

4-1-1982

The Derivation of Pollution Coefficients: Urge energy and Employment Impacts Module

Randall W. Jackson

Follow this and additional works at: https://researchrepository.wvu.edu/rri_iotheormethods

Recommended Citation

Jackson, Randall W., "The Derivation of Pollution Coefficients: Urge energy and Employment Impacts Module" (1982). *Theory and Methods*. 25.

https://researchrepository.wvu.edu/rri_iotheormethods/25

This Article is brought to you for free and open access by the RRI Input-Output Archive at The Research Repository @ WVU. It has been accepted for inclusion in Theory and Methods by an authorized administrator of The Research Repository @ WVU. For more information, please contact beau.smith@mail.wvu.edu.

ERG TECHNICAL MEMO NO. 142

THE DERIVATION OF POLLUTION COEFFICIENTS :
URGE ENERGY AND EMPLOYMENT IMPACTS MODULE

by

Randall W. Jackson

Energy Research Group
Office of Vice Chancellor for Research
University of Illinois at Urbana-Champaign
Urbana, IL 61801

April 1982

The Energy and Employment Impacts module of the Universities Research Group on Energy Advanced Simulation Model has as its primary charge the determination of the direct and indirect impact on energy and employment which result from various electricity generation and pollutant emission standards policy option scenarios. A secondary effort is the determination of direct and indirect impacts on pollutant emissions of three types of pollutants. The group responsible for implementing the Impacts model, the Energy Research Group (ERG) at the University of Illinois, Urbana - Champaign campus (UIUC), was, in 1980, in the process of collecting data from the EPA's SEAS model. The data were acquired primarily from the MITRE Corporation, which was one of the primary contributors to the generation of the pollution coefficients in the SEAS model. Since that time, however, numerous obstacles have resulted in abandoning the SEAS coefficients in favor of a different set of pollutant coefficients.

This document describes the difficulties encountered in the ERG's efforts to employ SEAS model data and the data eventually employed by the ERG. In addition, the derivation of the pollutant coefficients for SO_x , NO_x and particulates is presented.

The initial SEAS model data was forwarded to the ERG at the request of the U.S. Environmental Protection Agency. The SEAS national and state residual coefficient files, the SEAS Names and Definitions Manual, the SEAS Taxonomy Manual and a summary Guidance Paper were received in October, 1980, from the Environmental

Assessment and Planning Department of the MITRE Corporation. These data were reorganized and compiled, then shelved until summer, 1981, in order to concentrate on the principal purposes of the module, and to determine the precise units required for the operation of the pollution section of the module.

The national coefficient file was chosen for use in the Impacts module since the pollution impacts were not to be regionalized. It was determined that the units necessary are pounds of pollutant per 1972 dollar output for each of 88 industrial sectors.¹ The data in the national coefficient file are in mixed units, and are listed at what might be referred to as a sub-subsector level. Major sectors are essentially 1-digit SIC level. Subsectors are roughly 2-digit level, and sub-subsectors are roughly 3 and 4 digit SIC level. The units of the data are lbs/dollar, lbs/gallon, lbs/BTU, and lbs/bushel.

The input-output data base maintained by the ERG at UIUC is the basis for the Impacts module, and analysis will be carried out at an 88 sector level of industrial disaggregation. As such, the SEAS data required aggregation. In order to aggregate the SEAS data accurately, it is necessary to use a weighted averaging technique. For example, if sectors 140 through 145 constitute aggregated sector 30, then the procedure is as follows:

¹The sectoring relationships of the ERG 88 sectors with BEA and BLS data are detailed in ERG Technical Memo No. 138.

$$\frac{\sum_{i=140}^{145} \text{lbs}/\$ \text{ output sector } i \cdot \$ \text{ output sector } i/\text{yr}}{\$ \text{ of output sector } 30} \quad (1)$$

If units are not in lbs/\$, dollar equivalents for physical outputs are required. Unfortunately, repeated attempts to locate either output by subsector or dollar value equivalents proved unsuccessful. Contact with both MITRE Corporation and EPA in Washington, D.C., indicated that the generation of the necessary data would require a special run of the SEAS model, for which funds were no longer available. Before requesting the appropriation of funds for a special run of the SEAS model, we decided to reevaluate the usefulness of the SEAS coefficients that would be generated.

