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WASTE DISPOSAL INVENTORY FOR MISSISSIPPI-ALABAMA COASTAL COUNTIES

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WASTE DISPOSAL INVENTORY FOR MISSISSIPPI-ALABAMA COASTAL COUNTIES

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PREFACE

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The theoretical and computational developments were undertaken jointly by researchers at the Bureau of Business Research at the University of Southern Mississippi and the Department of Agricultural Economics and Rural Sociology at Auburn University.

Any errors of fact, logic, or judgment in the report are the responsibility of the authors.

TABLE OF CONTENTS

Page

PREFACE iii

LIST OF TABLES v

INTRODUCTION 1

METHODOLOGIES FOR ESTIMATING PHYSICAL QUANTITIES OF POLLUTANTS MISSISSIPPI-ALABAMA COASTAL COUNTIES 3

THE ENVIRONMENTAL STRUCTURE MISSISSIPPI-ALABAMA COASTAL COUNTIES 5

EVALUATION OF THE MODEL 27

BIBLIOGRAPHY 28

LIST OF TABLES

Table		Page
1.	Physical Quantities of Water Effluents, Air Pollution, and Solid Wastes, Mississippi Coastal Region.	9
2.	Physical Quantities of Water Effluents, Air Pollution, and Solid Wastes, Alabama Coastal Region.	12
3.	Physical Quantities of Water Effluents, Air Pollution, and Solid Wastes, Mississippi-Alabama Coastal Region. . . .	15
4.	Ranking of Physical Quantities of Pollution Category by Sector, Mississippi-Alabama Coastal Counties.	18
5.	Quantities of Pollutants Per $10,000 Output, Mississippi-Alabama Coastal Counties.	20
6.	Ranking of Pollutant Quantities Per $10,000 Output, Category by Sector, Mississippi-Alabama Coastal Counties.	23
7.	Percent of Total Pollutants Attributable to the Top Five Sectors by Pollutant Category, Mississippi-Alabama Coastal Counties.	25

I. INTRODUCTION

The motivation of this research is to provide an estimate of the magnitude of waste in the coastal counties of Mississippi and Alabama. The analysis is focused on three main categories of pollutants which are:

(1) Water Effluents,

(2) Air Pollution,

(3) Solid Wastes.

The coastal counties included are: Hancock, Harrison, and Jackson in Mississippi and Mobile and Baldwin in Alabama. As a unit, these counties comprise an important economic section with an anticipated vital growth in population and commerce.

Some of the most prominent industries in this region are naturally those related to commercial and recreational fishery as well as tourism. Hence, the quality of water is directly linked to the future production opportunities of these industries. That is, water pollution imposes an external burden that could hamper their growth and perhaps their survival.

Bell and Canterbery [2] indicate that economic losses due to water pollution may result from reduced marketability and reduced biological productivity of marine resources. They estimate the potentially productive shellfish areas closed in 1971 due to pollution at 118,460 acres for both the Mississippi and Alabama coastal region.

In addition to water pollution, both air pollution and solid wastes have serious consequences in that they threaten wildlife and natural resources and may ultimately cause illness and premature death to people [6].

The literature of the last decade is rich in references to the adverse nature of pollution. Many popular books and essays were written to dramatize the plight of our habitat. Most take the view that economic growth resulting from the application of science is at the heart of the problem. Such books as those written by Zwick and Benstock [18], Commoner [4], Battan [1], Benarde [3], and DeBell [5], made it quite clear that a sense of urgency prevails among ecologists, economists, politicians, and, most important, private citizens.

Since most environmental abuse is attributed to the growth of output of goods and services in the recent years, it became necessary for economists to evaluate the consequences of such growth. Their task is two-fold: first, there should be an assessment of the severity and extent of the environmental problem; second, there should be an attempt to provide answers to questions such as whether it is necessary to curtail the economic growth or whether it is possible to maintain such a growth without abusing the environment.

Through cooperative efforts among researchers at the Bureau of Business Research at the University of Southern Mississippi and the Department of Agricultural Economics and Rural Sociology at Auburn University, research into the economic-ecologic trade-off in the coastal counties of Mississippi and Alabama was undertaken. The approach of this research followed broadly methodologies adopted from the input-output techniques.

This research is the second portion of a three stage effort. A report on the first portion, an economic evaluation, was completed in 1978 [9]. A third report which attempts to link the economic-ecologic activities of the region will be completed later this year.

II. METHODOLOGIES FOR ESTIMATING PHYSICAL QUANTITIES OF POLLUTANTS MISSISSIPPI-ALABAMA COASTAL COUNTIES

The estimates of the total physical quantities of pollutants for the coastal counties of Mississippi and Alabama were obtained through aggregation of separate estimates, one for Mississippi coastal counties and the other for Alabama coastal counties. Sources of data were the reports published by the Bureau of Business Research, University of Southern Mississippi [10], and the Agricultural Experiment Station, Auburn University [8].

Data for the coastal counties of Mississippi were gathered from various sources. Water effluent loadings were basically derived from 1977 waste water treatment facility printouts provided by the Mississippi Air and Water Pollution Control Commission (MAWPCC) [7]. The majority of industrial process waste water contributed by commercial establishments and households were estimated using PAWPCC printouts as well as secondary sources.

Quantities of air pollutants for the Mississippi coastal counties were derived from national data published by the Environmental Protection Agency [15 and 16] and from studies of other areas [17]. Solid waste data were obtained primarily from per-capita solid waste factors [13]. For further details, the reader is referred to [9].

