424
23.6	Mixing of waste waters	370		<i>Dairy Wastes</i>	
23.7	Special significant recommendations of consultant	372	26.5	Origin and characteristics of dairy wastes	427
Chapter 24	Lack of Complete Coordination Between Industrial Product Manufacturing and Waste Treatment	373	26.6	Treatment of dairy wastes	428
24.1	Introduction	373		<i>Brewery, Distillery, Winery, and Pharmaceutical Wastes</i>	
24.2	Processes	373	26.7	Origin of brewery, distillery, winery, and pharmaceutical wastes	431
24.3	The problem	374	26.8	Characteristics of brewery, distillery, winery, and pharmaceutical wastes	432
24.4	The treatment plant	374	26.9	Treatment of brewery, distillery, winery, and pharmaceutical wastes	434
24.5	Design limitations and reasons for malfunctioning	381		<i>Meat Packing, Rendering, and Poultry-Plant Wastes'</i>	
24.6	Resolution of the problem	381	26.10	Origin and characteristics of meat-packing wastes	436
24.7	Sludge production and removal	382	26.	Treatment of meat-packing wastes	439
24.8	Sufficient aeration capacity	383	26.12	Feedlot wastes	441
PART 4	MAJOR INDUSTRIAL WASTES			<i>Beet-Sugar Wastes</i>	
Chapter 25	The Apparel Industries	393	26.13	Origin and characteristics of beet-sugar wastes	445
	<i>Textile Wastes</i>		26.14	Treatment of beet-sugar wastes	445
25.	Origin and characteristics of textile wastes	393	26.15	Cane sugar wastes	446
25.2	Treatment of textile wastes	396			

	<i>Miscellaneous</i>				
	<i>Food-Processing Wastes</i>				
26.16	Coffee wastes	448	28.2	Cornstarch-industry wastes	544
26.17	Rice wastes	451	28.3	Phosphate-industry wastes	548
26.18	Fish wastes	452	28.4	Soap- and detergent-industry wastes	553
26.19	Pickle and olive wastes	453	28.5	Explosives-industry wastes	558
26.20	Soft-drink bottling wastes	454	28.6	Formaldehyde wastes	563
26.21	Bakery wastes	456	28.7	Pesticide wastes	565
26.22	Water-treatment-plant wastes	456	28.8	Plastic and resin wastes	567
26.23	Agricultural wastes	457	28.9	Fertilizer industry wastes	575
26.24	Palm oil wastes	458	28.10	Toxic chemicals	580
Chapter 27	The Materials Industries	461	28.11	Mortuary science wastes	582
	<i>Wood Fiber Industries</i>		28.12	Hospital and laboratory wastes	584
27.1	Pulp- and paper-mill wastes	461	28.13	Polychlorinated biphenyls	584
27.2	Builders paper and roofing felt manufacturing waste	477	28.14	Chloralkali wastes	588
27.3	Photographic wastes	477	28.15	Organic Chemicals	589
	<i>Metal Industries</i>		Chapter 29	Energy Industries	597
27.4	Steel-mill wastes	478	29.1	Steam power plants	597
27.5	Other metal-plant wastes	485	29.2	Scrubber wastes	602
27.6	Metal-plating wastes	492	29.3	The coal industry	603
27.7	Motor industry wastes	499	Chapter 30	Radioactive Wastes	615
27.8	Iron-foundry wastes	502	30.1	Origin of wastes	616
	<i>Liquid Materials Industries</i>		30.2	Nuclear power-plant wastes	616
27.9	Oil-field and refinery wastes	504	30.3	Fuel-processing wastes	619
27.10	Petrochemicals	515	30.4	Treatment of radioactive wastes	623
27.11	Fuel and lub-oil wastes	517	30.5	Cost of radioactive waste treatment	643
27.12	Rubber wastes	518	Chapter 31	Non-point Source Pollution	645
27.13	Glass-industry wastes	523	31.1	Introduction	645
27.14	Metal container wastes	523	31.2	Land non-point wastes	645
27.15	Porcelain enameling wastes	526	31.3	Urban non-point street wastes	647
27.16	Naval-stores wastes	526	31.4	Leachate from landfill sites	648
27.17	Animal glue manufacturing wastes	528	Chapter 32	Hazardous Wastes	653
27.18	Wood-preservation wastes	532	32.1	Definitions	653
27.19	Candle-manufacturing wastes	534	32.2	Dangers	653
27.20	Plywood-plant glue wastes	534	32.3	Scope of problems and cost of solutions	653
27.21	Cement industry	535	32.4	Effects on environment	655
27.22	Wood furniture and fixture manufacturing	537	32.5	Philosophies of solutions	656
27.23	Asbestos wastes	537	32.6	Varied types of industrial hazardous wastes	656
27.24	Paint and printing ink wastes	538	32.7	Ignitable hazardous wastes	658
Chapter 28	Chemical Industries	541	32.8	Waste oils	658
28.1	Acid wastes	541	32.9	Spent oil emulsions	659
			32.10	Other oily wastes	659