It was at that point that it became apparent that the SEAS model contained less information than believed. After aggregating the SEAS coefficients, were that possible, only 15 aggregated sectors would have had non-zero values. Of these new sectors, there was considerable doubt that the resulting coefficients were representative of the aggregated sector. This was principally due to the incomplete nature of the national coefficient file, and the suspicion that the sub-sector data listed represented only a small fraction of the aggregate sector outputs.

In the meanwhile, other data sources were being explored. We contacted a source of the NEDS (National Emissions Data System) data who informed us that the same types of problems might be expected with that data base. In general, these data bases have rather good data at the process level but incomplete data at the industry level.

A third source for this type of data is the Energy and Environmental System Division at Argonne National Laboratory. These data relate only to pollutant emissions from the combustion of fuels. These account for 85-95% of total NO_x and SO_x emissions, but less than 50% of total particulate emissions. Argonne checked the results of their calculations against the NEDS data. Differences are greatest for agriculture, forestry, fisheries and the construction sectors, but these are not significant parts of the totals. Most other differences are said to be explained by the lack of fugitive emissions and the assumption of meeting revised New Source Performance Standards.

The pollutant data supplied us by Argonne is a breakdown of the three pollutant types by three industry types and five fuel types. NO_x , SO_x and particulate data in tons/ 10^{12} BTU input of energy are listed for utilities (BEA 68), industry (manufacturing BEA sectors) and residential/commercial (other BEA sectors) and distillate fuel oils, residual fuel oils, coal, natural gas and gasoline. Upper and lower estimates are listed for each category. These data are listed in Appendix A.

It is necessary at this point to convert the data from tons/ 10^{12} BTU to tons/\$ output. In order to accomplish this we multiply tons/ 10^{12} BTU by BTU/\$ (yielding tons/ 10^{12} \$). Summing across all fuel types for one pollutant and one industry yields the total direct pollutant emission for that industry. We may formulate this relationship in matrix terms by imagining a matrix

of pollutant vectors, say $\underline{\underline{S}}$, postmultiplied by a matrix of BTU/\$ output by fuel type and by industry, say $\underline{\underline{T}}$, as shown below.

$$\begin{array}{c}
 \underline{\underline{S}} \\
 \begin{array}{|c|} \hline 1 \\ \hline 2 \\ \hline 3 \\ \hline 4 \\ \hline \vdots \\ \hline \vdots \\ \hline \vdots \\ \hline 88 \\ \hline \end{array}
 \end{array}
 \begin{array}{c}
 \underline{\underline{T}} \\
 \begin{array}{|c|} \hline 1 \\ \hline 2 \\ \hline 3 \\ \hline 4 \\ \hline 5 \\ \hline \end{array}
 \begin{array}{|c|} \hline 1 \\ \hline 2 \\ \hline \dots \\ \hline 88 \\ \hline \end{array}
 \end{array}
 =
 \begin{array}{c}
 \underline{\underline{L}} \\
 \begin{array}{|c|} \hline 1 \\ \hline \vdots \\ \hline \vdots \\ \hline \vdots \\ \hline 88 \\ \hline \end{array}
 \begin{array}{|c|} \hline 1 \\ \hline \dots \\ \hline \dots \\ \hline 88 \\ \hline \end{array}
 \end{array}
 \quad (2)$$