Data for the coastal counties of Alabama were gathered from various sources also. For industrial firms a significant portion of water effluents data were gathered from files maintained by the Alabama Water Improvement Commission (AWIC) or from the Mobile 208 study [14]. All firms with significant discharges made directly to stream segments had their monitoring reports filed

with the AWIC. Any firm in the region for which there was no file either had no significant or measurable discharge, or discharged to a municipal, semi-public, or private treatment facility. Accordingly, the discharge of municipal treatment facilities was then allocated to the industrial sectors on the basis of their employment, the assumption being that the waste was primarily "sanitary waste."

Air pollution emissions data for the Alabama coastal counties were also obtained primarily from EPA publications [15 amd 16]. For solid waste data, the majority of estimation factors came from Salvato [13] and Niessen [11 and 12].

For further description and analysis of data collection and estimation procedures, the reader is referred to the Alabama report [8].

III. THE ENVIRONMENTAL STRUCTURE MISSISSIPPI-ALABAMA COASTAL COUNTIES

In cases where there was disparity between the two components of environmental data, an effort was undertaken to make them compatible. This effort has taken two forms. The first involves the classification of the economic activities of the two regions into producing sectors and households. Each producing sector comprises a set of industries. The pattern adopted in this study follows the procedure used in the economic portion [9]. There, the economic activity was divided into 26 endogenous sectors and a household sector. The second effort involves the allocation of physical volumes of pollutants to the proper economic sectors.

For this purpose, environmental data that appeared in the separate reports for the coastal counties of Mississippi [10] and the coastal counties of Alabama [8] are summarized in Table 1 and Table 2, respectively. It can be observed from these tables that the effluents chosen to be included in the aggregation are those for which data are available in common for the two regions.

The three main categories of pollutants which were common to both studies were:

<u>Water Effluents</u>

Waste Water
Nitrogen
Sulfide
Flouride
Phosphate
Zinc
Cadmium
Iron
Chromium
Aluminum
Copper

Nickel
Lead
BOD (Abnormal)
Suspended Solids
Oil and Grease
Phenols
Organic Carbon

Air Pollution

Nitrogen Oxide
Sulfur Oxides
Carbon Monoxide
Particulates
Aldehydes
Hydrocarbons

Solid Wastes

Solid Wastes

The combined basic structure of the environmental matrix for the coastal region of Mississippi and Alabama is given in Table 3. This table, which is constructed through the aggregation, item by item, of Tables 1 and 2 contains 26 rows representing the endogeneous sectors, one row representing households, and 25 columns. The first column headed Waste Water is water partially treated or non-treated which is discharged to natural waters as a consequence of the economic process. The other 24 columns are net unpriced loadings of water effluents, air emissions, and solid waste from the area's economy into the environment. The units of measurement differ but, when appropriate, were given in tons per year. The coefficients in the table represent values estimated for the year 1977.

An examination of Table 3 reveals that some producing sectors have no environmental data. There are several reasons for these omissions: the unavailability of data in published form, the impossibility of obtaining information directly, or the relative insignificance of that pollutant to that sector.

A ranking of pollutants according to economic criteria as represented

by the producing sectors is given in Table 4. The information in this table provides a basis for identifying and comparing the sectors in terms of their relative importance in generating volumes of pollutants. For instance, ranking for sulfides, Chemicals and Allied (Sector 13) is ranked highest among the producing sectors in its contribution. The lowest contribution is by Lumber and Wood (Sector 10).

Table 5 gives the volume of pollutants per $10,000 of output. Each entry in the table represents the magnitude of pollutants per $10,000 produced. For instance, Food Processing (Sector 8) contributes .476 million gallons of waste water, .015 tons of nitrogen, .028 tons of BOD, .049 tons of suspended solids, .025 tons of settleable solids, .013 tons of oil and grease, .018 tons of nitrogen oxide, .067 tons of sulfur oxide, .001 tons of carbon monoxide, .035 tons of particulates, and 3.2 tons of solid waste for each $10,000 produced during one year.

It this manner, a comparison can be made among sectors in terms of the production of pollutants per unit of sales, a unit being defined as $10,000 of output. It is necessary to mention here that the values given in the table represent the "direct" environmental effect of $10,000 of sectoral sales. The "secondary" environmental effects resulting from the interindustry sales and purchases will be given in a later report.

Table 6 ranks the producing sectors in terms of the environmental factors for each $10,000 of sales. For instance, Sector 11 produces more phosphate per $10,000 of sales than Sector 27, and this sector in turn produces more phosphate per $10,000 than Sector 15, and so on. A look at Table 4 and Table 6 will reveal that the two types of ranking give different results. In Table 4, the ranking is based upon total magnitudes, while in Table 6 it is based upon a unit of production of $10,000.

Table 7 gives a review of each pollutant separately. For each pollutant, the top five sectors that contributed the highest direct loadings are specified and the results displayed as percentages. For each of the residuals the top five contributors accounted for the majority. Some residuals as indicated by this table are shown to be contributed entirely by a single sector. For instance, sulfides are produced entirely by Chemicals and Allied (Sector 13).