32.11	Oily shipboard waste or refinery sludges	660	32.47	Segregation	675
32.12	Corrosive hazardous wastes	661	32.48	Location of facilities	675
32.13	Acid wastes	661	32.49	Treatment required-risk evaluation	678
32.14	Alkaline wastes	661	32.50	Land treatment	678
32.15	Reactive industrial wastes	661	32.51	Thermal treatment	679
32.16	Wastes containing cyanides and isocyanides	662	32.52	Incineration	680
32.17	Sulfide residues	662	32.53	Chemical, physical and/or biological treatment	683
32.18	Oil refinery sludges	662	32.54	Neutralization	684
32.19	Trihalomethanes	662	32.55	Underground injection	684
32.20	EP toxic industrial wastes	662	32.56	Landfarming	685
32.21	Mercury-containing wastes	663	32.57	Disposal in natural storage areas	685
32.22	Metal containing sludge	663	32.58	Permanent landfills	685
32.23	Other inorganic wastes	663	32.59	Ocean dumping	687
32.24	Pickling liquors	664	32.60	Secure burial, reuse, chemical fixation	687
32.25	Galvanizing and metal plating wastes	664	32.61	Exportation	689
	Graphic and photographic waste liquors	664	32.62	Recovery and reuse	689
32.27	Salts	664	32.63	Copper recovery from plating and/or engraving baths	690
32.28	Phosphatic fertilizer sludges and ore extraction wastes	665	32.64	Spent caustic soda regeneration	690
32.29	Ore extraction wastes	665	32.65	Mercury recovery	691
32.30	Power plants	665	32.66	Cadmium recovery	691
32.31	Nitrogenous fertilizers	665	32.67	Silver recovery from plating and photographic wastes	691
32.32	Wood preserving wastes	665	32.68	Waste oil recovery	691
32.33	Acute hazardous industrial wastes	666	32.69	Solvents recovery	692
32.34	Radioactive wastes	666	32.70	Water recovery and reuse from industrial laundries	692
32.35	Biological wastes	667	32.71	Dye recovery and reuse from textile wastes	693
32.36	Hospital wastes	668	32.72	Detoxification	694
32.37	Biological wastes and other contaminants	669	32.73	Regional exchanges of hazardous wastes	697
32.38	Asbestos-laden wastes	669	32.74	Solar evaporation	699
32.39	Toxic industrial wastes	670	32.75	Landfilling with leachate treatment	699
32.40	Organic-laden wastes	670	32.76	Disposal into publically owned wastewater treatment plants	699
32.41	PCB-laden oil/PCB-containing wastes	670	32.77	Membrane technology	699
32.42	Phenols and formaldehydes	671	32.78	Electrochemical treatment	702
32.43	Spent solvents	672	32.79	Legal problems of industrial hazardous wastes	703
32.44	Organic wastes containing halogens, sulfur, and nitrogen	673	32.80	Superfund	703
	Special treatment for hazardous wastes	674	32.81	Industrial insurance	719
	General treatment	674			

32.82	Illegal dumping	720
32.83	Storage of hazardous industrial wastes	720
	Transportation and spill prevention of industrial hazardous wastes	721
	Spills	722
Appendix A	National Standards of Performance	727
Appendix B	National Pollutant Discharge Systems (NPDES)	729
Appendix C	Reference List of USEPA Effluent Guidelines Documents	733
	Index	737