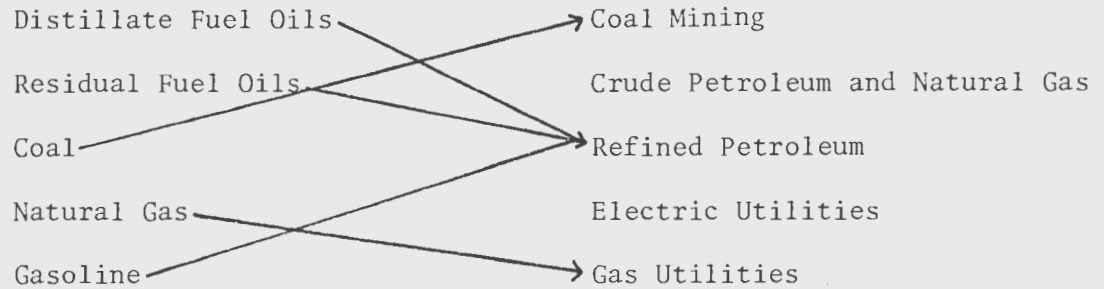
INDUSTRY (left of S), FUEL TYPE (left of T), INDUSTRY (below T), FUEL TYPE (below S), 1 2 3 4 5 (below S), 1 2 88 (below T), 1 88 (below L)

$\underline{\underline{S}}$ is here the matrix of, for example, tons of SO_x per BTU. Row n of $\underline{\underline{S}}$ is a vector of pollutant by fuel type for the industry type of column n of $\underline{\underline{T}}$. It will be noted that the matrix $\underline{\underline{S}}$ is made up of only 3 distinct row vectors, ordered in a sequence consistent with the ERG 88 sector ordering. It is also apparent that not all of the elements of $\underline{\underline{L}}$ are meaningful, since off diagonal elements may be the dot product of, for example, a utility row and a manufacturing column. The diagonal elements of $\underline{\underline{L}}$ are each meaningful, and represent the desired result of total direct SO_x emissions by industry. We may now let \underline{s} represent the vector found by extracting the diagonal elements of $\underline{\underline{L}} = \underline{\underline{S}} \underline{\underline{T}}$, or

$$\underline{s} = \text{diag } \underline{\underline{L}} \quad (3)$$

The ERG 88 sector scheme, however employs only five energy sectors. These are coal mining, crude petroleum and natural gas, refined petroleum products, electric utilities and gas utilities.

How do the Argonne sectors map into these five sectors? The mapping is depicted below:



The mapping of coal to coal mining presents no problem, as coal used for energy inputs must come from the coal mining sector. Natural gas also maps directly into gas utilities. Distillate fuel oils, residual fuel oils, and gasoline, however must be aggregated to the refined petroleum sector. This is accomplished by summing the three sectors' coefficients, in ton per BTU, weighted by their respective percentage contributions to BTU consumption of the output of the refined petroleum sector. These weights are .443, .259, and .074 for gasoline, distillate fuel oils and residual fuel oils, respectively. The consumption figures are listed in Appendix B. The new coefficients are shown in Appendix C.

Equations (2) and (3) remain the same, except that the matrix \underline{S} is now modified as

$$\underline{S} = \begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 & 5 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ \vdots \\ \vdots \\ \vdots \\ 88 \end{matrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ \vdots & \vdots \\ \vdots & \vdots \\ 0 & 0 \end{bmatrix} \end{matrix}$$

where columns 2 and 4 are now filled with zeros.

Column 1 corresponds to coal, column 3 to refined petroleum, and column 5 to natural gas. The first five rows in the \underline{S} matrix, for SO_x as an example, would be

	1	2	3	4	5	
1	1522.	0	93.58	0	.29	(upper estimates)
2	1522.	0	93.58	0	.29	
3	1534.	0	93.58	0	.29	
4	1752.	0	54.06	0	.29	
5	1752.	0	54.06	0	.29	

T in equation (2) may be derived by multiplying the DET matrix (see ERG Doc. 307) by \hat{g}^{-1} for 1972, where \hat{g}^{-1} is the inverse of a diagonalized vector of industrial output.

It is apparent that three \underline{S} matrices, each corresponding to a different pollutant, will be needed. As a result three \underline{s} vectors will be determined, one for each pollutant, w. The direct and indirect contribution of SO_x to the environment in year t by sector can now be expressed as

$$s_{SO_x, t} \underline{D} = [\underline{I} - \underline{B}_t \underline{D}]^{-1}$$

where D is a constant normalized "make" matrix, and B_t is a normalized use matrix for time t. (For further explanation of D and B, see ERG Doc. 307.) A 3 by 88 matrix, \underline{p}_{wt} , for time t, can be formed by vertically augmenting s_1 , s_2 and s_3 . The row sums represent the total direct contribution of each pollutant to the environment at time t. The resulting units are ton per trillion dollar output. 1972 Industrial Output is listed in Appendix D and the Final Direct Pollution Coefficients are listed in Appendix E.