TABLE 3

PHYSICAL QUANTITIES OF WATER EFFLUENTS, AIR POLLUTION, AND SOLID WASTES
MISSISSIPPI COASTAL REGION

Number	Sector Name	Waste Water MGY	Nitrogen Tons/ Yr.	Sulfide Tons/ Yr.	Flouride Tons/ Yr.	Phosphate Tons/ Yr.	Zinc Tons/ Yr.	Cadmium Tons/ Yr.	Iron Tons/ Yr.	Chromium Tons/ Yr.	Aluminum Tons/ Yr.
1.	Fishery										
2.	Forestry										
3.	Livestock Products										
4.	Crops & Agriculture	175.634									
5.	Ag., For., Fish. Serv.										
6.	Mining	633.600									
7.	Construction	759.000									
8.	Food Processing	7534.839	245.560								
9.	Apparel & Textiles	328.634	2.246				.671			.671	
10.	Lumber and Wood	311.268	12.979								
11.	Paper and Allied	7245.000									
12.	Printing, Publishing	6.495									
13.	Chemicals, Allied	12874.239	153.936	1.811	256.363			.576	46.496	.626	
14.	Stone, Clay, and Glass	3240.408									
15.	Primary & Fabric. Metals	1458.868	17.983			7.004	.669	1.508	2.307	.431	7.429
16.	Transportation Equip.	324804.460				.271	2.168			.109	
17.	Other Manufacturing	86.848	.919				.009		.006	.013	
18.	Water Transportation	17.500	.438								
19.	Other Transportation	10.335	.259								
20.	Communication & Utilities	44.832							.003		
21.	Whsl. & Retail Trade	613.906	15.361								
22.	Finance, Ins., Real Estate	5.685	.142								
23.	Hotel, Pers. and Repr. Serv.	61.628	1.542								
24.	Medical, Educ. & Non-Prof.	293.785	7.330								
25.	Other Services	3385.135	84.696								
26.	State & Local Gov't.	29.910	.749								
27.	Households	5205.740	136.383								
	Totals	369127.735	680.523	1.811	256.363	7.275	3.717	2.084	49.414	1.850	7.429

TABLE 1 (Cont)

Sector Number	Copper Tons/Yr.	Nickel Tons/Yr.	Lead Tons/Yr.	BOD Tons/Yr.	Suspended Solids Tons/Yr.	Oil and Grease Tons/Yr.	Phenols Tons/Yr.	Organic Carbon Tons/Yr.	Nitrogen Oxide Tons/Yr.	Sulfur Oxide Tons/Yr.	Carbon Monoxide Tons/Yr.	Particulates Tons/Yr.
1.												27.133
2.												73.660
3.												221.037
4.												
5.												
6.					113.302					189.005	14.450	16.762
7.					143.290							
8.				467.941	812.232	209.382			160.014	810.204	6.934	90.097
9.				6.760	20.885				188.576	143.200	1.179	14.143
10.				41.284	68.110	7.727	.160		8.394	54.393	.448	672.758
11.				473.000	1383.000				83.874	543.504	4.474	500.000
12.										.273		
13.				230.190	607.011	116.628	.314	52.836	3526.913	1600.002	7.622	82.567
14.				36.655	632.101	12.902			117.970	203.310	1.632	1091.850
15.	.778	1.736		.051	34.469	16.951			77.500	77.722	.698	300.000
16.				36.655	47.370	.703			2306.791	116.659		
17.			.077	2.117	5.613	1.161			191.053	148.027	11.246	31.014
18.				2.190	2.190	1.095	.002		91.599		140.921	133.874
19.				1.293	1.293	.647			128.768		196.104	188.199
20.	.001			.019	7.965	.170			9.083	40000.000	7.445	2500.000
21.				76.801	76.801	38.401						20.000
22.				.711	.711	.356						
23.				7.710	7.710	3.855						
24.				36.754	36.754	18.277						
25.				423.480	423.480	211.740						
26.				3.742	3.742	1.871						
27.				664.920	5367.271	320.961			8813.096	427.640	40160.945	1115.582
	.779	1.736	.077	2512.273	9795.300	962.927	.476	52.836	15703.631	44313.917	40556.093	7068.606

TABLE 1 (Cont,

Sector Number	Aldehydes Tons/ Yr.	Total Hydrocarbons Tons/Yr.	Solid Wastes Tons/Yr.
1.			
2.			
3.			23919.900
4.			
5.			
6.	14.450	14.450	21.450
7.			223.500
8.	6.934	6.934	42543.280
9.	1.179	1.179	540.950
10.	.448	.448	3428.700
11.	4.474	4.474	2652.000
12.		250.000	212.170
13.	7.623	381.077	17148.971
14.	1.632	1.632	1828.800
15.	.698	.698	43060.350
16.			29942.900
17.	1.225	1.225	1100.900
18.	21.138	28.184	80.523
19.	29.716	39.621	47.541
20.	74.450	223.349	292.695
21.			59917.254
22.			261.441
23.			903.870
24.			16012.817
25.			907.764
26.			687.930
27.		4834.188	161377.920
	163.967	5787.459	407110.626

TABLE 2

PHYSICAL QUANTITIES OF WATER EFFLUENTS, AIR POLLUTION, AND SOLID WASTE
ALABAMA COASTAL REGION

Sector Number	Sector Name	Waste Water MGY	Nitrogen Tons/ Yr.	Sulfide Tons/ Yr.	Floride Tons/ Yr.	Phosphate Tons/ Yr.	Zinc Tons/ Yr.	Cadmium Tons/ Yr.	Iron Tons/ Yr.
1.	Fisheries		1.56			.520			
2.	Forestry								
3.	Livestock								
4.	Crops								
5.	Ag., For., & Fish. Services		.246			.081			
6.	Mining		8.99			3.030			
7.	Construction	462.890	2.532			.798			
8.	Food Processing		2.25			.744			
9.	Apparel & Textiles	432.850	3.98	.012		.930	.011		.005
10.	Lumber & Wood	49372.050	937.230	.403		83.930	19.270		.005
11.	Paper & Allied		.936			.310			
12.	Printing & Publishing	667632.020	131.300	3962.490	.691	49.580	17.017	.003	2.883
13.	Chemicals & Allied	304.200	3.510		3.210	.248			
14.	Stone, Clay, Glass	52.110	.676		.002	.224	.003		.007
15.	Primary & Fabricated Metals	388.430	3.623			1.239	.572		
16.	Transportation Equip.	910.890	2.480			1.420	.001		.143
17.	Other Manufacturing		3.490			1.160			
18.	Water Transportation		4.340		.063	1.440			
19.	Other Transportation		4.590			2.200			
20.	Communication & Utilities		33.070		.063	12.670			
21.	Whls1. & Retail Trade		5.360			1.770			
22.	Finance, Ins., Real Estate		4.120			5.280			
23.	Hotel, Pers. and Repr. Serv.		13.370			8.820			
24.	Medical, Educ., and Non-Prof.		5.876			1.960			
25.	Other Services		15.830			5.260			
26.	State and Local Gov't		873.260			294.010			
27.	Households								
		719555.44	2062.61	3962.905	4.029	477.624	36.874	.003	3.043