APPENDIX A

Lower Estimates

	SO _x	NO _x	Particulates	
1	0.	0.	0.	
2	548.	350.	29.	Utilities
3	1752.	344.	2960.	
4	0.	331.	0.	
5	30.5	716.	79.6	
1	156.	79.	7.2	
2	536.	152.	33.	
3	1534.	240.	2380.	
4	0.	59.	2.4	
5	30.5	716.	79.6	
1	156.	79.	7.2	Other
2	536.	152.	33.	
3	1522.	120.	2480	
4	0.	59.	2.4	
5	30.5	716.	79.6	

Emissions coefficients are based on data in Compilation of Air Pollutant Emission Factors, EPA AP-42; revised New Source Performance Standards; a draft Argonne report on Ambient Air NO₂ regulations. Emissions for gasoline are believed to be somewhat overestimated.

APPENDIX A (continued)

Upper Estimates

	SO _x	NO _x	Particulates	
1	0.	0.	0.	
2	548.	408.	33.	
3	1752.	572.	2960.	Utilities
4	.29	342.	7.3	
5	30.5	716.	79.6	
1	156	79.	7.2	
2	536.	200.	38.	
3	1534.	290.	2380.	Manufacturing
4	.29	112.	7.8	
5	30.5	716.	79.6	
1	156.	79.	7.2	
2	536.	200.	38.	
3	1522.	290.	2480.	Other
4	.29	67.	7.8	
5	30.5	716.	79.6	

1. Distillate Fuel Oil
2. Residual Fuel Oil
3. Coal
4. Natural Gas
5. Gasoline

APPENDIX B

SECTOR	CONSUMPTION (trillion BTU's)	PERCENT OF TOTAL CONSUMPTION
31 Gasoline	11686.210	.443
41 Distillate Fuel Oils	6831.263	.259
42 Residual Fuel Oils	1954.295	.074
48 Fuel Oils Not Classified	745.979	} .224
2 Light hydrocarbon gases	1135.146	
33 Special naphthas	46.371	
Other sectors in BEA 3101	3983.539	
TOTAL	<hr/> 26382.803	

SOURCE: National Energy Accounts: Energy Flows in the U.S. 1947-1972
Vol. III & V, Jack Faucett Assoc., Inc., Nov. 1975.

APPENDIX C

Upper Estimates

	SO _x	NO _x	Particulates	
1	54.06	347.38	37.70	Utilities
2	1752.	572.	2960.	
3	.29	342.	7.3	
1	93.58	352.45	39.94	Manufacturing
2	1534.	290.	2380.	
3	.29	112.	7.8	
1	93.58	352.45	39.94	Other
2	1522.	290.	2480.	
3	.29	67.	7.8	

1. Refined Petroleum
2. Coal
3. Natural Gas

Lower Estimates

	SO _x	NO _x	Particulates	
1	54.06	343.09	37.41	Utilities
2	1752.	344.	2960.	
3	0.	331.	0.	
1	93.58	348.9	39.57	Manufacturing
2	1534.	240.	2380.	
3	0.	59.	2.4	
1	93.58	348.9	3.57	Other
2	1522.	120.	2480.	
3	0.	59.	2.4	

Utilities - ERG Sectors 78, 4, 5

Manufacturing - ERG Sectors 3, 16-68

Other - ERG Sectors 1, 2, 6-15, 69-88 (excl. Sector 78)

APPENDIX D

1972 Industrial Dollar Output

ERG Sector	SIC Code	Industry	1972 Dollar Output	ERG Sector	SIC Code	Industry	1972 Dollar Output
1	700	COAL MINING	5442400000.	46	4200	FAB METAL PROD	14141200000.
2	800	CRUDE PETRO, GAS	17819000000.	47	4300	ENGINES, TURBINES	5409500000.
3	3101	PETRO REFIN PROD	29581100000.	48	4400	FARM MACHINERY	5566200000.
4	6801	ELECTRIC UTIL	31664900000.	49	4500	CONST, MINING EQ	7888600000.
5	6802	GAS UTILITIES	20138700000.	50	4600	MAT HANDLING EQ	2809000000.
6	100	LIVESTOCK	43338900000.	51	4700	METALWORKING EQ	7148000000.
7	200	MISC AG PRODUCTS	35079700000.	52	4800	SPEC IND MACH	5863300000.
8	300	FOREST FISH PROD	1970500000.	53	4900	GEN IND MACH	8132000000.
9	400	AG FOR, FISH SER	3565700000.	54	5000	MACH SHOP PROD	4443300000.
10	500	IRON ORE MINING	1232500000.	55	5100	OFC, COMPUT MACH	8050800000.
11	600	NONFERR MINING	2270000000.	56	5200	SERVICE IND MACH	8495400000.
12	900	STONE CLAY MIN	2847100000.	57	5300	ELEC IND APPARAT	10391700000.
13	1000	CHEM MINERAL MIN	7746000000.	58	5400	H'HOLD APPLIANCE	6658900000.
14	1100	NEW CONSTRUCTION	129580500000.	59	5500	ELEC LIGHT EQ	5522100000.
15	1200	MAINT, REP CONST	36417100000.	60	5600	R-TV COMMUN EQ	17950200000.
16	1300	ORDNANCE	7084100000.	61	5700	ELECTRONIC COMP	8392900000.
17	1400	FOOD	118300600000.	62	5800	ELECTRICAL EQUIP	4276700000.
18	1500	TOBACCO	9226900000.	63	5900	MOTOR VEH & EQ	65079500000.
19	1600	FABRIC & MILLS	17632500000.	64	6000	AIRCRAFT & PARTS	17021100000.
20	1700	TEXTILE GOODS	5958400000.	65	6100	TRANSPORT EQUIP	12762800000.
21	1800	APPAREL	30182700000.	66	6200	PROF SCIENT SUPP	6980700000.
22	1900	FAB TEXTILE PROD	4922600000.	67	6300	OPTICAL SUPPLIES	6526900000.
23	2000	WOOD PRODUCTS	21511400000.	68	6400	MISC MANUFACT	11978800000.
24	2100	WOOD CONTAINERS	4657000000.	69	6501	RAILROAD	15066900000.
25	2200	H'HOLD FURNITURE	7281600000.	70	6502	LOCAL TRANSPORT	7406300000.
26	2300	FURN, FIXTURES	3727500000.	71	6503	MOTOR FGT TRANSP	29992400000.
27	2400	PAPER PRODUCTS	19833400000.	72	6504	WATER TRANSPORT	7307500000.
28	2500	PAPERBOARD CONT	7909700000.	73	6505	AIR TRANSPORT	13133700000.
29	2600	PRINTING, PUBL	29635300000.	74	6506	PIPE LINE TRANSP	1616700000.
30	2700	CHEM PRODUCTS	24040600000.	75	6507	TRANSP SERVICES	1636100000.
31	2800	PLASTICS	9684000000.	76	6600	COMMUNICATIONS	31565300000.
32	2900	DRUGS, TOIL PREP	17227700000.	77	6700	R-TV BROADCAST	4513100000.
33	3000	PAINTS	3610100000.	78	6803	WATER, SANIT SER	2582200000.
34	3102	PAVING	902600000.	79	6900	WHOLE, RETAIL TR	264933700000.
35	3103	ASPHALT	9470000000.	80	7000	FINANCE INSUR	77886200000.
36	3200	RUBBER PRODUCTS	20647500000.	81	7100	REAL ESTATE	174580800000.
37	3300	LEATHER PRODUCTS	1052400000.	82	7200	HOTELS, PERS SER	30504100000.
38	3400	FOOTWEAR	4529100000.	83	7300	BUSINESS SERVICE	68709600000.
39	3500	GLASS PRODUCTS	5583400000.	84	7500	AUTO REPAIR	24340200000.
40	3600	STONE CLAY PROD	15266200000.	85	7600	AMUSEMENTS	12744800000.
41	3700	PRIM IR, STL MANU	36439700000.	86	7700	MED, EDUC SER	84899500000.
42	3800	PRIM NONFER MET	23874400000.	87	7800	FED GOVT ENTERP	10817900000.
43	3900	METAL CONTAINERS	4823600000.	88	7900	ST, LOC GOVT ENT	8100800000.
44	4000	HEATING, PLUMBING	15304400000.				
45	4100	SCREW MACH PROD	11134200000.				