TABLE 2 (Cont)

Sector Number	Chromium Tons/ Yr.	Aluminum Tons/ Yr.	Copper Tons/ Yr.	Nickel Tons/ Yr.	Lead Tons/ Yr.	BOD Tons/ Yr.	Suspended Solids Tons/Yr.	Oil & Grease Tons/Yr.	Phenols Tons/ Yr.	Organic Carbon Tons/Yr.
1.						1.560	1.560			
2.							40425.000			
3.							76000.000			
4.							2867400.000			
5.										
6.						.246	.246			
7.						9.080	9.030			
8.						4.660	7.290	2.360		
9.						2.250	2.250			
10.	3.170	.030	10.860		.001	89.210	87.860	1.320	.058	67.290
11.	36.490		.002	.001	.003	6204.000	11250.000	3.170	54.860	12.780
12.						.936	.936			
13.	6.570	104.500	.013	.408	.005	710.200	1032.030	60.200	.324	355.100
14.	.053		.002			2.210	1264.000			
15.	.021			.030		.880	1.670			
16.	.708					3.900	6.290			
17.	.902		.054			2.580	47.560	8.730	.690	
18.						3.490	3.490			
19.	.007		.003			5.370	5.820	.615	.001	
20.						5.780	5.170			
21.	.006					37.900	72.100	.861		
22.						5.360	5.360			
23.						3.590	6.920			
24.						25.710	19.970			
25.						5.960	5.930			
26.						15.860	15.850			
27.						877.830	877.280			
	47.927	104.530	10.934	.439	.009	8018.562	2998552.500	77.256	56.133	435.17

TABLE 2 (Cont)

Sector Number	Nitrogen Oxide Tons/Yr.	Sulfur Oxide Tons/Yr.	Carbon Monoxide Tons/Yr.	Particulates Tons/Yr.	Aldehydes Tons/Yr.	Total Hydrocarbons Tons/Yr.	Solid Waste Tons/Yr.
1.	3032.540	238.250	1193.760			459.080	
2.	525.170	6.640	18227.280	2213.090		3125.190	
3.	48.190	5.460	503.120	4.670	1.930	23.490	
4.	621.470	46.860	3696.900	89.440	23.350	216.610	
5.							
6.	89.520	17.100	143.020	8.580	1.030	10.760	
7.	1223.550	78.880	14516.600	115.620	43.080	621.470	4234.000
8.	143.790	318.630	17.890	505.910	.970	9.030	11416.000
9.	2.920	20.840	.320	.860	.040	.180	558.000
10.	183.250	155.580	23.610	32.480	2.080	11.120	109325.000
11.	3631.730	8342.940	371.560	1445.670	27.150	125.180	15100.000
12.	28.230	41.980	2.260	6.550	.830	1.480	441.000
13.	2565.730	5562.280	237.290	1162.120	8.130	90.480	18014.000
14.	986.950	2750.000	73.420	585.000	3.410	28.560	1440.000
15.	28.700	31.030	3.670	5.940	.290	1.730	1105.000
16.	59.400	141.810	5.620	20.540	.860	3.300	3565.000
17.	166.320	490.310	21.660	138.000	.490	10.790	7629.000
18.	1168.250	3145.680	2610.440	342.550		196.040	5699.000
19.	395.130	322.600	2089.080	51.050	2.070	201.840	7084.000
20.	5974869.000	49184.560	145883.440	2521.890	10.040	8917.890	3015.000
21.	238.310	561.330	21.560	73.520	3.130	12.880	34143.000
22.	22.840	37.850	2.620	8.910	.200	7.900	7789.000
23.	7.620	13.210	.700	1.900	.200	.460	3702.000
24.	1964.630	4501.040	153.640	614.810	47.720	103.690	27174.000
25.	18.240	30.810	1.990	4.460	.190	1.030	4383.000
26.	823.400	2405.610	55.460	299.940	15.600	41.320	16462.000
27.	11467.910	462.210	192272.630	1484.680	2.180	26148.350	190074.000
	6004312.500	78913.490	382129.530	11738.180	194.970	40369.850	472351.000