APPENDIX E

Direct Fuel Related Industrial Pollution Coefficients:
Lower and Upper Estimates (Tons/\$Output)

ERG Sector	SIC Code	Industry	SO		NO		Particulates	
			Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
1	700	COAL MINING	.0000213674	.0000045131	.0000335868	.0000213675	.0000068436	.0000338879
2	800	CLAY PITTS, GAS	.0000006628	.0000029778	.000000459	.0000006653	.0000030717	.0000003499
3	3101	PEFO RIFIN PRD	.0000060008	.0000207904	.0000030375	.0000060008	.0000210156	.0000030594
4	6801	ELECTRIC UTIL	.0004631941	.0001645607	.000775771	.0004632316	.0002260097	.0007785491
5	6802	GAS UTILITIES	.0000000276	.0000054449	.0000002335	.0000000535	.0000101810	.0000007159
6	100	LIVESTOCK	.0000004311	.0000015554	.0000000422	.0000004311	.0000015738	.0000002042
7	200	MISC AG PRODUCTS	.0000020791	.0000078606	.0000001543	.0000020803	.0000079773	.0000009701
8	300	FOREST FISH PRD	.0000048217	.0000179936	.0000001846	.0000048218	.0000181787	.0000020601
9	400	FG FOR, FISH SER	.0000007255	.0000028676	.0000000351	.0000007254	.0000029399	.0000003337
10	500	IRON ORE MINING	.00000221646	.0000074989	.0000348668	.0000221776	.0000102697	.0000354397
11	600	NONFERR MINING	.0000017069	.0000046918	.0000010689	.0000017098	.0000048861	.0000015456
12	900	STONE CLAY MIN	.0000077890	.0000123892	.0000079425	.0000077930	.0000131470	.0000091843
13	1000	CHEM MINERAL MIN	.0000095208	.0000208303	.0000106516	.0000095610	.0000227604	.0000126677
14	1100	NEW CONSTRUCTION	.0000010715	.0000039977	.0000000410	.0000010715	.0000040387	.0000004577
15	1200	MAINT, REP CONST	.0000017501	.0000065300	.0000000670	.0000017501	.0000065970	.0000007476
16	1300	REFINANCE	.0000004196	.0000007500	.0000005014	.0000004205	.0000009324	.0000005191
17	1400	FOOD	.0000016731	.0000010593	.0000024510	.0000016746	.0000013845	.0000024790
18	1500	TOBACCO	.0000008041	.0000003817	.0000011780	.0000008042	.0000004367	.0000011812
19	1600	FABRIC & MILLS	.0000036310	.0000018631	.0000053222	.0000036323	.0000022298	.0000053485
20	1700	TEXTILE GOODS	.0000013827	.0000017659	.0000017656	.0000013842	.0000020896	.0000017952
21	1800	APPAREL	.0000003179	.00000006259	.0000003494	.0000003184	.0000007335	.00000003598
22	1900	FAB TEXTILE PRD	.0000013110	.0000004888	.0000019716	.0000013114	.0000006605	.0000019788
23	2000	WOOD PRODUCTS	.0000010752	.0000002164	.0000011631	.0000010769	.0000025131	.0000011970
24	2100	WOOD CONTAINERS	.0000004881	.0000012987	.0000005169	.0000004901	.0000016832	.0000005553
25	2200	H'OLD FURNITURE	.0000016099	.0000007269	.0000023877	.0000016105	.0000008608	.0000023984
26	2300	FURN, FIXTURES	.0000011444	.0000008064	.0000016967	.0000011460	.0000011449	.0000017277
27	2400	PAPER PRODUCTS	.00000202571	.0000124522	.0000290385	.0000202646	.0000144912	.0000291864
28	2500	PAPEPCAND COM	.0000011781	.0000014581	.0000015174	.0000011794	.0000017360	.0000015422