TABLE 3

PHYSICAL QUANTITIES OF WATER EFFLUENTS, AIR POLLUTION, AND SOLID WASTES
MISSISSIPPI-ALABAMA COASTAL COUNTIES

Sector Number	Sector Name	Waste Water Tons/Yr.	Nitrogen Tons/ Yr.	Sulfide Tons/ Yr.	Floride Tons/ Yr.	Phosphate Tons/ Yr.	Zinc Tons/ Yr.	Cadmium Tons/ Yr.	Iron Tons/ Yr.	Chromium Tons/ Yr.
1.	Fisheries		1.56			.520				
2.	Forestry									
3.	Livestock Products									
4.	Crops & Agriculture	175.634								
5.	Ag., For., Fish. Serv.									
6.	Mining	633.600	.246			.081				
7.	Construction	759.000	8.990			3.030				
8.	Food Processing	7997.729	248.092			.798				
9.	Apparel & Textiles	328.634	4.496			.744	.671			.671
10.	Lumber & Wood	744.118	16.959	.012		.930	.011		.005	3.170
11.	Paper & Allied	56617.050	937.230	.403		83.930	19.270		.005	36.496
12.	Printing, Publishing	6.495	.936			.310				
13.	Chemicals & Allied	680506.250	285.236	3964.301	257.054	49.580	17.017	.579	49.381	7.196
14.	Stone, Clay, & Glass	3544.608	3.510		3.210	.248				.053
15.	Primary & Fab. Metals	1510.978	18.659		.002	7.228	.872	1.508	2.914	.452
16.	Transportation Equip.	325192.890	3.623			1.510	2.740			.817
17.	Other Manufacturing	997.738	3.399			1.420	.010		.149	.915
18.	Water Transportation	17.500	3.928			1.160				
19.	Other Transportation	10.335	4.599		.063	1.440				.007
20.	Communication & Utilities	44.832	4.590			2.200			.003	
21.	Whlsl. & Retail Trade	613.906	48.431		.063	12.670				.006
22.	Finance, Ins., Real Estate	5.685	5.502			1.770				
23.	Hotel, Pers. & Repr. Serv.	61.628	5.662			5.280				
24.	Med., Educ. & Nonprof.	293.785	20.700			8.820				
25.	Other Services	3385.135	90.572			1.960				
26.	State & Local Gov't	29.910	16.579			5.260				
27.	Households	5205.740	1009.643			294.010				
		1088682.400	2743.140	3964.716	260.392	484.899	40.591	2.087	52.457	49.777

TABLE 3 (Cont)

Sector Number	Aluminum Tons/ Yr.	Copper Tons/ Yr.	Nickel Tons/ Yr.	Lead Tons/ Yr.	BOD Tons/ Yr.	Suspended Solids Tons/Yr.	Oil & Grease Tons/Yr.	Phenols Tons/ Yr.	Organic Carbon Tons/Yr.	Nitrogen Oxide Tons/Yr.
1.					1.560	1.560				3032.540
2.						40425.000				525.170
3.						76000.000				48.190
4.						2867400.000				621.470
5.										
6.					.246	113.548				89.520
7.					9.080	152.320				1223.550
8.					472.601	819.522	211.742			303.804
9.					9.010	23.135				191.496
10.	.030	10.860		.001	130.494	155.970	9.047	.218	67.290	191.644
11.		.002	.001	.003	6667.000	12633.000	3.170	54.860	12.780	3715.604
12.					.936	.936				28.230
13.	104.500	.013	.408	.005	940.390	1639.041	176.828	.638	407.936	6092.643
14.		.002			38.865	1896.101	12.902			1104.920
15.	7.429	.778	1.766		.931	36.139	16.951			106.200
16.					40.555	53.660	.703			2366.191
17.		.054		.077	4.697	53.173	9.891	.890		357.373
18.					5.680	5.680	1.095	.002		1259.849
19.		.003			6.663	7.113	1.262	.001		523.896
20.		.001			5.799	13.135	.170			5974887.083
21.					114.701	148.901	39.262			238.310
22.					6.071	6.071	.356			22.640
23.					11.300	14.630	3.855			7.520
24.					62.464	56.724	18.277			1964.630
25.					429.440	429.410	211.740			18.240
26.					19.602	19.592	1.871			823.400
27.					1542.750	6244.551	320.961			20281.006
	111.959	11.713	2.175	.086	10520.835	3008348.912	1040.083	56.609	488.006	6020025.321

TABLE 3 (Cont)

Sector Number	Sulfur Oxide Tons/Yr.	Carbon Monoxide Tons/Yr.	Particulates Tons/Yr.	Aldehydes Tons/Yr.	Total Hydrocarbons Tons/Yr.	Solid Waste Tons/Yr.
1.	238.250	1193.750			459.080	
2.	6.640	18227.280	2240.223		3125.190	
3.	5.460	503.120	78.350	1.930	23.490	23919.900
4.	46.860	3696.900	310.477	23.350	216.610	
5.						
6.	206.106	157.473	25.342	15.480	25.210	21.450
7.	78.880	14516.600	115.620	43.080	621.470	4457.500
8.	1128.834	24.824	585.917	7.904	15.964	53958.280
9.	164.040	1.499	15.003	1.219	1.359	1098.950
10.	209.970	24.058	705.238	2.528	11.568	112753.700
11.	8886.444	376.034	1945.670	31.624	129.654	17752.000
12.	42.253	2.260	6.550	.830	251.480	653.170
13.	7162.280	244.912	1244.687	15.753	471.657	35162.971
14.	2953.310	75.052	1676.850	5.042	30.192	3268.800
15.	108.732	4.368	305.940	.988	2.428	44165.350
16.	258.468	5.620	20.540	.860	3.300	33507.900
17.	638.337	32.906	169.014	1.715	12.015	8729.900
18.	3145.680	2751.361	476.424	21.138	224.224	5779.523
19.	322.600	2287.184	239.249	31.786	241.461	7131.541
20.	89184.560	145890.560	5021.890	84.490	9141.239	3307.695
21.	561.330	21.560	93.520	3.130	12.880	94060.254
22.	37.850	2.620	8.910	.200	7.900	8050.441
23.	13.210	.700	1.900	.200	.460	4605.870
24.	4501.040	153.640	614.810	47.720	103.690	43186.817
25.	30.810	1.990	4.460	.190	1.030	5290.764
26.	2405.610	55.460	299.940	15.600	41.320	17149.930
27.	889.850	232433.575	2600.262	2.180	30982.538	351451.920
	123227.400	422685.168	18806.786	358.937	46157.309	879464.456

TABLE 4

RANKING OF PHYSICAL QUANTITIES OF POLLUTION CATEGORY BY SECTOR
MISSISSIPPI-ALABAMA COASTAL COUNTIES

Rank	Waste Water	Nitrogen	Sulfides	Florides	Phosphate	Zinc	Cadmium	Iron	Chromium	Aluminum	Copper	Nickel	Lead	BOD	Suspended Solids
1.	13	27	13	13	27	11	15	13	11	13	10	15	17	11	4
2.	16	11	11	14	11	13	13	15	13	15	19	13	13	27	3
3.	11	13	10	19	13	16		17	10	10	17	11	11	13	2
4.	8	8		20	21	15		10	17		13		10	6	11
5.	27	25		15	24	9		11	16		19			25	27
6.	14	21			15	10		20	9		11			10	14
7.	25	24			23	17			15		14			21	13
8.	15	15			26				14		20			24	8
9.	17	10			7				19					16	25
10.	7	26			20				21					14	10
11.	10	7			25									26	7
12.	6	23			22									23	21
13.	21	22			16									7	6
14.	9	19			19									9	24
15.	24	20			17									19	20
16.	4	9			18									22	21
17.	23	18			10									20	15
18.	20	16			8									18	9
19.	26	14			9									17	26
20.	18	17			1									1	23
21.	19	1			12									12	20
22.	12	12			14									15	19
23.	22	6			6									6	22
24.															18
25.															1
26.															12
27.															

TABLE 4 (Cont)

Rank	Settleable Solids	Oil & Grease	Phenols	Organic Carbon	Nitrogen Oxide	Sulfur Oxide	Carbon Monoxide	Particulates	Aldehydes	Total Hydrocarbons	Solid Waste
1.	8	27	13	13	20	20	27	20	20	27	27
2.		8	10	10	27	11	25	27	24	20	10
3.		25	11	11	13	13	2	2	7	2	21
4.		13			11	24	[illegible]	11	19	[illegible]	8
5.		21			[illegible]	18	4	14	11	13	15
6.		24			16	14	15	13	4	1	24
7.		15			24	26	13	10	18	12	13
8.		14			18	8	[illegible]	24	13	19	16
9.		17				27	3	8	26	18	3
10.		10			14	17	11	18	6	4	11
11.		23			26	21	[illegible]	4	8	11	26
12.		11			4	19	23	15	14	24	17
13.		26			2	16	14	26	21	26	22
14.		19			19	1	26	19	10	30	19
15.		18			17	10	[illegible]	17	27	8	18
16.		16			8	6	[illegible]	7	3	3	20
17.		22			21	9	10	21	17	6	23
18.		20			10	15	21	3	9	21	7
19.					9	7	18	6	15	17	20
20.					15	4	15	16	16	10	14
21.					6	12	22	9	12	22	9
22.					3	22	12	22	22	16	12
23.					12	25	25	12	23	15	6
24.					22	23	[illegible]	25	25	9	
25.					25	2	23	23		25	
26.					23	3				23	
27.											

TABLE 5

QUANTITIES OF POLLUTANTS PER $10,000 OUTPUT
MISSISSIPPI-ALABAMA COASTAL COUNTIES

Sector Number	Waste Water	Nitrogen	Sulfide	Flouride	Phosphate	Zinc	Cadmium	Iron	Chromium	Aluminum	Copper	Nickel
1.	.000526				.000176							
2.												
3.	.056057											
4.	.056058											
5.												
6.	.137817	.000054			.000018							
7.	.017910	.000212			.000072							
8.	.475664	.014756			.000047				.000119			
9.	.058432	.000799			.000132	.000119			.000426	.000004	.001459	
10.	.099937	.002276	.000002		.000125	.000001			.000834			
11.	1.294364	.021427	.000009		.001919	.000441						
12.	.002557	.000368			.000122							
13.	13.822213	.005794	.080522	.005221	.001001	.000346	.000018	.001003	.000146	.002123		.000008
14.	.727965	.000721		.000660	.000051				.000011			
15.	.227955	.002815			.001090	.000132	.000228	.000440	.000068	.001121	.000117	.000266
16.	5.335212	.000059			.000025	.000045			.000013			
17.	.003447	.000110			.000083			.000009	.000054		.000003	
18.	.001219	.000274			.000081							
19.	.000743	.000331		.000005	.000103							
20.	.001621	.000166			.000080							
21.	.009319	.000735			.000192							
22.	.000121	.000117			.000038							
23.	.008100	.000744			.000694							
24.	.014479	.001020			.000435							
25.	.140041	.003747			.000081							
26.	.000732	.000406			.000179							
27.	.030049	.005828			.001697							

TABLE 5 (Cont)