29	2600	PRINTING, PUBL	.0000002373	.0000003342	.0000003238	.0000002379	.0000004671	.0000003367
30	2700	CHEM PRODUCTS	.0000222551	.0000184806	.0000314725	.0000222784	.0000234781	.0000319166
31	2800	PLASTICS	.0000197769	.0000161317	.0000270052	.0000197829	.0000179049	.0000271315
32	2900	DRESG, TOIL PREP	.0000016120	.0000012492	.0000022463	.0000016129	.0000014597	.0000022651
33	3000	PAINTS	.0000010123	.00000033514	.0000006193	.0000010131	.00000035342	.0000006374
34	3102	PAVING	.00000506496	.0001236764	.0000423668	.0000506546	.0001264038	.0000425860
35	3103	ASPHALT	.0000291724	.0001086481	.0000127271	.0000291773	.0001106464	.0000129322
36	3200	RUBBER PRODUCTS	.0000027158	.0000014900	.0000039894	.0000027173	.0000018629	.0000040191
37	3300	LEATHER PRODUCTS	.0000046278	.0000032649	.0000068214	.0000046295	.0000037380	.0000068556
38	3400	FOOTWEAR	.0000008515	.0000005540	.0000007065	.0000008519	.0000006489	.0000007147
39	3500	GLASS PRODUCTS	.0000015828	.0000038475	.0000023033	.0000015864	.0000063813	.0000025570
40	3600	STONE CLAY PRD	.0000261166	.0000098424	.0000395017	.0000261276	.0000127159	.0000397111
41	3700	PRIM IR, STL MANU	.0000952369	.0000187181	.0001470502	.0000952438	.0000230767	.0001471804
42	3800	PRIM NONFER MET	.0000042875	.0000032555	.0000061987	.0000042925	.0000043130	.0000062937
43	3900	METAL CONTAINERS	.0000001260	.0000006595	.0000001083	.0000001276	.0000009535	.0000001394
44	4000	HEATING, PLUMBING	.0000011816	.0000009513	.0000016848	.0000011829	.0000012268	.0000017081
45	4100	SCREEN MACH PRD	.0000016270	.0000008531	.0000024142	.0000016281	.0000011057	.0000024349
46	4200	FAB METAL PRD	.0000011719	.0000011319	.0000016541	.0000011737	.0000015125	.0000016895
47	4300	ENGINES, TURBINES	.0000011782	.0000008280	.0000016666	.0000011788	.0000009730	.0000016780
48	4400	FARM MACHINERY	.0000032274	.0000010418	.0000049307	.0000032287	.0000013819	.0000049549
49	4500	CONST, MINING EQ	.0000023980	.0000007968	.0000036706	.0000023991	.0000010852	.0000036922
50	4600	MAT HANDLING EQ	.0000004310	.0000005988	.0000005694	.0000004319	.0000007862	.0000005874
51	4700	METALWORKING EQ	.0000007893	.0000008528	.0000010764	.0000007905	.0000010861	.0000010980
52	4800	SPEC IND MACH	.0000006672	.0000009063	.0000008452	.0000006681	.0000010888	.0000008622
53	4900	GEN IND MACH	.0000009748	.0000008505	.0000013847	.0000009761	.0000011166	.0000014090
54	5000	MACH EXCP PRD	.0000007396	.0000007912	.0000010304	.0000007409	.0000010586	.0000010555
55	5100	OPC, COMPUT MACH	.0000005764	.0000003282	.0000008500	.0000005768	.0000004250	.0000008581
56	5200	SERVICE IND MACH	.0000015352	.0000006873	.0000023106	.0000015362	.0000009141	.0000023289
57	5300	ELEC IND APPARAT	.0000007890	.0000007817	.0000010906	.0000007900	.0000009957	.0000011102