Sector Number	Lead	BOD	Suspended Solids	Settleable Solids	Oil & Grease	Phenols	Organic Carbon	Nitrogen Oxide	Sulfur Oxide	Carbon Monoxide	Particulates
1.		.000527	.000527					1.023539	.060414	.402913	
2.			31.738243					.412318	.005213	14.310497	1.755851
3.			37.863691					.024009	.002720	.250658	.039034
4.			915.195810					.198356	.014956	1.179950	.099096
5.								.019472	.044831	.034252	.005512
6.		.000054	.024698					.028871	.001861	.342546	.002726
7.		.000214	.003594					.018067	.067137	.001476	.034847
8.		.028108	.048741	.025170	.012543			.034048	.029167	.000267	.002668
9.		.001602	.004113					.025738	.031916	.003231	.094715
10.		.017526	.020947		.001215	.000029	.009037	.084945	.203160	.008597	.044481
11.		.152000	.288812		.000072	.001254	.000292	.011113	.016633	.000890	.002578
12.		.000368	.000368					.123752	.145478	.004975	.025282
13.		.019101	.033292		.003592	.000013	.008286	.226920	.606529	.015414	.344379
14.		.007982	.389407		.002650			.016022	.016404	.000659	.046156
15.		.000140	.005452		.002557			.038820	.004241	.000092	.000337
16.		.000665	.000880		.000012	.000052		.021007	.037522	.001934	.009935
17.	.000005	.000276	.003126		.000581			.087789	.219197	.191723	.033198
18.		.000396	.000396		.000076			.037650	.033184	.164371	.017194
19.		.000479	.000511		.000091			216.036820	3.224688	5.275046	.181579
20.		.000210	.000475		.000006			.003618	.008521	.000327	.001420
21.		.001741	.002260		.000596			.000487	.000808	.000056	.000190
22.		.000130	.000130		.000008			.000988	.001736	.000092	.000250
23.		.001485	.001923		.000507			.096827	.221834	.007572	.030301
24.		.003079	.002796		.000900			.000755	.001275	.000082	.000185
25.		.000811	.017764		.003760			.020149	.005887	.001357	.007340
26.		.000480	.000479		.000046			.117067	.005136	1.341667	.015009
27.		.008905	.036045		.001853						

TABLE 5 (Cont)

Sector Number	Aldehydes	Total hydrocarbons	Solid waste
1.		.154948	
2.		2.453631	
3.	.000962	.011703	11.917049
4.	.007453	.069136	
5.			
6.	.003367	.005484	.004666
7.	.001017	.014664	.105183
8.	.000474	.000949	3.209166
9.	.000217	.000242	.195397
10.	.000340	.001554	15.143059
11.	.000723	.002964	.405842
12.	.000327	.098996	.257123
13.	.000320	.009578	.714218
14.	.001035	.006201	.671322
15.	.000150	.000366	6.663048
16.	.000014	.000054	.549741
17.	.000101	.000706	.513155
18.	.001473	.015624	.402729
19.	.002284	.017353	.512515
20.	.003055	.330524	.119598
21.	.000048	.000196	1.427873
22.	.000004	.000169	.171790
23.	.000026	.000060	.605422
24.	.002352	.005110	2.128467
25.	.000008	.000043	.218876
26.	.000382	.001011	.419663
27.	.000013	.178839	2.028670

TABLE 6

RANKING OF POLLUTANT QUANTITIES PER $10,000 OUTPUT, CATEGORY BY SECTOR
MISSISSIPPI-ALABAMA COASTAL COUNTIES

Rank	Waste Water	Nitrogen	Sulfide	Flouride	Phosphate	Zinc	Cadmium	Iron	Chromium	Aluminum	Copper	Nickel	Lead	BOD	Suspended Solids
1.	13	11	13	13	11	11	15	13	11	13	10	15	17	11	4
2.	16	8	11	14	27	13	13	15	10	15	15	13		8	3
3.	11	27	10	19	15	15		17	13	10	17			13	6
4.	14	13			13	9			9					10	14
5.	8	25			23	16			15					27	11
6.	15	15			24	10			17					14	8
7.	25	10			21				16					24	27
8.	6	24			1									21	13
9.	10	9			9									9	8
10.	9	23			26									23	10
11.	4	21			10									25	25
12.	3	14			12									16	15
13.	27	26			19									1	9
14.	7	12			17									26	7
15.	24	19			18									19	17
16.	21	18			25									18	24
17.	23	7			20									12	21
18.	17	20			7									17	23
19.	12	22			14									7	16
20.	20	17			8									20	1
21.	18	16			22									11	19
22.	19	6			16									15	26
23.	26				6									22	20
24.	1													6	18
25.	22														12
26.															22
27.															

TABLE 6 (Cont)

Rank	Settleable Solids	Oil & Grease	Phenols	Organic Carbon	Nitrogen Oxide	Sulfur Oxide	Carbon Monoxide	Particulates	Aldehydes	Total Hydrocarbons	Solid Waste
1.	8	8	11	10	20	20	2	2	4	2	10
2.		25	17	13	1	14	20	14	6	20	3
3.		13	10	11	2	24	27	20	20	27	15
4.		14	13		14	18	4	4	24	1	8
5.		15			4	11	1	10	19	12	24
6.		27			13	13	7	15	18	4	27
7.		10			27	1	3	11	14	19	21
8.		24			24	8	18	3	7	18	13
9.		21			18	6	19	8	3	7	14
10.		17			11	17	6	18	11	3	23
11.		23			16	10	14	24	8	13	16
12.		19			19	9	11	13	26	14	17
13.		18			9	19	24	19	10	6	19
14.		11			7	12	13	27	12	24	26
15.		26			10	15	10	17	14	11	11
16.		16			3	4	17	26	9	10	18
17.		22			17	21	8	6	15	26	12
18.		20			26	26	26	1	17	8	25
19.					6	2	12	9	21	17	9
20.					15	27	15	12	23	15	22
21.					12	16	21	21	16	9	20
22.					21	3	9	16	27	21	7
23.					23	7	16	23	25	22	6
24.					25	23	23	22	22	23	
25.					22	25	25	25		16	
26.						22	22			25	
27.											