58	5400	H'OLD APPLIANCE	.0000014363	.0000006938	.0000021622	.0000014374	.0000009477	.0000021635
59	5500	ELEC LIGHT EQ	.0000013092	.0000008000	.0000019156	.0000013102	.0000010257	.0000019346
60	5600	R-TV COMMUN EQ	.0000002267	.0000003210	.0000002939	.0000002272	.0000004102	.0000003024
61	5700	ELECTRONIC COMP	.0000003860	.0000008328	.0000004069	.0000003867	.0000009776	.0000004209
62	5800	ELECTRICAL EQUIP	.0000012068	.0000006639	.0000017748	.0000012075	.0000008363	.0000017887
63	5900	MOTOR VEH & EQ	.0000014470	.0000005081	.0000021926	.0000014475	.0000006640	.0000022023
64	6000	AIRCRAFT & PARTS	.0000005791	.0000005225	.0000008026	.0000005797	.0000006540	.0000008133
65	6100	TRANSPORT EQUIP	.0000007819	.0000008072	.0000010351	.0000007824	.0000009301	.0000010455
66	6200	PREC SCIENT SUPP	.0000003074	.0000005633	.0000003572	.0000003080	.0000006824	.0000003687
67	6300	OPTICAL SUPPLIES	.0000049194	.0000013463	.0000074782	.0000049198	.0000015779	.0000074859
68	6400	MISC MANUFACT	.0000005956	.0000008416	.0000007481	.0000005964	.0000010144	.0000007643
69	6501	RAILROAD	.0000049206	.0000153676	.0000015342	.0000049211	.0000156314	.0000031318
70	6502	LOCAL TRANSPORT	.0000010171	.0000075992	.0000008858	.0000020176	.0000076882	.0000008768
71	6503	MOTOR VEH TRANSP	.0000022896	.0000085309	.0000000974	.0000022897	.0000086203	.0000009865
72	6504	WATER TRANSPORT	.0000105333	.0000364095	.0000016734	.0000105336	.0000368746	.0000054616
73	6505	AIR TRANSPORT	.0000102273	.0000381801	.0000003922	.0000102275	.0000385747	.0000043715
74	6506	PIPE LINE TRANSP	.0000016889	.0000097978	.0000001073	.0000016931	.0000009498	.0000009206
75	6507	TRANSP SERVICES	.0000001213	.0000004920	.0000000062	.0000001215	.0000005020	.0000000570
76	6600	COMMUNICATIONS	.0000001135	.0000004454	.0000000052	.0000001137	.0000004527	.0000000514
77	6700	R-TV BROADCAST	.0000001931	.0000007936	.0000000104	.0000001935	.0000008109	.0000000922
78	6800	WATER, SEWTR SER	.0000009358	.00000061936	.0000000476	.0000009360	.0000002763	.0000006582
79	6900	WOLE, RETAIL TR	.0000006235	.0000024209	.0000000277	.0000006240	.0000024576	.0000002788
80	7000	PIPEWKE INSUR	.0000002446	.0000009651	.0000000115	.0000002448	.0000001114	.0000009114
81	7100	REAL ESTATE	.0000000589	.0000002170	.0000000284	.0000000590	.0000002275	.0000000502
82	7200	HOTELS, REFS SER	.0000010621	.00000325311	.0000007841	.0000010612	.0000026339	.0000030214
83	7300	ENTERTAIN SERVICE	.0000002412	.0000002412	.0000000109	.0000002414	.0000005961	.0000001035
84	7500	AUTO REPAIR	.0000001719	.0000003713	.0000000055	.0000001722	.0000007797	.0000003829
85	7600	AMUSEMENTS	.0000002026	.0000000924	.0000000133	.0000002033	.0000000198	.0000001047
86	7700	MED, HEOC SER	.0000007863	.0000016742	.0000007574	.0000007977	.0000017051	.0000009174
87	7800	RENTAL TRUCKS	.0000000007	.0000000007	.0000000000	.0000000007	.0000000000	.0000000000