TABLE 7

PERCENT OF TOTAL POLLUTANTS
ATTRIBUTABLE TO THE TOP FIVE SECTORS BY POLLUTANT CATEGORY
MISSISSIPPI-ALABAMA COASTAL COUNTIES

Sector	Percent
Waste Water	
13	63
16	30
11	5
8	1
27	1
Nitrogen	
27	37
11	34
13	10
8	9
25	3
Sulfides	
13	100
Flouride	
13	99
14	1
Phosphate	
27	61
11	17
13	10
21	3
24	2
Zinc	
11	47
13	42
16	7
15	2
9	2

Sector	Percent
Cadmium	
15	72
13	28
Iron	
13	72
15	28
Chromium	
11	74
13	15
10	7
17	2
16	2
Aluninum	
13	93
15	7
Copper	
10	93
19	7
Nickel	
15	81
13	19

TABLE 7 (Cont)

Sector	Percent
Lead	
17	90
13	6
11	3
10	1
BOD	
11	63
27	15
13	9
8	4
25	4
Suspended Solids	
4	95
3	3
2	1
Oil & Grease	
27	31
8	20
25	20
13	17
21	4
Phenols	
13	84
10	14
11	2
Organic Carbon	
13	84
10	14
11	2
Nitrogen Oxide	
20	99

Sector	Percent
Sulfur Oxide	
20	72
11	7
13	6
24	4
18	3
Carbon Monoxide	
27	55
20	34
2	4
7	3
4	1
Particulates	
20	27
27	14
2	12
11	10
14	9
Aldehydes	
20	23
24	13
7	12
19	9
11	9
Total Hydrocarbons	
27	66
20	20
2	7
7	1
13	1
Solid Waste	
27	40
10	13
21	11
8	6
15	5

IV. EVALUATION OF THE MODEL

The purpose of this report is to determine the physical magnitudes of air, water, and solid waste pollution generated through the economic activities of the coastal region of Mississippi and Alabama. It is a joint effort undertaken by two separate study groups in Mississippi and Alabama. Although there was coordination in developing the models, it was necessary for each unit to construct its own model for its own coastal region. The combined information common to both regions was extracted and adapted to produce this report. Therefore, no detailed explanations of sources and uses of data were given. Instead, the interested reader is referred to the individual sources [10 and 8] for further reference.

The bulk of time and effort for both studies was devoted to finding data to fill cells in a matrix. Some of the data were readily available in a useable form. Others had to be generated through various estimation procedures such as adaptation of data of other regions, the use of national data, or the use of factors established by engineering and scientific methodologies. Hence, each study group had to rely on available sources of information in its own region.

Even though the separate studies used principally similar techniques at arriving at the results, some differences naturally occur. Therefore, due to such shortcomings, the reader is cautioned to keep in mind the necessary qualifications when interpreting and applying the results of this report.

BIBLIOGRAPHY

1. Battan, Louis J. The Unclean Sky. New York: Anchor Books, 1966.

2. Bell, Frederick W., and Canterbery, E. Ray. Benefits from Water Pollution Abatement. National Technical Information Service, U.S. Department of Commerce, April 1976.

3. Benarde, Melvin A. Our Precarious Habitats. New York: W.W. Norton & Co., Inc., 1970.

4. Commoner, Barry. The Closing Circle: Nature, Man and Technology. New York: Bantam Books, Inc., 1974.

5. DeBell, Garrett, ed. The Environmental Handbook. New York: Ballantine Books, Inc., 1970.

6. Enthoven, Alain C., and Freeman, Myrick A. III, ed. Pollution, Resources, and the Environment. New York: Norton & Company, Inc., 1973.

7. Mississippi Air and Water Pollution Control Commission. NPDES Self Monitoring System Data Summary Report. Unpublished Computer Printout. Jackson, Mississippi, March, 1978.

8. Nelson, Robert G., Hardy, William E. Jr., and Flynn, John B. The Economic and Environmental Structure of Alabama's Coastal Region, Part II: Environmental Structure. Department of Agricultural Economics and Rural Sociology, Agricultural Experiment Station. Auburn University (in press).

9. Nissan, Edward, Williams, D.C., Green, Trellis, Hardy, W.E., and Nelson, R.G. An Economic Input-Output Analysis for Mississippi-Alabama Coastal Counties. Bureau of Business Research, University of Southern Mississippi.

10. Nissan, Edward, Williams, D.C., and Green, Trellis. Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi, Part II: Environmental Model. Bureau of Business Research, University of Southern Mississippi. June, 1979.

11. Niessen, Walter R. "Properties of Waste Materials." In David Gordon Wilson ed. Handbook of Solid Waste Management. New York: Van Nostrand Reinhold Company, 1977, pp. 10-62.

12. Niessen, Walter R. "Estimation of Solid-Waste Production Rates." In David Gordon Wilson, ed. Handbook of Solid Waste Management. New York: Van Nostrand Reinhold Company, 1977, pp. 554-574.

13. Salvato, Joseph A., Jr. Environmental Engineering and Sanitation. 2nd Edition. New York: John Wiley & Sons, Inc., 1972.

14. South Alabama Regional Planning Commission. Water Quality Management Plan, Mobile and Baldwin Counties, Alabama, The Mobile 208 Study Area, Vol. 4.

15. U.S. Environmental Protection Agency, Office of Air and Waste Management, Office of Air Quality Planning and Standards. Compilation of Air Pollutant Emission Factors. Publication AP-42, Part A. Second Edition. Research Triangle Park, North Carolina, 1976.

16. U.S. Environmental Protection Agency, Office of Air and Waste Management, Office of Air Quality Planning and Standards. Compilation of Air Pollutant Emission Factors. Publication AP-42, Part B, Third Edition, Research Triangle Park, North Carolina, 1976.

17. Victor, Peter. Pollution: Economy and Environment. London: George Allen and Unwin, Ltd., 1972.

18. Zwick, David, and Benstock, Marcy. Water Wastelands. New York: Bantam Books, Inc., 1972.